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Introduction

Marion Ernwein, James Palmer, Franklin Ginn

What can a worker do? They can drudge and gripe but take the pay. They may be able to organise and demand. They might collectivise, strike, picket. They could commit to heterodox identity practices, widening their struggle. They might draw up a more equitable rota for domestic duties. They might die, smothered and quiet, in a concrete corner. Or lose a limb. They might compose a ballad, nurture a wound down through generations to earth their pain. They can tweet.

But can they photosynthesise?

From ‘tree-based’ climate solutions and ‘green infrastructures’ to ‘plant-based’ diets and ‘woods for health’: more hope than ever before is being invested in plants to help respond to a multi-dimensional environmental, social and economic crisis (Springmann et al. 2018; Clark et al. 2019; OTHERS). Emerging confidently from the background to which western ontologies have historically confined them, plants of all kinds are increasingly understood as active contributors to the making and safeguarding of worlds. At one level, the changing place seemingly attributed to plants and their dynamics today speaks to a deep transformation within conservation and environmental management, where process-based, functionalist approaches to ecosystems are increasingly taking over from the more static, species-based, compositionist paradigms that had dominated 20th century practice (cf Marris 2011; Lorimer 2015). [Decentred from the pursuit of preserving species depending on their place in a value-](#)

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[laden hierarchy, such approaches more readily integrate uncharismatic beings and communities, including in the lower orders of the plant realm.](#) No less important is a formidable increase, particularly in the past thirty years or so, in scientific understandings of plants' remarkably diverse and complex modalities of reproduction, dispersal, and communication. And in a more contested but certainly no less intriguing set of developments, previously marginal scholarly commitments to the ideas of plant "memory", "sensitivity", "cognition", and even "intelligence" (cf. Pollan 2013), have – despite lamentations of widespread "plant blindness" (Wandersee and Schussler 1999; see also Sanders 2019) – become the foundational basis of a burgeoning new wave of popular writing, both fictional and non-fictional, on the intricate modes of existence of vegetal life.

These various emerging spheres of knowledge, public engagements with them, and indeed the types of policy and management interventions that they inspire, raise many questions: What are humanity's ethical responsibilities towards vegetal life, once plants have been acknowledged as sensory, communicative, 'intelligent', [world-making](#) beings? How can 'plant-based' solutions to environmental problems acknowledge and accompany vegetal capacities, without further subjecting plants to the very objectifying forms of knowledge and disciplinary regimes of regulation that arguably gave rise to the environmental crisis in the first place? And what role should there be for scientific concepts and knowledges in reshaping anthropological relations with plants, given that gardeners and gatherers in both hemispheres have long known that plants are lively, inventive world-makers? Although the history of humanity is a history of plant selection and breeding, of variety creation, of tree pruning and grafting, the molecular turn in the life sciences has recently shifted the scale at which plant life can be known and intervened in: through genetic engineering and biocomputation, for example, relations between capital-intensive technologies and plant life are not merely intensifying, but multiplying, often with an explicit focus on accelerating

plants' metabolic activity and imprinting proprietorship directly within plants' basic functions (ref). There clearly isn't therefore, a single, coherent direction in which new understandings of plant life are leading, inviting the question: If the future is to be vegetal, then what futures can be built with plants at the edge of, and beyond, a broken capitalist world? No less urgent, from the perspective of this volume, is another question: How can the social sciences help to scrutinise and discriminate between the multiple avenues available for shaping human–plant relations yet to come?

Human-plant relations are of course a long-standing topic within the social sciences, with anthropology, archeobotany and ethnobotany all having played central roles in examining the modes of categorisation used by different societies and social groups to know and order the plant world, as well as the sociotechnical knowledges developed to help select, breed, and grow plants in practice (e.g. Haudricourt 1962). Human relations to plants have in fact been recognised as pivotal in shaping relations among people for some time, whether through symbolic mechanisms – as captured, for example, in Laura Rival's (1998) edited collection "The social Life of Trees" – or in a more material sense – as evidenced for instance by anthropologist Martine Bergues' (2004) ethnography of gardens in rural France. Countless other contributions to this rich background might just as easily be mentioned here. Yet the more recent 'plant turn' nonetheless captures something of an ontological and epistemological shift. Increasingly, plants are apprehended not merely as socio-cultural artefacts and symbols, but as living organisms "at the fulcrum of [their] world" (Marder 201x: 8), putting their own imprint firmly onto the relations within which they are enrolled. To fully understand the emergence of such a thing as the 'plant turn', one must – at least initially – acknowledge the important influence of work in multispecies, and more specifically animal, studies. Guided by the motto that "We have never been human" (Haraway xxxx), this wide body of thought highlights the active role that non-human

