Seed Care in the Palm Oil Sector

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Abstract The palm oil sector is widely associated with the destruction of the environment in the pursuit of profit. Drawing from fieldwork in an oil palm concession in Riau, Sumatra, I highlight a heretofore unexplored dimension of the agribusiness nexus—the affective attachments of corporate actors to oil palm seeds. I begin by describing how nursery workers in their everyday practices adopt the role of motherly caregivers to seeds as their cherished "babies." I then explore how scientists conceive experimental breeding as a way of caring for the future of plants and the planet. This loving care contrasts with the violence entailed in seed selection, controlled breeding, and regular culling. Furthermore, tensions arise between breeders and workers on the one hand and corporate "money makers" on the other over seeds as objects of care and sources of value. I demonstrate how seeds reconfigure the relations among human corporate practitioners as they align with or run against each other over matters of care. These internal tensions, however, remain framed by a shared dependence on the well-being of oil palm. Divided as they may be over care, "caregivers" and "money makers" alike ultimately live off the same seed. I highlight that care for seeds enacted by corporate actors troubles the issue of how, and who, we should love, when it comes to a plant whose proliferation produces and depends on the extinction of other species, and which is itself subjected to coercive violence. I argue that the inarguably destructive external effects of the oil palm industry obscure the internal and conflicting affective attachments of corporate actors to seeds. I assess the ethical implications of attending to lively yet lethal capital as it emerges from situated practices of care with corporate assemblages.

Keywords care, corporations, oil palm, violence, seeds, capitalism, lively capital

"Love Your Darlings, Kill Your Darlings"

I was sitting in a conference room on the thirty-fifth floor of the Harapan Baru headquarters, one of Indonesia's largest oil palm conglomerates.[1] Over the course of a four-hour-long meeting, company representatives described the various stages of palm oil production in the plantation, mill, refinery, and kernel crushing plant. The presenters referred to PowerPoint slides packed with formulas, flowcharts, tables, and technical jargon to explain how palm oil yield and profit could be maximized. Finally, the meeting

1. All names of persons, places, and entities used in this article are pseudonyms.

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facilitator introduced the last speaker, Guthrie, Head of Breeding and Nurseries, a lean, bespectacled gentleman of some forty years of age. Guthrie gathered his notes in a hurry and strode over to the podium, mumbling under his breath with excitement, "Ah, seeds, seeds . . . finally, seeds!"

Unlike the other presenters who limited their speeches to forty-five minutes, Guthrie spoke for over two hours. His slides consisted entirely of photographs of seeds rather than text and calculations. Guthrie referred throughout to seeds as "babies" who needed great attention because they were precious, young, and vulnerable. Gesturing animatedly as he scrolled through his 136 slides, he explained each photograph in detail: the morphology of seeds at different phases of growth, their movements from biotechnology lab to plantation, and the various ways they were artificially bred. Passion and excitement were manifest in the way he talked about and sometimes *to* the seeds: "Look at you, growing beautifully! You would make any parent proud!"

Whereas previous speakers presented their "data" in a functional manner, Guthrie spiced up scientific facts with humorous anecdotes, sprinkled descriptions of complex genomic sequences with personal experiences, and compared some seeds to his own children: "This one is just like my eldest: it costs me so much in fertilizer to keep it happy!" Every so often, Guthrie chided his colleagues for forgetting that "oil palm is a living being, not just money. We are not businessmen. We are nannies. We are caregivers." Agus, the head of mill operations, whispered in my ear, "That's a breeder for you. They're all like that. They just can't stay away from their babies."

Guthrie's presentation conveyed a sense of deep concern for and cherishing of seeds—in a word, a sense of *care*. At the same time, however, he talked about seeds in terms of control, conditioning, and culling. "Babies" who failed to achieve the standards of an "elite" he referred to as "runts" and "rogues." Guthrie described artificial breeding in almost eugenic terms as "making the best children for the best future." Strict parameters of "normal" growth determined which seeds lived or were discarded. Various abnormalities condemned the "inferior stock" to destruction—crinkled leaves, twisted shoots, fungal rots, and more. No deviation was tolerated. Regular culling, for Guthrie, had a simple rationale: "If in doubt, kill it." On the one hand, Guthrie talked with affection about seeds as living beings rather than sources of profit. Yet violence mingled with love in Guthrie's stories. After the meeting, I asked him how he felt about culling, given how much he cared about his "babies." Guthrie drew a long puff from his cigarette and responded, "Caring is tough. No one said it's easy. You love your darlings. You kill your darlings. It's tough love, I guess."

Monocrop plantations are a prime example of the mass commodification of other-than-human life within global techno-capitalist regimes, or what Kaushik Sunder Rajan and others describe as "lively capital."[2] Among these industries, the palm oil sector is notorious for its destructive environmental impacts. Oil palm plantations reduce biodiversity and destroy the habitat of endangered species. They undermine ecosystem

2. See Rajan, *Lively Capital.*

services such as nutrient cycling, water purification, and soil formation and stability, and are major contributors to greenhouse gas emissions.[3] These effects are particularly pronounced in Indonesia, the world's largest palm oil producer, with an estimated 8.9 million hectares of plantations. Despite widespread controversy over its social and environmental impacts, the palm oil sector continues to expand across the tropical belt, driven by national economic-development imperatives, renewable energy directives, and a growing global population.[4]

Scholars across a range of disciplines have condemned the monocrop plantation model for subjecting plants to human/techno-scientific control to the detriment of pre-existing multispecies worlds and the commodified plant's own lifeway. For instance, anthropologist Anna Tsing describes plantation science as a "hegemonic, extinction-oriented creed" rooted in the absolute domination of crops by humans.[5] Philosopher Michael Marder decries the plantation model for violently homogenizing plant growth and reproduction.[6] Plant explorer and geneticist Jack Harlan criticizes the uncompromising "pure-line mentality" of monocropping for eliminating variation in favor of uniformity from seed to plantation.[7] Political scientist and anthropologist James Scott condemns agronomic science for radically simplifying nature and excluding knowledge and ecologies outside its productionist paradigm.[8]

In this article, I demonstrate that techno-capitalist violence enacted toward cash crops and the environment, while indubitably significant, is only part of the story. Drawing from fieldwork carried out in an oil palm concession in the province of Riau, Sumatra,[9] I highlight a heretofore unexplored dimension of the agribusiness nexus—the affective attachments of corporate actors to oil palm seeds. I begin by describing how nursery workers in their everyday practices adopt the role of motherly caregivers to seeds as their cherished "babies."[10] I then explore how scientists conceive experimental breeding as a way of caring for the future of plants and the planet. This loving care contrasts with the violence entailed in seed selection, controlled breeding, and regular culling. Affect and care sit awkwardly alongside value and profit in the situated practices of nursery workers and scientists.

In their analysis of "rice worlds" in the Philippines, Glenn Stone and Dominic Glover highlight how seeds lie at the heart of distinctive institutional and ideological

3. For a review, see Petrenko, Paltseva, and Searle, *Ecological Impacts of Palm Oil Expansion*.

4. See Pye and Bhattacharya, *The Palm Oil Controversy.*

5. Tsing, "Arts of Inclusion," 19.

6. Marder, "Vegetal Anti-Metaphysics," 469–70; Marder, "The Sense of Seeds."

7. Harlan, "Genetics of Disaster," 212.

8. Scott, *Seeing Like a State*, 262–306, 342–58.

9. Harapan Baru facilitated my visits to the plantation where I carried out interviews with employees over a three-week period from November 1–21, 2016. I also participated in meetings in Jakarta and Riau with company staff from across the palm oil supply chain. This research was independently funded.

10. Interviews with nursery workers and scientists were carried out in Bahasa Indonesian and English respectively. Bahasa Indonesia terms have been translated to English and set in quotation marks, followed by the original in parentheses.

bundles shaped by divergent and often conflicting concepts of what rice should be and how it should be produced.[11] In a similar vein, I explore internal contestations over care *within* "palm oil worlds" as their actors respond to the material agency of seeds in different ways.[12] In the Harapan Baru concession, tensions over whether, how, and why seeds should be cared for, arise between those intimately invested in seeds *as living entities* ("caregivers") and those who perceive seeds solely *as investments* ("money makers"). These internal tensions, however, remain framed by a shared dependence on the well-being of oil palm. Divided as they may be over care, caregivers and money makers alike ultimately live off the same seed.

Following the lead of Rajan's seminal edited volume, *Lively Capital*, I seek to open new modes of inquiry into the entanglements of life and capital by exploring how seed vitality materializes within the contested affective economy of the palm oil sector. I reveal how vegetal "lively capital" is simultaneously subject to human violence and care, a perpetrator of environmental degradation, and an active participant in the "success" of capitalist endeavor. Situated care gives rise to the ontology of the seed as a vegetal "body multiple" produced by manifold practices and knowledges that "hang together" in more or less cohesive ways within the institutional assemblage of the plantation.[13] At the same time, seeds also reconfigure the relations among *human* corporate practitioners who align with or against each other over matters of care. Exploring care—both loving and violent—as "an alignment of interests and practices,"[14] I reveal how seeds, genes, technologies, knowledges, affects, and power animate the palm oil sector as an assemblage where, as Donna J. Haraway notes, "commerce and consciousness, evolution and bioengineering, and ethics and utilities are all in play."[15] I argue that care for seeds in capitalist natures emerges as a situated interspecies process whose affective valence gives rise to internal tensions heretofore obscured by the industry's destructive external effects.

My approach is inspired by the methods and concerns of multispecies ethnography, an interdisciplinary current that explores the historical, political, and biological life-worlds of diverse organisms that humans "become-with." Science and technology studies, anthropology, the natural sciences, and other fields converge in this ethically driven approach, which calls for care, curiosity, and respect in the cultivation of relations with other-than-human species increasingly threatened in the late capitalist era.[16] These questions, multispecies scholars argue, are of immediate and practical

11. Stone and Glover, "Disembedding Grain." See also Glover, "A System Designed for Rice?"

12. Brooks, "Living with Materiality."

13. Mol, *The Body Multiple.*

14. Hartigan, *Care of the Species*, xiii.

15. Haraway, *When Species Meet*, 46.

16. van Dooren, Kirksey, and Münster, "Multispecies Studies"; Kirksey and Helmreich, "The Emergence of Multispecies Ethnography."

consequence for all lifeforms, and converge around a shared concern, aptly phrased by Matthew Chrulew: "How should we love in a time of extinction?"[17]

This article contributes more specifically to the budding "plant turn" in multispecies ethnography by exploring plant-people relations within a corporate setting.[18] I argue that the practices of nursery workers and scientists in the Harapan Baru plantation complicate notions of care so far developed primarily in the context of extinction and conservation, and which tend to encourage greater concern and accountability toward lifeforms jeopardized by the violence of human actions.[19] Oil palm is aggressively exploited to feed and fuel human communities. At the same time, oil palm plantations are a form of "lethal capital" that threaten biodiversity by destroying forest ecologies. Both these aspects highlight the ambivalent violence often enacted in the name of care, or what Aryn Martin, Natasha Myers, and Ana Viseu describe as "care's darker side."[20]

And yet, deep-seated (if always coercive) human love for seeds lies at the very heart of an industry that seemingly "doesn't care" about anything other than profit. The "affective ecologies" of the palm oil nexus highlight the ambivalent moral valence of interspecies co-becomings in contemporary capitalist natures.[21] This ambivalence has important ethical implications, given the ongoing expansion of palm oil production across the tropical belt and its concomitantly growing community of global consumers. In this light, I suggest that Chrulew's question merits the awkward complement of another: how, and *who*, should we love in a time of destructive *proliferation*?

Seed "Babies" and Motherly Care

According to the majority of employees at Harapan Baru, the first year or so of seedling growth is "the most important time in the life of oil palm." Those responsible for the well-being of seedlings in this critical period are the nursery workers, a group of approximately thirty men originating from various parts of Indonesia and ranging between twenty-five and forty-five years of age. Like Guthrie during his presentation in Jakarta, the nursery workers of Harapan Baru refer to seeds and seedlings with the English term "baby," a word borrowed in Bahasa Indonesia to refer primarily to human children and romantic partners. My informants explained that seeds are "babies" because they are young and weak and require sustained care to grow well.[22] Flown in from the biotechnology lab in Bogor (Java) or germinated in situ, seedlings and their environment

17. Chrulew, "Managing Love and Death," 139.

18. On the "plant turn," see Sheridan, "Boundary Plants," 39; and Myers, "Conversations."

19. For example, see Nabhan, *Enduring Seed*; Parreñas, *Decolonizing Extinction*; van Dooren, *Flight Ways*; Rose, *Wild Dog Dreaming*; van Dooren and Rose, "Introduction."

20. Martin, Myers, and Viseu, "The Politics of Care," 627.

21. On "affective ecologies," see Hustak and Myers, "Involutionary Momentum."

22. The anthropomorphization of seeds as vulnerable babies by nursery workers resonates with the description of stem cells as fragile babies among placental laboratorians in Korea as described by Lee ("Placental Economies," 467–68).

are the object of assiduous care during the period of "incubation," when they "adapt to their new home." The nursery purchases soil from reputable suppliers to ensure that it is nutrient-rich and disease-free. Each seedling is grown in an individual polybag to avoid fungal cross-contamination. The distance between seedlings is carefully measured to ensure each receives sufficient water and sunlight. No cost, time, or detail is spared in promoting their growth.