processes and organisms play in shaping social life, from slugs complicating gardening (Ginn 2014), through to charismatic birds sustaining conservationists' interest and passion in their work (Lorimer 2008), and even pigeons helping to monitor air pollution (Haraway 2016). More-than-human geographers, for instance, have raised the important point that not only are there "animal spaces", ordered by and through human social relations, but also "beastly places", made and experienced by animals themselves (see Philo/Wilbert 2000). Paying closer attention to animals' perspectives, lived worlds, and ethologies, moreover, is frequently argued to be key to enacting more ethical modes of co-existence, as for example in work on urban feral animals commonly treated as pests (Barua/Sinha 2019).

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The decentring of the "metaphysical image of the human" (Marder 2013: 1), some argue, has been predominantly predicated on a recentring of other animals, their lives, and their entanglement with us. Whilst this move has in many ways redressed the marginalisation suffered by animals "throughout the history of Western thought" (ibid: 2), it does still leave important gaps in the list of organisms deemed to have a legitimate place in our understanding of ourselves, our world, and our responsibilities. Indeed, if animals have long been marginalised, "then non-human, non-animal living beings, such as plants, have populated the margin of the margin, the zone of absolute obscurity undetectable on the radars of our conceptualities" (ibid: 2). By extension then, 'plant turn' advocates can arguably be seen to attempt to achieve – in shifting attention from 'plant spaces' to 'vegetal places' – a recentring of plants predicated on the idea that they not only "are" but "exist" (Vattimo/Zabala, foreword to Marder 2013: xiv). Far from being "decorations on the tree of life" (Coccia 2019: 4, citing Niklas 2016: viii), from this perspective plants are in fact the most fundamental *makers* of the world; they "transform everything they touch into life, they make out of matter, air, and sunlight what, for the rest of the living, will be a space of habitation, a world" (Coccia 2019: 8). Moreover, as sensory, communicative, and perhaps

even ‘intelligent’ beings, plants not only *make* but *experience* lifeworlds; therefore, to understand the relational and entangled character of habitation requires multispecies or environmental (post)phenomenology to account for plants’ sensoria as well.

The ‘plant turn’ is particularly lively within the discipline of philosophy. Michael Marder’s (2013) agenda-setting ‘Plant-Thinking’ volume, for instance, reappraises centuries of Western philosophy through “scrutiniz[ing] the uncritical assumptions on the basis of which [plant] life has been hitherto explained” (ibid: 3), foregrounding instead the “surprisingly heterodox approaches to the vegetal world” that have germinated on its fringes (ibid: 6). In a similar vein, Jeffrey Nealon’s (2016) “Plant Theory: Biopower and Vegetable Life” seeks to redress the “elision of plant life in recent biopolitical theory” (ibid: xi) and to use the unearthing of plant life to redefine the boundaries of the “wider biopolitical focus on ‘life’ in humanities theory today” (p. xiv). Whilst Nealon readily admits that his interest is not strictly in “lauding plants or wondering about animals and will” (ibid: xiv), such questions have nonetheless fuelled writing at the other end of the plant philosophy spectrum. Emanuele Coccia (2019: 124), for example, criticises the writings of Marder, Nealon and others for “insist[ing] on finding the truth about plants in purely philosophical or anthropological research, without having any truck with contemporary botanical thought – which, on the contrary, has produced remarkable masterpieces in the philosophy of nature”. Coccia’s own work, in contrast, seeks to revisit philosophy from the starting point of ‘plants themselves’, engaging directly with research into plant life, behaviour, and communication. Yet he also perceives a need to take some distance from the ‘analogising’ tendencies evident in some quarters of the plant sciences – or what he describes as the “stubborn attempt to ‘rediscover’ organs ‘analogous’ to those that make perception possible in animals without trying at all to imagine [...] another possible form of the existence of perception, another way of thinking the relation between sensation and body” (ibid: 126). Not dissimilarly, for Karen

Houle (2011), everything plants disrupt – the binary between individual and collective, the idea that communication takes place within two participants in a dyadic unit, etc. – should help to build a case *against* analogies, and instead provoke more radical and creative thinking that goes far beyond re-readings, however sophisticated, of existing concepts.