When the seedlings' roots begin to perforate the polybags, they are ready to be transplanted. This delicate process demands utmost caution to avoid causing transplant shock to the plant (fig. 1). The small polybags containing the earth and seedling are carefully placed inside a larger polybag, followed by copious amounts of fertilizer and water. Just as a nimble and gentle touch is required to transfer the full root system of the plant and avoid stunting its growth, so too only the best drivers are trusted to transport seedlings to the concession. In the nursery, Budi guided me through the rows of plants and explained:

> The babies are still weak, so we water them with mist twice a day. To help the seedlings retain moisture, we scatter wood chippings, lemongrass stalks, and palm kernel shells on the soil surface. That also keeps the weeds from growing and stunting their growth. We spread palm kernel shells because it's nice for the babies to grow close to their families. That way, they feel they are at home, you know? It's like me—I'm from Manado so I need my spicy Manado food to keep me going!

Agus, a nursery worker from Flores, pulled out a pair of cutters and crouched beside the first seedling in the row, caressing its soft downy stem. He cut off some dry leaves at the crown of the plant and disposed of them in a plastic bag. Picking up a clump of soil and sifting it carefully, he commented: "We make sure the soil is rich for the babies—like a mother's milk. We mix it with Trichoderma, which is a fungus that makes the seedlings' roots stronger and more numerous. We always keep the babies in the shade, especially the clones, because they need to rest and concentrate on growing. Hey, Budi, do I sound like my mom or what?! Don't tell my wife; she'll think I've gone soft!"

Much like the phenomenology of plant-human interactions described by Natasha Myers and others, close observation and tactile engagement feature prominently in the practices of seed management that nursery workers perform on seeds.[23] These include, for instance, the way workers stroke the plants, regularly water them, heal them by removing parasitic abnormalities, nourish their soil environment with fertilizer, and notice seedlings' morphological particularities. Knowledge-as-vision interlaces with knowledge-as-touch in the material relations of workers to seeds.[24] To take care of the "babies," Agung, another nursery worker, told me, "You cannot have rough hands. You

23. See, for example, Myers, "Conversations"; Glover, "A System Designed for Rice?"; Hartigan, *Care of the Species*; and Kortright, "On Labor."

24. Puig de la Bellacasa, "Touching Technologies."

Figure 1. Improper handling of seeding roots can result in transplant shock. Credit: Sophie Chao

must have soft hands and a soft heart. Like a mother." This care requires technical experience and knowledge, but more importantly, it calls for parental love on the part of workers, which many workers like Agus compared to that of "mothers" (*ibu*) toward their babies.

Workers also joke about their relations to seeds in gender-inflected ways. Like Agus, they talk of becoming overly motherly or "sweet" (*manis*) because they care so

much about their "babies." Workers ask each other how their "children" are doing, the joke being which "children" are being referred to—plant or human. Workers who spend excessive amounts of time fertilizing or watering the seedlings are teased: "You'll run out of breastmilk at this rate!" "How are you going to wean that baby if you keep feeding it like that?" Childless married workers are warned good-humoredly that their wives will get angry when they find out about all the "babies" they have on the plantation. Rian, who had not returned to his village or seen his children for over two years, joked that "[workers] look after the babies better than our own children."

Like proud parents, nursery workers express great personal satisfaction when the seeds they attend to grow well. As we walked through the nursery, they pointed out the seeds they oversaw, describing with fondness the intricate details of their growth, diseases, morphology, origin, and so forth. The greatest pride is expressed by nursery workers in charge of the oil palm ramets, or clones, sprouted from a single parent plant. The clone nursery, tellingly, is the only place in the entire twenty-thousand-hectare concession where smoking is not permitted—and more importantly, where that rule is respected. Here, 130-pound former police Rottweilers are unleashed every night, their fierce canine teeth and great speed a deterrent to anyone planning to steal the precious "babies."

In clonal breeding, palms of optimal yield and resilience called ortets are re-created through tissue cultures to produce ramets. It takes around ten years to select an ortet, and its growth is subject to minute and regular monitoring throughout this period to ensure the clone qualifies as an "elite" performer. While sexual reproduction takes six months, clonal breeding requires around three years. Workers described the delicate processes involved in ramet production as an "art" that requires immense patience, time, and attention. Ramets are sent from the biotechnology lab to the nursery once genetic differentiation of the calli takes place and the ramet specializes as either a shoot or a root. At this stage, the ramets are weak and vulnerable. Unlike sexually reproduced seeds, ramets grow roots only after the stem has developed. Conditioned to the 100 percent relative humidity of test tubes and humidity domes in the aseptic environment of the laboratory, clones have little surface wax and have never been exposed to sunlight. They are soft and fragile, "like a premature baby," said nursery worker Rudi.

The clones spend several weeks in an enclosed acclimatization room, where they are soaked and rinsed in cocopeat to increase their pH. They also receive frequent fungicide treatment and misting before being transplanted to the prenursery, where they are housed in a separate unit to avoid contamination from normal seedlings. The entire process is costly, resource-intensive, and frequently fails. But those ramets that succeed are the "children of the elite" (*anak elit*), said nursery worker Putri, because they produce high yields and are resistant to drought and disease.

In her research on plant love in Mozambique, Julie Archambault highlights how plant-human relations both constitute and symbolize broader socioeconomic orders.[25]

25. Archambault, "Taking Love Seriously."

Many workers in the Harapan Baru concession relocated to Riau from other parts of the archipelago to work on the plantation. Workers face indefinite separation from their kin and relative confinement in the plantation. They live in an environment overwhelmingly dominated by men across all levels and types of professions, yet heterogeneous in its ethnic and religious composition, which includes individuals from Java, Sulawesi, Kalimantan, Nusa Tenggara, and Bali, of alternately Muslim, Catholic, or Hindu denominations.

In this context, seedlings to some extent become symbolic children to whom nursery workers direct care in the absence of their own human families. Care enacted to seeds, which Agung and others associate with the care of mothers to their infants, might be conceived as emotional displacements of the loving attention workers cannot give to or receive from their human relatives. For instance, by surrounding seedlings with a "family" (*keluarga*) of palm kernels, Budi sought to make seeds "feel at home" in ways he himself could only imagine because of the distance between his native Manado and his Riau workplace. Seeds thus appear to offer a *surrogate* form of intimacy in the absence of laborers' own family members. The distinctively gendered ways in which workers conceive themselves as "mothers" and seeds as "babies" also suggest that the nursery offers a social space in which workers might legitimately foreground their longing to be both objects and subjects of maternal and paternal care in ways that might not otherwise be condoned—including by their human family, as Agus's joke suggests. Furthermore, deep-seated yearnings for children, wives, and mothers are expressed through the veiled medium of seed love in ways that transcend differences in culture and creed. As Budi put it, "Agus may be Catholic and I may be Muslim, but we are the same. We are all far from home, and our only family for now are the seeds."

Seed Identities and Futures

Seed scientists at the Harapan Baru research center are hired by the company to produce seeds of optimal yield and maximum profit. However, the breeders I interviewed rarely talk about seeds in these business terms. Instead, they describe seeds through the places, events, and scientists that have shaped their genetic makeup, and find great professional and personal satisfaction from sharing seeds' histories and transnational movements. These stories, breeder Lien affirmed, remind us that "the seed has a past." Rolling out before me the pedigree diagram of Jaya Mas DxP (Deli x Pisifera), the seed variety grown in the Harapan Baru nursery, Lien explained: "To know a palm tree, you must know its seed. You must know who its mother and its father were, its grandmothers, and its grandfathers. You must understand its past—not just the money you can make off it. The businessman sees only dollar bills and rupiahs, but to care you must see families in seeds—brothers, sisters, cousins, in-laws even!"

Jaya Mas DxP is the genetic product of over a century of cross-fertilization trials carried out by scientists around the world (fig. 2). Like all other oil palms in Indonesia, it descends from the first four palms introduced to the Bogor Botanic Gardens in 1848.

Figure 2. Jaya Mas DxP seedlings. Credit: Sophie Chao

The source of the germplasm of these four palms is subject to debate between present-day Democratic Republic of Congo, Cameroon, Angola, and La Réunion. Lien described to me how numerous cycles of progeny selection had been undertaken in Sumatra, Malaysia, Papua New Guinea, and Colombia. Eventually, these led to the development of "elite *dura*" and "elite *pisifera*" varieties, whose cross-pollination produced the heterozygous gamete, *tenera* (fig. 3). Jaya Mas DxP is the offspring of female Deli *dura* and male AVROS (Algemeene Vereeniging van Rubberplanters ter Oostkust van Sumatra) *pisifera*. "Deli refers to the place where oil palm was first planted in monocrop form in Indonesia. "AVROS" refers to the Dutch General Association of Rubber Planters on the East Coast of Sumatra, the first regional institute to research commodities including rubber and oil palm. Different geographies and colonial histories coalesce in the body of the Jaya Mas DxP seed.

If nursery workers practice care toward seeds through "intimate interactions" that are at once physical, affective, and gender-inflected, in the laboratory, scientists practice "care of the species" by cultivating "intimate knowledge" about seeds' distinctive histories and biographies.[26] Scientists affirm that knowing the descent and relations of seeds is central to recognizing their unique identity. At the same time, ascertaining the past of the seed is necessary to determine its progeny. For instance, palm parents of artificially bred seeds must be of proven pedigree and are selected based on family and individual performance tests to encourage the stacking of desirable traits in their

26. On "intimate interactions," see Glover, "A System Designed for Rice," 235. For "care of the species," see Hartigan, *Care of the Species*, 8–11, 113.

Figure 3. "The model offspring": tenera variety oil palm fruit. Credit: Sophie Chao

offspring. Bar coding, seed labeling, clone identity codes, and seed accreditation further preserve the genetic purity of Jaya Mas DxP.

Knowing the genetic identity of seeds allows breeders to enhance the resilience of their progeny through selective breeding. This is a form of care for seeds because, in phyto-pathologist Rachman's words, "It makes seeds stronger and gives them a better life." In this regard, breeders position themselves within a broader community of scientists who have shaped the future of seeds through breeding trials across time and space, in what might be described as a form of "distributed care." As Rachman explained: "Each seed has an identity and an origin, and seeds travel to all kinds of places, growing on different soils. Each seed makes a journey. By breeding them, we participate in that journey, as many other scientists like us did in the past, and many others are doing today across the world. We all want seeds to have a better life. Seeds make their story with us."

While clonal reproduction takes place in the Harapan Baru biotechnology laboratory in Java, conventional and marker-assisted breeding take place on the plantation. In conventional breeding, pollen from a *dura* flower, isolated in a plastic case to avoid natural pollination, is manually crossed over to fertilize an isolated *pisifera* flower (fig. 4). With utmost care, human pollinators transfer the pollen to the base of the flower from a test tube with a quick blow, adding talcum and silica to the tube as desiccants to avoid contamination from the blower's breath. Once fertilized, the seed bunch is chopped, fermented, depericarped (the removal of the outer layer of the fruit), scraped, sorted, printed with the Jaya Mas DxP yellow label, then rinsed and placed in cold storage. When space is available in the prenursery, the seeds are soaked in vats of water

Figure 4. Controlled-pollination equipment and samples of tenera, pisifera, and dura fruit. Credit: Sophie Chao

and germinate for forty-five days in a hot room. Dozens of workers, including a few women volunteers from nearby communities, busy themselves at these activities in silence, checking on germination rates, removing abortive seeds, and carefully counting seed stock with checkerboards. As we walked through the hot room, Lien exclaimed: "It's a maternity ward here. All the babies are taken care of and kept warm, like babies in the womb. It's magical to see them sleep, then wake up, spreading their plumule [the future stem and leaves], then their radicle [the future roots], discovering the world, slowly, one after the other. It's a miracle, watching the seed grow."

Breeders talk of seed germination in affectively charged rather than scientific language, with the English terms "magical," "amazing," or "incredible."[27] Like Lien, many take pride in successful seed germination as the fruit of their technical labor and emotional investment. At the same time, scientists acknowledge that human control is not the only factor determining seeds' development.[28] They also attribute seed growth to the agency of the seed itself as an autonomous living being, "waking up" to the world. The seed responds to human acts of care through the "miracle" of its growth, fascinating breeders with its capacity to "discover the world," slowly, in its own time. Resonating with Glover's analysis of the evolution of the System of Rice Intensification,[29] breeders recognize that invention, discovery, and experimentation together participate in the making of optimal seeds. Plants develop through the actions of the humans invested in

27. For similar descriptions among rice researchers, see Kortright, "On Labor," 572.

28. Rajan, *Lively Capital*, 17.

29. Glover, "A System Designed for Rice?" See also Brooks, "Living with Materiality," 185–186; and Kortright, "On Labor," 558.

their growth, but plants are also endowed with the capacity to engage with the world around them,[30] in what Marder describes as "vegetal non-conscious intentionality."[31] The "selfing" of seeds, in John Hartigan's terms,[32] is an interspecies collaboration for seeds, which, as Rachman put it, "make their story" with humans.