There is a fine line, in these accounts, between driving towards an understanding of plants in their own terms on the one hand, and building a new ‘field’ of philosophy squarely upon the foundations of natural scientific enquiry on the other, as if decades of work in the history and sociology of science had not given sufficient heed to humanities scholars or indeed social scientists tempted to take expert knowledge claims at face value. This is a point perhaps most forcefully and effectively made by decolonial and indigenous thinkers, who rightly question the reliance, in [posthumanist thought more broadly](#), upon predominantly western philosophy and science ([cf Sundberg 2013; Todd](#)). Indeed, through anchoring their writings within such a specific heritage, ‘plant thinkers’ might even be said to have a tendency to ‘background’ the very rich veins of plant-thinking that have long existed within non-western philosophies and knowledge traditions. That these alternative knowledges about plants appear as new and valid from the vantage point of Western epistemic communities is, in other words, symptomatic in itself of a deeper structural politics (see e.g. Sundberg; Todd; Wall Kimmerer).

Although partly shaped by the longer traditions of ethnobotany, archeobotany, and the anthropology of plant–people relations mentioned earlier, work on plants in the social sciences hasn’t been left untouched by more recent ontological, epistemological, and political discussions. Under the umbrella of “vegetal politics” (Head et al. 2016), social science accounts of people–plant relations have recently re-centred plants as living, lively, and indeed capable beings. While certainly sharing with plant philosophy and humanities an interest in advances in plant science, the specificity of these studies typically lies in the empirically-

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Informed by cultural criticism and performance studies; also gestures speculatively at the role of plant-performance in opening alternative societal paths (Myers [highlight her engagement in thinking plant performance beyond western concepts?], Thorsen)...
e.g. Michael Marder editor of book series “Critical Plant Studies: Philosophy, Literature, Culture”. Focus on visual and plastic arts, literature... aesthetics, ethics... e.g. Laist, Randy (ed.)(2013): *Plants and Literature: Essays in Critical Plant Studies*. Brill.

grounded character of their observations, and in the connections that they establish between broad ontological and epistemological questions and situated practices of plant growing and management. Work in this guise proceeds in two principal ways. The first seeks to renew registers of analysis through recentring plant life in interpreting and conceptualising human practices. This approach, perhaps best exemplified by scholars such as Lesley Head and Jenny Atchison, develops a conceptual vocabulary that seeks to render the analyst's toolbox more apt to take into account the difference that vegetal lifeforms make within concrete socio-natural settings. Head, Atchison and Phillips (2015: 399), for example, draw on biological research to discuss "the differences" that the "shared capacities of one grouping of beings called plants [...] bring to relations with humans and others." They discuss how accounting for plants' distinctive materialities, the singularities of their movements, their capacities to sense and communicate, and indeed the flexibility of their bodies, can help to renew understandings of and ultimately better inform invasive species management. Elsewhere, Atchison and Head (2013) reflect on the implications of plant bodies for broader efforts to conceptualise embodiment within the social sciences. Plant bodies, they argue, "challenge our understanding of individual and collective bodies" (ibid: 952), with broader implications for thinking about the embodied nature of environmental management.

A second approach, meanwhile, seeks to reappraise and recentre situated knowledges about what plants are and what they do. This approach does not presume that academic concepts of plant agency, behaviour and capacity need to be centred; instead, it is interested in unpacking the categories that practitioners themselves mobilise to talk about, think about, and interact with lively vegetal processes. Rather illustrative of this second approach, Jeremy Brice (2016; this volume) centres social practices of attention and registering in analysing vine growers' relations to the sometimes tumultuous processes of plant growth and ripening. He highlights how specific characters of vine life are registered and monitored, and how this

in turn shapes relations between vine agencies and wine production. These two broad approaches are, of course, overlapping and often interconnect; nonetheless, they suggest that plant agency and capacity in fact play two kinds of roles – as categories of practice *and* of analysis – and that these roles themselves inspire the development of distinct conceptual registers and frameworks.

To date at least, this relatively new and still very active strand of research into “vegetal politics” has been firmly positioned within the more ‘cultural’ branches of the social sciences (and especially within cultural anthropology and cultural geography). The premise of this book, intended to both contrast with and complement such work, is that the conceptual resources of the ‘plant turn’ in fact also have much to offer to our understandings today of contemporary economic processes of value creation, accumulation and reproduction. Indeed, notwithstanding occasional forays into the terrain between plant studies and critical political economy, scholars of vegetal politics have typically tended to appraise plants’ roles in shaping the terms of situated, “embodied interrelating”, rather than in co-constituting processes “of greater interest to political ecologists, including resource distribution and state–local relations” (Fleming 2017: 33). Accordingly, this book sets out to offer readers a collection of inquiries advancing diverse conceptual, empirical and methodological entry-points for beginning to unpack the complex relations between vegetal agencies, resource making, commodity production, and ultimately value creation.