The third form of breeding at the Harapan Baru research center is marker-assisted breeding, which relies on molecular markers (fragments of DNA at certain locations within the genome) to identify the plant's genetic sequence. The Shell gene of the seed determines the thickness of the fruit kernel shell, or endocarp, and therefore the amount of oily mesocarp and endosperm within it. Knowing the Shell gene variant thus allows breeders to genetically screen seeds at the nursery stage and select only those that produce optimal yield for planting. As he ran through various genotype tests, Lien remarked: "Scientists invest so much to understand the genetics of seeds, and how they might grow. It's like trying to predict the future. We are magicians, in a way, but the magic lies in the DNA of the seed. It's wonderful to discover the seed's secrets, if only you take the time to explore. Every seed is an adventure." Genetic sequencing is also being used in crop architecture modeling to develop an oil palm "ideotype." Soil scientist Budianto talked about the ideotype with excitement, rattling through the traits that this "perfect seed" would possess: high bunch number; high photosynthesis efficiency; high density planting potential; high yield of quality oil; resistance to diseases, parasites, drought, and water stress; a slow height increment (which allows a longer span of productivity); strong nutrient uptake efficiency; and low free fatty acid content. This seed, Budianto anticipated, would be "stronger than any other seed. It will be the oil palm superhero!" Producing the ideotype is a long-term project, particularly since oil palm's genetic code was only sequenced in 2013.[33] However, the idealized plant is the object of eager anticipation among scientists like agronomist Rian, who noted: "The ideotype is a futuristic scenario. Maybe in some thirty or forty years we will get there. Until then, all we can do is make the seed stronger and healthier, plant by plant. Eventually there will be no more improvements needed. The seed will be perfect. No more diseases, no more pests, no more basal stem rot. Seeds will have a better future. God, I hope I am alive to see that day!"

As with breeding in general, scientists conceive the perfection of seeds through genetic sequencing as benefiting seeds by making them immune to disease and adverse climactic conditions. They describe marker-assisted breeding as the new frontier of genetic research, an exhilarating journey to discover the "secrets" of oil palm. The magic of plants and the magic of scientific endeavor come together in the shared "adventure" of making futures for seeds. In the context of widespread controversy over the

30. Myers, "Conversations," 34.
31. Marder, *Plant-Thinking*, 153–62.
32. Hartigan, *Care of the Species*, 94–97, 136–39.
33. Bryce, "Sequenced Palm Oil Genome."

environmental impacts of oil palm expansion, breeding is also explained by scientists as a way of caring for the future of the planet. More productive seeds will theoretically limit the area of land converted to plantations. Alwi, a breeder trained at the renowned Bogor Institute of Agriculture, explained: "*Sustainability* is the buzzword these days. You hear it everywhere. Stop cutting the forest. Stop killing the orangutans. Stop grabbing land off indigenous peoples. I couldn't agree more. But what people don't see is that the most important change lies in the seed. If we improve the seed, it produces more. Therefore, we need less land to achieve the same yield. Sustainability starts in the seed. Seeds are the future." Scientists like Alwi are distanced from the public advocacy campaigns that condemn the palm oil sector for its adverse ecological effects. Yet they conceive their breeding practices as an expression of altruistic care for the "sustainability" of the planet, even as their contribution is not publicly acknowledged. Working behind the scenes yet at the very heart of the industry, scientists see themselves as supporting global futures through the professional and personal care they invest in seeds. The seed becomes the promise and premise not only of its own future but also that of humans. "Caring for the seed," as Lien put it, "is caring for the whole world."

Violent Care

María Puig de la Bellacasa describes care as inseparably "a vital affective state, an ethical obligation, and a practical labor."[34] These facets coalesce in the practices of Harapan Baru nursery workers and scientists toward seeds. For nursery workers, the phenomenology of seed care takes the form of motherly love, performed with a "soft heart" and "soft hands" in the everyday, practical labors of seed observation, protection, and maintenance. Meanwhile, in the laboratory scientists conceive breeding in ethical terms as a way of improving the future of seeds and the sustainability of the industry and planet. Fragile yet lucrative organisms, seeds give rise to pride, fondness, curiosity, and fascination among their human "caregivers." Like the placental tissue economies described by Jieun Lee, the biological vitality, or "biovalue" of seeds arises from flows of care involving different practices, relations, actors, and motivations.[35] Seed economies in the palm oil sector are also "economies of care" in which the liveliness of plants is nourished and enhanced by human bodily, affective, and ethical investments.[36]

At the same time, the life of seeds is governed by "regimes of violent care," a term developed by Thom van Dooren to describe the entanglement of care with coercion in interspecies relationships.[37] Subjected to the brutal logic of utilitarian pragmatism and experimental optimization, every step in the seed's journey from the laboratory or nursery to the plantation is determined by stringent parameters of growth and health,

34. Puig de la Bellacasa, "Nothing Comes without its World," 197.
35. Lee, "Placental Economies."
36. Ibid., 459.
37. van Dooren, *Flight Ways.*

set by the company to achieve high yield and profit. Plants that fail to meet these standards are immediately culled. In this violent care, the touch that enables affective relations between humans and seeds transforms into a violent invasion that determines which plants get to live well or die young.[38]

For instance, to enter the prenursery, seeds must reach a set length and width of plumule and radicle, both of which must grow in directly opposite directions. The plumule must be an ivory yellow and thinner than the radicle, which should be no more than two centimeters long. Seeds that are white, small, split, affected by fungi, with undeveloped or overextended plumules and radicles, are trashed or incinerated. The draconian selection process continues in the nursery. Seedlings destroyed include those with overly short, narrow, blunt, or broad pinnae, overly short or wide internodes, compressed fronds, flaccid anatomies, and/or overly rigid (and therefore sterile) morphologies. They include seedlings whose leaves and rachis are yellowing, dull, fishbone shaped, crinkled, atrophic, or desiccated. They also include seedlings with hooked or corrugated leaflets, chlorotic stripes, necrotic lesions, orange frond discoloration, and signs of disease including *ganoderma*, *helminthosporium*, and *curvularia*. These and others are the many criteria that distinguish the treasured from the trashed.

Three cullings take place during the first nine months of seedling life, before their leaves begin to overlap and mask diseased or stunted plants. Seedlings are clustered according to age group so that individuals demonstrating signs of poor growth are easily identified (fig. 5). A final culling is undertaken before the seedlings are transplanted to the concession. In between, further culling takes place on an ad hoc basis. Every day, nursery workers tick off plants to be disposed of from the nursery population chart in the head office. Up to 40 percent of seedlings may be discarded over this three-year period.

As the seedling grows into a mature palm, the culling continues based on yield criteria. For instance, Jaya Mas DxP "strong performers" must bear fruit within twenty-four months, at a yield of eight to ten tons of fresh fruit bunches per hectare. Between three and eight years, their yield must increase to a minimum twenty-six tons per hectare. Palm oil extraction rates must be over 24 percent and kernel oil extraction rates over 6 percent. Plants that fail to achieve these targets undergo a radical dismembering. Felled, deboled, defronded, chipped, and stacked by the voracious mandibles of trunk shredders, faulty palms are pulverized in under four minutes.

The violence of culling is compounded with the violence of artificial breeding. In controlled pollination, plants are isolated from their natural environment in tightly fastened plastic bags. Pesticides sprayed in abundance cut off birds and insects from their symbiotic relations with oil palm. In clonal reproduction, abnormalities frequently arise, and defective samples are immediately destroyed. These include ramets to whom the elite characteristics of the ortet are not passed on because they turn out to be

38. On the violence of touch, see Puig de la Bellacasa, "Touching Technologies," 300.

Figure 5. Planting seedlings according to age facilitates the identification of "runts" and "rogues." Credit: Sophie Chao

phenotypic rather than genotypic. They also include infertile ramets that produce no fruit bunches, or produce them prematurely, leading to small and poor-yield fruit (fig. 6). In marker-assisted experimentation, thousands of plants are sacrificed in the pursuit of the perfected ideotype.

As with Guthrie's presentation at the Harapan Baru headquarters, the way scientists describe seeds changes when seeds fail to grow well. Once-cherished "babies" are demoted to the categories of "runts," "rogues," and "renegades," English terms used by breeders to describe faulty seeds. "Elite seeds" are contrasted to the "inferior stock." Photos of seed morphology in the nursery show the difference between "normal" (*biasa*) and "worthless" (*apkir*) seeds. Just as the growth of seeds depends in part on the seed's own agentive vitality, so too the responsibility for failed development is distributed across species lines. Indeed, workers and scientists overwhelmingly attribute abnormalities to factors outside human control, notably the "will" (*niat*) of the plant itself, which manifests in the form of poor nutrient uptake, limited capacity for moisture retention, or genetic inferiority. As "babies" turn into "rogues," workers and scientists dissociate themselves from their role as caregivers and absolve themselves of responsibility by placing the onus to grow well on the plant itself. "After all," noted Budi, "we can only do so much. After that, it's up to the seed."

Nursery workers and scientists affirm that love and violence are necessary to ensure healthy seed growth. Both constitute forms of care.[39] For instance, Lien described

39. van Dooren, *Flight Ways*, 87–124.

Figure 6. Premature inflorescence in a clone seedling. Credit: Sophie Chao

culling as a "compassionate" act that spares weak plants a lifetime of disease and inevitable death. Selection is also altruistic in that it prevents the contamination of healthy seedlings and allows strong plants to obtain nutrients, water, and fertilizers otherwise wasted on weak plants. Lien explained:

> If we don't get rid of the diseased seedlings, they contaminate the others, and more must be culled. By culling the weak, we help the strong live. Otherwise, the fertilizers are wasted on the runts. *Ganoderma*, for instance: it's a fungus that spreads so damn fast, like cancer. Because oil palm's roots grow laterally, the rot spreads quickly to other plants, and then we not only have to destroy the plants, but also replace all the soil. Sometimes, culling is the kindest thing to do.

The violence of culling, selection, and breeding demonstrates that love for seeds is *conditional* on the seed's ability to respond to human care by thriving, albeit along narrowly prescribed lines. This loving is valued so long as caregivers can detach themselves emotionally when violence is called for. Violent care itself is *selective* in terms of which plants survive. Indirectly, culling helps healthy plants survive by eradicating the "rogues," reserving more resources for those beloved seeds that achieve growth targets. For the "rogues"—as the direct objects of culling—"violent care" means immediate death. Yet culling also spares "rogues" the cruelty of disease and poor growth. These acts of killing are also part of caring for things other than individual seeds and plants. Much as van Dooren describes the care for species in the violence directed toward individual cranes and other avian critters,[40] culling the weak enables oil palm scientists and workers to focus their attention and resources on nurturing and developing more efficient and sustainable plant varieties, including, eventually, the ideotype. In this sense, sacrificing individual organisms, too, constitutes a form of care for the broader and longer-term well-being of the palm oil sector and the planet. As caregivers sway

40. Ibid., 87.

affectively between the enchantment of good growth and the disenchantment of failed thriving in the (necro)biopolitics of seed care, affective attachments, scientific knowledge, and economic rationale all contribute to sealing the fate of seeds as darlings or disposables.[41]

Caregivers and Money Makers

When describing their practices of seed care, breeders and nursery workers in the Harapan Baru plantation frequently contrast themselves with the finance, marketing, and investment employees of the company, whom they refer to with the English term, *money makers*. Money makers, breeders and nursery workers say, "do not understand seeds" (*tidak mengerti biji*) and "do not care about seeds" (*tidak peduli sama biji*). For money makers, seeds are just "dollars and rupiah," as Lien put it. Money makers might be good at sweet-talking investors and marketing palm oil products. But they lack the "soft hands and soft heart," in Agung's words, required for seeds to grow well.

On one level, the contrast between money makers and caregivers arises from the divergent forms and sites of their labor within the corporation. Money makers tend to be based in offices in Pekanbaru, the capital of Riau province, or in Jakarta. Physically removed from the materiality of the plantation, they lack affective involvement with and knowledge of seeds and reduce them to percentages, charts, and statistics.[42] Yet money makers fail to recognize that, without care for seeds, no amount of calculation alone can produce profit. As Guthrie noted in his presentation, successful seed growth requires that humans take on the role of loving "nannies" rather than disengaged businessmen. On this basis, scientists often felt they shared more in common with workers than with money makers, even though scientists' levels of education and salaries are closer to those of the money makers. Indeed, whenever we visited the nursery, Lien made a point of asking workers not to address him by his title of Doctor because "We are all the same. Doctor or not, it doesn't matter. What matters is that we care about the seeds. We are not money makers."

Furthermore, caregivers and money makers differ in terms of how and why they value seeds—the former as living beings with potential to grow, the latter as generators of profit. The competing authority of caregivers and money makers is most evident when it comes to deciding which plants should be culled and when. Caregivers tend to want to give plants "a chance to heal" and are curious to see how they might adapt to disease or degradation. In contrast, money makers encourage culling as soon as signs of deterioration surface. Caregivers are frustrated when money makers interfere in these matters. "They don't see the plant, they only see profit," nursery worker Carlos complained.