Of course, inquiries into the roles played by vegetal lifeforms within evolving relations between capitalism, nature, and the state are themselves longstanding. Jack Kloppenburg (2004), for example, draws from earlier work in agricultural political economy in pinpointing the nature of seeds – at once the basis for producing crops *and* for deriving additional seeds – as a historical impediment to the ability of capitalism to establish full control over the means of agricultural production. From this perspective, the development of

hybrid crop cultivars appears as essential not only to markedly increased global agricultural productivity in the second half of the twentieth century, but also – given the sterility of those cultivars’ seeds – to the establishment of properly capitalist social relations in industrial agriculture, wherein farmers must enter the market for an expanding range of basic agricultural input commodities. In another classic study, meanwhile, Scott Prudham (2005: 13) has examined capital’s “confrontation with and reliance on ecological processes” not in the sphere of industrial agriculture, but the quite different setting of the vast Douglas-fir forests of North America’s Pacific Northwest. For him as for Kloppenburg, the innate ‘obstacles’ presented by nature – whether in the form of inherently non-uniform patterns and temporalities of tree growth, or the sheer extent of forests themselves – can only be overcome through an ongoing “struggle over the social (re)production of new natures” (ibid: 13).

Yet, while these and other landmark studies are at pains to avoid depicting “the matter of nature” (FitzSimmons 1989) as a purely recalcitrant realm offering up “rigid limits to growth” (Prudham 2005: 17), an allegiance to theoretical frameworks regarding nature as inherently ‘socially constructed’ or ‘produced’ (cf. Smith 1984) nonetheless militates against a fuller acknowledgement of “the productive capacities” of the nonhuman world itself (Bakker and Bridge 2006: 11). By contrast, for scholars investigating the dynamics of new bioeconomies predicated upon recent, rapid developments in the life sciences, capital accumulation and value production are driven not just by the manipulation of biotic material or the marshalling of biological and genetic information by humans, but by the lively potentials of *all* biological life (Rajan 2006; Cooper 2011). The “regenerative work” (Cooper and Waldby 2014) through which all biological life is sustained here becomes the basis of surplus value production in a chiefly promissory and speculative manner, ultimately on account of that work’s innate contingency, and hence its potential – at least in theory – to be recast in an unlimited number of new, as yet unrealised ways. Yet, if studies of what has

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frequently been termed *biocapital* acknowledge the lively agencies of the nonhuman as a distinct “locus for accumulation” (Barua 2019: 650), [they have also sometimes been decried for playing into the fetishization of the basic category of ‘capital’ itself \(Helmreich 2008\).](#)

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In contrast, still more recent work in more-than-human political economy – led especially by animal geographers and environmental anthropologists – has sought to appraise nonhuman agencies not just as a form of “lively capital” (Haraway 2008) [that can be tapped into and drawn on](#), but as *co-constitutive* of the broader economic realm “from the outset” (Barua 2019: 651) [and through more active and varied registers than those described above](#). Work attending to regimes of value production centred around animal life, for example, has increasingly advocated a view of the lively capacities of diverse species – in contexts ranging from food production to conservation and even cinema – as forms of “nonhuman labour” in their own right, whether [metabolic \(Beldo 2017\), affective \(Barua\), or intersubjective \(Porcher and Estebanez\)](#). That nonhuman nature might be explicitly understood as capable of working [might come across as provocative](#). It would, [however](#), come as little surprise to communities already seeking to capitalise on its supposedly “enterprising” instincts (Dempsey 2016), for example by extracting ‘payments for ecosystem services’ in the realm of biodiversity conservation. Yet it is not just an ability to work or perform labour per se, but a fundamental capacity to shape basic economic processes centred around life – including its commodification, circulation, exchange, storage, and even consumption (Collard and Dempsey 2013; Banoub and Martin 2020) – that scholars at the forefront of this new wave of more-than-human political economic research attribute to the nonhuman. [In other terms, that tissues, animals, or organs need to be and remain alive throughout these processes sets them apart for a range of reasons including the practices and technologies required, the risks that living materials pose, and the potentials that ‘surplus’ biotic activities bring into processes of value creation](#). Set

against the backdrop of a world increasingly playing host to “troubled ecologies” (Besky and Blanchette 2019), questions about how nature not only is produced but also *works* in diverse contexts, and indeed about the terms on which ‘the work of nature’ might be better recognised and responded to (Battistoni 2017), have thus emerged of late not just as pressing theoretical concerns, but as urgent ethical problems as well. [Surprisingly enough, though, plants have so far occupied a marginal space within these types of accounts; a quasi-absence this books seeks to redress.](#)