41. Myers, "Conversations on Plant Sensing," 43; Hardt "Foreword," ix–x.

42. See Kortright, "On Labor," 575–76.

Caregivers criticize money makers for neglecting seeds as living organisms. Conversely, money makers dismiss the affective attachments of caregivers to seeds because these fall outside the utilitarian paradigm of profit maximization. Whereas nursery workers describe seed care in parental terms, money makers talk about seeds in the functional language of standard operational procedures and corporate policies. Money makers also deride caregivers for being "softies" who, as Agus joked during the meeting in Jakarta, "simply can't stay away from their babies." During nursery visits, finance and marketing representatives made fun of parental terms used by workers to describe seeds, calling them "lame" and "embarrassing." Whereas workers enjoyed joking among themselves about "becoming mothers," similar jokes coming from money makers fell flat, causing vexation and irritation.

In her work on iron-biofortified rice in the Philippines, Sally Brooks demonstrates the pressures placed on researchers by a funding environment demanding "impact at scale" within ever shorter time frames.[43] Similarly, in the Harapan Baru breeding center, scientists complained about the exacting demands placed on them by money makers to develop the ideotype as quickly and cheaply as possible. The money makers, breeders said, do not understand the patience, rigor, and commitment required of scientific experimentation. They fail to appreciate the "magic" of seeds as living beings who play a part in scientific discovery, a process never solely determined by the human researcher. Refusing to "make time for care,"[44] money makers see everything in terms of immediate cost and revenue. These contrasting perceptions epitomize Chris Kortright's distinction between "working *on*" and "working *with*" seeds.[45] While money makers position the human as producer and the plant as passive raw material, caregivers position humans and plants as "working together" in a situated relationship.

Some scientists also note with concern how they are often asked by money makers to exaggerate potential seed yields and resistance in meetings with clients. Breeders who refuse to massage their findings to attract investors are criticized for being overly fastidious "intellectuals" or overly emotional "softies." Many money makers complain about scientists' frustrating ignorance of the strategic embellishments and convenient gloss-overs required to close big deals. "Softies" tend to be diplomatically steered away from corporate meetings, including one I attended between Harapan Baru and potential investors from the United States and Australia. When I asked if Lien, head of breeding, would attend, the head of finance shook his head and responded: "No way, Lien never talks with the investors! He talks to them like a professor giving a conference—way too much detail! All investors want to know is how much money they can make with us. Lien, he gets carried away, you know. No, Lien isn't good with this kind of thing. He's too emotional about his seeds." As Stone and Glover note, the rhetoric surrounding

43. Brooks, "Living with Materiality," 186.
44. Puig de la Bellacasa, "Making Time for Soil."
45. Kortright, "On Labor."

biotechnology and its predicted impacts can often cause discomfort to those practitioners directly involved in scientific experimentation.[46] At Harapan Baru, the capacity of researchers to be transparent about the unknowns of seed technology is further compromised by their status as company employees. Tensions with money makers give rise to reflections among scientists about the risks of corporate endorsement that, as Lien expressed, "puts science at the service of salesmen." For instance, some noted that their employment by the oil palm industry undermined their credibility in the eyes of independent scientific institutions. Others questioned the potential of breeding to make palm oil production more sustainable, given the corporate logic of always pursuing greater profits. On my last night in Riau, Lien shared his reservations with me:

> I've been at this research center for over forty years now, but I do wonder about all the stuff we do to oil palm—the culling, the breeding. The millions of plants we destroy, the waste of life. Scientists and businessmen, they don't really mix. For the money makers, you can't care about something that doesn't have financial value. For me, it's the other way around. Value comes from caring. But maybe I've become a softie. Maybe it's time for me to retire! Then, I could grow my own garden. I've always wanted to grow my own garden.

Martin, Myers, and Viseu describe care as a "selective mode of attention" that privileges some lives while excluding others. They remind us that asymmetrical power dynamics inevitably determine who has the power to care, what care means in practice, and toward what objects care is either exercised or withheld.[47] In the Harapan Baru concession, caregivers and money makers selectively privilege divergent yet coexistent aspects of seeds—their magic as plants versus their potential as profit. Scientists, like nursery workers, form intimate personal attachments to seeds as living objects of intimate care. Yet as they engage in the necessary labor of killing seeds that fail to produce expected yields, they face difficult decisions over how, from whom, and why, to care.[48] These decisions are complicated by the interference of money makers, whose resources scientists depend on to practice seed care in the first place.

Science and technology studies scholars have noted how science practitioners can become affectively transformed by their subjects of inquiry.[49] Brian Massumi's definition of affect as "the power to affect and be affected" helps elucidate the tension between caregivers and money makers in the Harapan Baru concession.[50] Seeds as "lively

46. Stone and Glover, "Disembedding Grain," 86, 94–96.

47. Martin, Myers, and Viseu, "The Politics of Care," 627.

48. On "the necessity and labor of killing," see Haraway, *When Species Meet*, 80.

49. See, for example, Despret, "The Body We Care For"; Hustak and Myers, "Involutionary Momentum"; Latimer and Puig de la Bellacasa, "Re-thinking the Ethical"; and Myers, "Conversations."

50. Massumi, *Politics of Affect*, ix.

capital" generate "lively affects" among their human counterparts[51]—wonder, tenderness, and curiosity, among others. Seeds also enlist humans in contested regimes of care, prompting contextual alignments and divisions *among* corporate actors as they side with or against each other over matters of care. Scientists and workers align in their capacity to exert positive transformations in seeds and become themselves emotionally invested in seed life. In contrast, money makers are concerned solely with "the power to affect" seeds by optimizing them as commodities. While for scientists like Lien the practice of caring endows seeds (and seed-human relations) with affective and ethical value; for the money makers, market value prevails over affective care. Value, as a material and ethical concept,[52] is imbricated with care for both groups of actors, but these concepts diverge in their attributed precedence. For scientists like Lien, the value of seeds—affective and material—*arises* from practices of care, whereas for money makers like Budi, financial value alone *justifies* sustained care.

The dilemma faced by caregivers can be understood as a struggle over "response-ability," Haraway's term for the ethical responsibilities of researchers toward their worlds and their capacity to be affected by their objects of inquiry.[53] Scientists and nursery workers affirm that love for seeds is imperative to successful seed growth. Yet "tough love," in Guthrie's words, is needed when seeds fail to deliver expected yields and profit. Scientists must also temper their love for seeds to avoid being discredited as "softies" by the money makers. The worlds scientists inhabit are plural yet enmeshed—corporate and scientific, human and vegetal. Each demands a different yet mutually dependent modality of ethical response. Being response-able to all parties is a complicated endeavor, not least because scientists recognize that money makers, too, care in their own way. After all, pushing for the mass production of high-yield plants guarantees that employees' salaries are paid, and the world is fed and fueled. Overlapping "regimes of care"[54] arise within the contested space of the plantation and its interspecies relationships, as situated actors contend over who gets to speak for the seed.[55] The tension between caregivers and money makers and their respective notions of care and value reveals itself as a necessary paradox within the plantation economy.