[In this light](#), this book’s own ambition to explore the heterogeneity of the *planty* agencies at work in capitalist economies today will clearly demand experimentation with a wide array of conceptual tools, an embrace of diverse empirical sites, types and stages of vegetal life, and perhaps even a refusal – in line with a view of fundamental economic processes as co-constituted by human and non-human agencies alike – to reify the category ‘plant’ itself (Head/Atchison/Phillips 2015). Such an agenda, moreover, is far from merely academic in scope. Indeed, and as the last section of the book in particular aims to make clear, current environmental issues – ranging from food insecurity to urban vulnerability and climate change – are not just symptoms of the breakdown of existing vegetal economies, but opportunities to experiment with entirely new ways of both living and working with vegetal lifeforms. The stakes entailed therefore, in developing more sensitive understandings of the work that plants do, extend not just across the diverse political-economic terrain of the present, but into the realm of practices oriented explicitly towards the shaping of both human and vegetal futures as well.

Planty commodities

Plants at work (1,706 words)

The next chapters extend the work performed by the previous ones on vegetal commodities, by highlighting that plant agencies in fact are involved in multiple processes of value creation and social reproduction. While plants are produced as commodities, through their metabolic activity they are also producers, not only of themselves but of social infrastructures, work relations, and value. The chapters argue that recognising their productive and reproductive role as a form of labour can help to renew the registers of Marxist critique at a time when the articulation between environmental change and a crisis of labour requires urgent creative thinking (Barca). Although the papers share an interest in Marxist analysis, they expand its boundaries by bringing to bear conceptual resources from Actor-Network Theory, feminist theory, and the anthropology of time. The chapters closely engage with one or more specificities of plant life – whether plants’ metabolism, the peculiar form of their intent, or their capacity to partake in intersubjective relations and to imprint their non-sidereal temporalities upon capitalist processes. Together, they therefore not only bring different twist to Marxist labour theory of value, but importantly also highlight the importance of developing a specific conceptual vocabulary to take plants’ lives in a capitalist world seriously.

Harold Perkins’s chapter, reproduced from a 2007 *Geoforum* article, marked at its publication a key milestone in efforts to bring together ‘materialisms old and new’. The chapter offers a sophisticated discussion of the ways the concept of distributed agency within ANT can help to renew Marxist understandings of exploitation and to highlight the momentum that different actants gain through their capacity to enrol others’ labours. In the chapter, Perkins deploys an extensive understanding of labour, which he draws from Marx’s mention, in *Capital* volume 2, of “instinctive forms of labour”. In those lines it appears clear that Marx holds labour to constitute the common ground of all living beings, who transform

their environments by the simple act of extracting matter to sustain their basic metabolic needs. To be clear, conventional Marxist analysis usually adopts a much more restrictive definition of ‘proper’, i.e. distinctively human, labour, as guided by some degree of intentionality. Perkins, however, argues it is necessary to take seriously Marx’s suggestion and examine its implications for understanding the power relations that unfold through the articulation of different types of labours.

Perkins advances the term “non-social labour” to highlight the active role that nonhuman organisms play in shaping capitalist processes of production and, in his chapter specifically, social reproduction. This is done by reference to the mass planting of elm trees across American cities in the late 19th and 20th Century. As lively commodities, grown, sold, purchased, planted, and maintained, trees embody the social labours of arboricultural workers, who direct their growth and “ensure future vitality and value” (p. xxx). Yet, as living organisms their growth always-also remains a biophysical metabolic process, predicated upon trees transforming their local environment through extracting nutrients and transforming air composition, for instance. The exploitation of this fundamental, metabolic activity marks for Perkins the appropriation of trees’ labour, put at the service of a specific capitalist and governmental project of social reproduction through the development of a “consumption fund”¹. This chapter offers a daring twist on conventional Marxist discussion of labour, and opens the door to further considerations of the politics of appropriating and enrolling basic, non-intentional, metabolic labour. In that sense, Perkins’ chapter provides the conceptual scaffolding of the next two chapters.