Conclusions

Human-seed relations explored in this article highlight the situated meaning of care in the productionist ecologies of late neoliberal capitalism.[56] On the one hand, the various forms of seed exploitation and manipulation practiced by workers and scientists support the critique of monocrop ecologies. Seeds and their ecosystems are enlisted in the

51. Rajan, *Lively Capital*, 16, 23–24.
52. Ibid., 19.
53. Haraway, *When Species Meet.*
54. van Dooren, *Flight Ways*, 87–124.
55. Barnes, "Separating the Wheat from the Chaff," 95.
56. Puig de la Bellacasa, "Nothing Comes without Its World," 211.

schemes of biotechnology and the dreams of biocapitalism.[57] Possessed by the spirit of capitalism and its productivist agendas,[58] the oil palm seed is a "captive form of life," in van Dooren's sense of a life produced through fundamentally coercive relationships.[59] Following Harry Cleaver and Jason Moore, one might describe seeds as the nonwaged, extrahuman workers whose vitality is appropriated and transformed by humans into capitalist value.[60]

Yet oil palm seeds are also *lethal capital* whose proliferation wreaks ecological havoc on complex biological systems. The notion of lethal capital complements the notion of species as "lively capital" developed by Rajan and others by attending to the destructive effects of particular lifeforms on other organisms and the environment. Lethal capital might encompass proliferating cash crops such as oil palm and soy, but also invasive and introduced species that radically undermine existing ecosystems and their living communities. The concept draws attention to *unloving* rather than "unloved" organisms that do violence to other species and their environment.[61]

At the same time, however, capitalist "natures" such as monocrop plantations are also multispecies "contact zones" where humans become invested in material, ethical, and affective ways in the seeds toward which they practice care.[62] At the heart of the plantation system is a group of people who nurture these organisms as seeds of life rather than kernels of profit. The forms of care they exercise are distinctive: passionate, parental, highly scientific, but also conditional and brutally selective. Yet scientists and nursery workers in their own ways also practice "multispecies love" as they immerse themselves in the lives of their vegetal "babies."[63] The widely documented destructive external effects of the oil palm industry obscure the internal care that animates the affective attachments of corporate actors to seeds, even as these attachments remain marginalized within the dominant logic of neoliberal capitalism and techno-scientific advancement.[64]

In this light, condemnations of the violence of biotechnical capitalism, while legitimate in many respects, fail to appreciate the ways in which corporate actors' affective attachments to plants as agentive lifeforms may transcend plants' value as capital.[65] In these economies of affect, seeds constitute what Susan Leigh Star and James Griesemer describe as "boundary objects."[66] Alternately "babies," "runts," or "green gold," the seeds

57. Kirksey, Schuetze, and Helmreich, "Introduction," 1.

58. Kirksey, *Emergent Ecologies*, 169–70.

59. van Dooren, *Flight Ways*, 87–124.

60. Cleaver, *Reading Capital Politically*; Moore, *Capitalism.*

61. On "unloved species," see van Dooren and Rose, "Introduction."

62. On "contact zones," see Kirksey, "The Multispecies Salon," 8; Barad, "On Touching," 208; Haraway, *When Species Meet*, 287.

63. On "multispecies love," see Tsing, "Arts of Inclusion," 19.

64. Puig de la Bellacasa, "Making Time for Soil," 692.

65. See Glover, "A System Designed for Rice?"

66. Star and Griesemer, "Institutional Ecology."

accrete meaning as they travel across material and affective realms, while also drawing together (but also apart) disparate yet mutually dependent individuals within the corporate nexus. In Harapan Baru, the drive for care toward crops as commodifiable produce rarely goes uncontested—including by the sector's own constituents.[67] The violence of seed selection, manipulation, and culling certainly imposes on seeds a singular mode and temporality of growth.[68] Yet seeds too are living histories constituted by the places, practices, and persons involved in their management across time and space. Even in the techno-capitalist ecology of monocrop oil palm plantations, "nothing comes without its world."[69]

To return to Chrulew's question and my counter-question in the introduction to this article, extinction and proliferation are both at play in the palm oil matrix. Care for seeds enacted by corporate actors troubles the issue of how, and who, we should love when it comes to a plant whose proliferation causes and depends on the extinction of other species, and which is itself subjected to coercive violence. Care within the palm oil sector is, as Puig de la Bellacasa notes, "political, messy and dirty, not an innocent category."[70] A nonidealized vision of care requires attending to conflicts and tensions inherent in the relational practices of knowing, thinking, and acting in capitalist interspecies relations.[71] As we wade through the troubled waters of *cui bono*, or "who benefits [more]" in the techno-scientific politics of making and perfecting the species,[72] we must also attend to life-generating care exercised within entities widely associated with the life-destroying pursuit of profit.

As Rajan notes, technoscience is coproduced through the deliberations and actions of policy makers, activists, purchasers, and other actors.[73] Similarly, the implications of this article extend beyond the realm of the plantation and the body of the seed. Palm oil is the most popular and cheapest vegetable oil on the market, and an ingredient in over half of all packaged goods, including foodstuffs, cosmetics, and cleaning products. We, too, as consumers, participate in the social world of oil palm as a growing global commodity of worldly consequences. Refusing "only-human stories" of the biosocial transformations wrought by techno-scientific capitalism, as I have sought to do, is a critical starting point in rethinking interspecies relations in more ethically grounded ways.[74] This includes cultivating "arts of attentiveness"[75] toward organisms, like oil palm, of destructive and ethically ambivalent effects.[76] Lively "ethographies"[77]

67. On commodifiable produce, see Puig de la Bellacasa, "Making Time for Soil," 700.
68. Tsing, *The Mushroom at the End of the World*, 168.
69. Puig de la Bellacasa, "Nothing Comes without its World."
70. Puig de la Bellacasa, "Making Time for Soil," 707. See also Rajan, *Lively Capital*, 440–46.
71. Puig de la Bellacasa, "Nothing Comes Without its World," 204.
72. Haraway, *Modest_Witness@Second_Millennium*.
73. Rajan, *Lively Capital*, 17.
74. van Dooren, Kirksey, and Münster, "Multispecies Studies," 2–3, 6.
75. van Dooren, Kirksey, and Münster, "Multispecies Studies."
76. Ginn, Beisel, and Barua, "Flourishing."
77. Van Dooren and Rose, "Lively Ethography."

such as the seed stories shared in this article bring us to realize that to consume palm oil is to become involved in the manifold extinctions and proliferations that produce palm oil as a multispecies process. Each seed embodies the simultaneous liveliness and lethality of commodified lifeforms. And just as the presence of each seed is enabled by the absence of countless culled others, so too every drop extracted from it carries within it a complex history of consequential care and coercion.

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