Marion Ernwein’s chapter bears empirical similarities with Perkins’, with its focus on urban horticulture and the exploitation of plants’ metabolic processes in the production –

¹ A term which describes the “association of commodities [...] directed by capitalists and state governments so that human labourers can consume them in their own process of rejuvenation” (p. xxx).

and maintenance – of urban landscapes. Key to her argument is the idea that plants' labour, rather than being "non-social" (Perkins, this volume), in fact partakes in wider, always-also social, relations of work. Drawing on research in Geneva (Switzerland), the starting point for Ernwein's chapter is a shift in park management paradigms, from "horticultural" to "ecological" approaches. Ernwein argues that this shift is accompanied by the development of "ecological labour", a form of maintenance labour "whose raison d'être is keeping nonhuman life alive and setting the right conditions for it to contribute its agencies to urban life" (p. xxx). Efforts to make labour 'ecological' "rely on new understandings of the nature of work and of workers themselves, with vegetal capacities increasingly integrated within work collectives" (p. xxx), an observation used as starting point for discussing plant labour.

Ernwein's discussion focuses specifically on two contentious points and their implications for the relevance of the term "labour" in the plant world: plants' presupposed lack of intentionality, and their incapacity to engage in intersubjective interactions. After reviewing the imports and limits of Marxist-inspired theories of nonhuman labour for thinking specifically about plants, Ernwein mobilises feminist writings on reproductive and regenerative labour to tackle the particular problem of intentionality – and lack thereof – in delineating work. Drawing on work on 'domestic' and 'clinical' labour, Ernwein develops a conceptualisation of work in which intent is not a requirement. In this view, that plants do not 'consciously' or 'intentionally' labour does not preclude them from having their labour-power exploited. This is, however, a disputed view, with some arguing on the contrary that work is by essence an intersubjective experience. Ernwein takes this as an opportunity to discuss the role that plant labour is made to play in reconfiguring human workers' engagement in their labour and their way of relating to each other; therefore decentring intersubjectivity away from plants themselves and onto the rest of the work collective. Finally, Ernwein argues that intersubjectivity need not be the primary means through which

the relational character of plant labour can be understood. Ecological labour is also shaped by wider social structures and bureaucratic logics. Plant labour is no exception and can itself be put at the service of workforce management, for example to streamline human labour. Plants, in this view, “are not merely contributing their labour to new more-than-human collaborations, but also to structural transformations of working conditions, which are neither all equalising nor all empowering” (p. xxx). Ultimately, the chapter positions the question of plant labour within wider debates about contemporary social relations and structural logics of work.

Jeremy Brice’s chapter follows a comparable logic with its intricate analysis of the modalities through which human and plant temporalities are made commensurable in efforts to organise Australia’s lucrative wine industry. Brice’s starting point is that discussing whether plants’ metabolic activity qualify as “labour” through the lens of intent and design partly misses the point. Instead, what makes plant qualify as workers has to do with their imprint on the time of production. Brice borrows from Gould, who situates Marx “within a philosophical lineage [...] which takes such differences between ‘befores’ and ‘afters’ as the stuff which the temporal distance between past and future is made”. As an activity that fundamentally produces conditions “which differ from those which preceded its occurrent” (p. xxx), labour “produces *time*” (p. xxx, original emphasis). And time, indeed, is central in Marx’s conception of exchange value, understood to emerge from comparing “the quantities of socially necessary labour-time required to produce two commodities which afford different use-values” (p. xxx). The history of capitalist development, Brice reminds us, was quintessentially a story of indexing human labour upon an “abstract and context-invariant (or sidereal) time” (p. xxx) that allows for such comparison to be performed, and for labour time to become a fungible quantity.

In the wine industry, the key role that the rhythms of plant metabolism play in shaping the stages of commodity production suggests that plants, too, in fact produce time, albeit not in the abstract manner described above. Brice therefore argues that different ways of reckoning time “may implicitly articulate a certain distribution of the capacity to produce change and generate value” (p. xxx). Brice describes the “precipitation of time” that takes place at vintage, as grapes must be harvested quickly, crushed and processed, which entails a complicated process of synchronising workers and logistics across time and space. Time reckoning is not achieved through the mechanical clock but through regular tests of sugar concentrations that help winery managers to assess the progression of maturation. Sugar time, however, may “speed, slow down, or occasionally even run backwards in relation to calendar dates”, therefore bearing little relation to sidereal time. It is precisely because of their ability to impress their own temporality on the production that vines “play an active role in generating value because they co-constitute the temporalities immanent to the *tasks* which compose more-than-human labour processes” (p. xx, original emphasis). Ultimately, for Brice, only some “niche industries” allow plants to actively participate in the capitalist value creation process and thus to labour. He is adamant therefore that plants have no innate capacity to produce value, and that their metabolic activity becomes labour only if it “constitutes the passage of time” – a view that is more restrictive than Perkins’ and even Ernwein’s.

Common across the three papers is the idea that plants do not intrinsically exist as workers. As opposed to other “economicising” ways of describing plant metabolism, such as “ecosystem services”, which assume that ecosystems always-already provide services that merely need to be made tangible and economically valued, all three authors highlight that plants’ metabolism qualifies as labour when it is enrolled in particular projects of social reproduction and commodity production. Through their different foci – on differential

capacities to command power within networks of labour, different modalities through which plants' labour organise social relations of work, or indeed shape the very temporalities of value creation, all three papers demonstrate the role that plants play in expanding the boundaries of work collectives, which in Ernwein's and Brice's chapter is explicitly linked to a discussion of forms of social vulnerabilities that can emerge when the streamlining of work is predicated not on human but vegetal temporalities. Common also between Brice's and Perkins' chapters is an understanding that labour is not merely more-than-human, but also more-than-vegetal, and that plants' performances emerge from specific, and often unstable, arrangements between not only human and vegetal, but also fungal and microbial agencies.

Seeding Vegetal Futures (1,611 words)

In the final section, the book turns its attention to the involvement of plants in emergent practices of future-making. Anxieties about the growing pace and severity of environmental change – and climate change in particular – are spurring diverse new modes of working with plants across far-flung geographical contexts, and not just in the predominantly rural milieux of agriculture and biodiversity conservation. Efforts to detoxify the metabolic flows and physical infrastructures underpinning large-scale industrial production and contemporary urban life are also increasingly tethered to vegetal capacities, whether as a basis for producing renewable alternatives to fossil fuel, for cleaning urban air, or more simply for protecting urban inhabitants and property from rising temperatures, waters, and extremes in weather. Across all of these domains, the scope of the vegetal futures being pursued can often appear self-evident: plants and trees are to act as the basis of 'natural' solutions for averting potentially irreversible environmental change and preserving a so-called "safe operating space" for humanity, unsullied by the spectre of ecological ruin. As the

three chapters in the book's final section aim to explore however, even while reconfigurations of human-plant relationships are typically advanced under innocuous banners – sustainability, 'green recovery', even human survival itself – the ideas and understandings of vegetal life which undergird these visions are frequently highly prescriptive and contestable. Moreover, and as the chapters also seek to expose, the actual work entailed in contesting these visions, and indeed in reinscribing alternative futures, may be just as much a capacity of plants themselves as it is of the human communities who variously cultivate, live-with, consume and exploit them.

In her chapter for example, Jenny Atchison outlines how reductive, essentializing imaginaries of trees – most notably of the African Mahogany (*Khaya senegalensis*) – are confounding efforts to counteract future risks posed both by rising temperatures and by increasingly frequent and intense cyclones in Darwin, Australia. Valued for decades as providers of shade, African mahoganies have more recently been demonised in Darwin, particularly following Cyclone Marcus in 2018, as out-of-place, 'towering monsters', with unusually long and large limbs prone to give way at any time. Efforts to improve natural tree canopy shade in the city – before climate change effectively renders some quarters uninhabitable – have thus become intertwined with an increasingly firm commitment to what the city's own council describes as an "arboreal cleansing process". Running just as deep as the nativist tropes that depict African mahoganies as innately ill-suited to the Australian climate, moreover, is an equally problematic tendency to see urban trees of all kinds as lifeforms that can "simply be put in their place", as ready-made – and readily substitutable – elements of benign 'green infrastructure'. The appeal of this green infrastructure lens, along with its associated promise of a perfect "botanical recipe for the salvation of urban problems", is felt far beyond Darwin of course. But for Atchison it represents nothing less than an "attempt to seize and structure the future" of urban human-plant interactions, one

guilty of overlooking much of what trees are and what they can do. Against this agenda, Atchison therefore advocates a closer attunement to what she terms the “shady work” of urban trees – that is, their propensity to engage in diverse forms of more-than-human labour whose acknowledgement is typically impeded either by its hidden nature, as in the case of subterranean root ball development for example, or else because of its slow-moving, precarious, or predominantly affective dimensions. Far from endorsing the pursuit of definitive or clear-cut ‘solutions’ to prevailing urban problems then, this lens of shady work incites a more tentative and humble approach to future urban regeneration, one importantly open and responsive to the complicating and disruptive influence of trees themselves.

Concerns about climate change are also at the core of efforts to reshape the future of the so-called ‘working forests’ of the US South, as discussed by James Palmer in his chapter. Rather than offering shade though, it is the ability of the trees growing in these forests to serve as ostensibly renewable bioenergy resources – and moreover to substitute coal as a basis for electricity generation – that drives their enrolment into efforts to cultivate a more clement global climatic future. The expanding production of biomass wood pellets from these forests, and especially from stands of trees comprising fast-growing loblolly pine, has attracted significant controversy, not least because the vast majority are exported to produce electricity abroad, especially in the UK. In seeking to counteract these criticisms, industry groups have placed particular emphasis, Palmer argues, on the benefits that wood pellet manufacturing purportedly brings to working forests’ *overall* productivity, with concomitant increases not just in the amount of coal replaced in the global energy sector, but also in the amount of carbon dioxide locked up in diverse wood-based commodities produced by other industries as well. From this vantage point, working forests are imagined as contributing to climate change mitigation not by functioning as carbon sinks, but rather as carbon conveyors – and, crucially, as carbon conveyors that bioenergy production serves to put to work more

efficiently than ever before. That trees growing in the US South *should* be put to work for the specific end goal of generating renewable electricity abroad is deeply contestable, of course, not least in view of the region's long history of colonial exploitation and forced labour. But Palmer contends that the starting point for contesting these moves should be an embrace, and not a rejection, of the idea of trees as workers – indeed, as vegetal labourers proper. For him, recognising and naming the metabolic activity of trees as vegetal labour could offer a potent basis for envisioning alternative forms of collaboration between trees and humans, outside of the constraints posed by logics of 'ecosystem services' and 'natural capital', and oriented instead towards more creative, self-determined ends than those presently offered up by foreign energy firms.

Rounding out the book's final section, Can Dalyan then examines the forms of labour which animate the day-to-day work of the Turkish Seed Gene Bank (TSGB), an institution founded only a few months prior to the international adoption, in 2010, of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. While Turkey may be party to the broader UN Convention on Biological Diversity under which the Nagoya Protocol was adopted, Dalyan's analysis reveals significant fault lines between the TSGB's outlook and the explicitly universalist perspectives associated with other prominent seed banking projects, such as the Svalbard Global Seed Vault and the Millennium Seed Bank at London's Kew Gardens. Indeed, Turkey's painful history of imperial losses and decline, not to mention its status as one of the world's key crop biodiversity hotspots, offer flimsy foundations upon which to build an image of seed banking as an endeavour concerned principally with "collaborative survival". Instead, Dalyan argues, TSGB employees enact a distinctly protectionist brand of conservation, routinely denying access to foreign researchers, and internalising a view of the latent genetic potentialities embodied by seeds stored in the Bank's vaults as a precious stock

of “national biowealth”. That the institution presently lacks the ability to sequence and license most of the crop species which make up that biowealth, moreover, does little – given the likely impacts of climate change upon future crop yields and food security – to prevent its potential value, as a source of new crop breeds and forms of crop resistance, from steadily increasing. As Dalyan puts it then, it is not strictly the future survival of humanity that the TSGB seeks to secure, so much as “the sorts of reparations that Turkey will be able to accrue” in that future, from what amounts to the systematic accumulation today of biological contingency and possibility itself. In the meantime, moreover, the already-existing potentials of seeds to facilitate alternative social relations around crops and food production – especially those predicated upon sharing and experimentation – are rooted out and extinguished as threats to the Turkish state’s future power and legitimacy, both domestically and on the international stage.

While the three chapters in section III traverse radically different empirical cases, each of them examines how plants are currently being enrolled into future-making projects that take for granted the goal of enhancing the collective capacities of earthly life, whether to endure, to metabolise, or even to create new kinds of vegetal lifeforms – and vegetal capacities – altogether. In their efforts to stretch windows of urban habitability, to intensify metabolic exchanges between the biosphere and the atmosphere, and to diversify the genetic profiles and living potentials of food crops, the initiatives discussed in this final section arguably all affirm a view of life itself as something to be intensified and expanded, both spatially and temporally, in the quest to overcome pressing global social and environmental challenges. While the visions of future human-plant relations at the core of these projects are highly developed however, all of the chapters also discern apertures for plants and humans to begin to work together in alternative ways, and potentially even to push back against deeper logics of enhancement, expansion and improvement themselves. Rather than viewing plants

as the basis for what Stefania Barca (2020: 60) might call “an even higher level of mastering earth-systems”, these apertures instead raise the prospect of working with plants to instil slower, more faltering, and perhaps even diminished future life-worlds than those typically envisaged under economic logics of efficiency, productivity, growth and profit. Indeed, as both these final chapters and the collection as a whole hope to make clear, the provocation of new ideas about what an economy should ultimately be for may just be the most crucial form of work that plants still have to undertake in the turbulent times ahead.

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