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Research papers

Strong sustainability and property rights

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Strong sustainability and property rights

Paper issued from the International Research Conference: **"Strong Sustainability: How sustainable are Net Zero trajectories?"**

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Abstract
The core principle of strong sustainability is non-substitutability. Many economic resources rely on ecosystem function, which is at best partially substitutable; ecosystem function can be maintained under moderate pressure, but at some level ecosystem function is compromised. Markets tend to promote degradation of ecosystems and loss of ecosystem function, raising the question what possible alternatives could support human provisioning while maintaining ecosystem function. This paper argues that a useful entry point is the property rights regimes that underpin markets. It briefly reviews how property rights have been theorized or observed to act in economic systems. It then draws on indigenous property law and the Law and Political Economy literatures to critique prevailing views. Finally, it suggests that property rights in an economics for strong sustainability should be framed in terms of general duties (or duties in rem) towards ecosystems.

Keywords
Strong sustainability; ecosystem services; property rights; non-substitutability

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Résumé
L'un des principes clé de la soutenabilité forte est la non-substituabilité. De nombreuses ressources économiques dépendent du fonctionnement et rôle des écosystèmes, qui sont au mieux partiellement substituable, et ce, seulement jusqu'à un certain point. Le bon fonctionnement des écosystèmes peut être garanti sous pression modérée, mais dépassée une certaine limite, ils sont compromis. Les marchés ont tendance à dégrader des écosystèmes et conduire à la détérioration des services écosystémiques. Ce phénomène met en évidence la nécessité de développer des alternatives pour soutenir l'approvisionnement humain tout en préservant le rôle des écosystèmes. Ce papier soutient que des manières utiles d'aborder ce sujet est de se placer du côté des régimes de droits de propriété qui sous-tendent les marchés, plutôt que des marchés eux-mêmes. Il examinera brièvement la façon dont les droits de propriété ont été théorisés ou observés dans les systèmes économiques. Il s'appuiera ensuite sur le droit de la propriété autochtone, les "droits de la nature" et la littérature sur le droit et l'économie politique pour critiquer les points de vue dominants. Enfin, il présentera une suggestion provisoire pour penser les droits de propriété dans une économie à l'aune de la soutenabilité forte. Plus précisément, le papier proposera que des devoirs généraux envers les écosystèmes soient spécifiés, puis clarifiés par la jurisprudence.

Mots-clés
Soutenabilité forte, services écosystémiques, droits de propriété, non-substituabilité

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Introduction

A key principle of strong sustainability is that substitutability cannot be assumed, and must be proven in each case (Godin et al. 2022, 13). There are indeed documented limits to substitutability, both for production (Ayres 2007) and consumption (Kemp-Benedict 2013). Some of these relate to mineral resources, such as metals, stone, and carbon deposits. However, some are closely tied to ecosystems. As noted by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES 2019), "Nature is essential for human existence and good quality of life. Most of nature's contributions to people are not fully replaceable, and some are irreplaceable."

Among nature's contributions are freshwater and net primary production – that is, creation of hydrocarbons out of carbon dioxide and water by plants and other photosynthesizing organisms, net of metabolic energy needs (Ayres 2007). Water is essential to humanity, at a minimum for drinking, food preparation, sanitation, and bathing (Gleick 1996). Beyond those basic necessities, humans use water for agriculture, in the service industries, and in industrial production (Gleick 2003). Water is also essential to ecosystems, and wetland ecosystems provide surface freshwater for human uses (Millennium Ecosystem Assessment 2005b). Moreover, as explicitly stated in the first Dublin Principle, water is a finite, albeit renewable, resource, (Solanes and Gonzalez-Villarreal 1999).

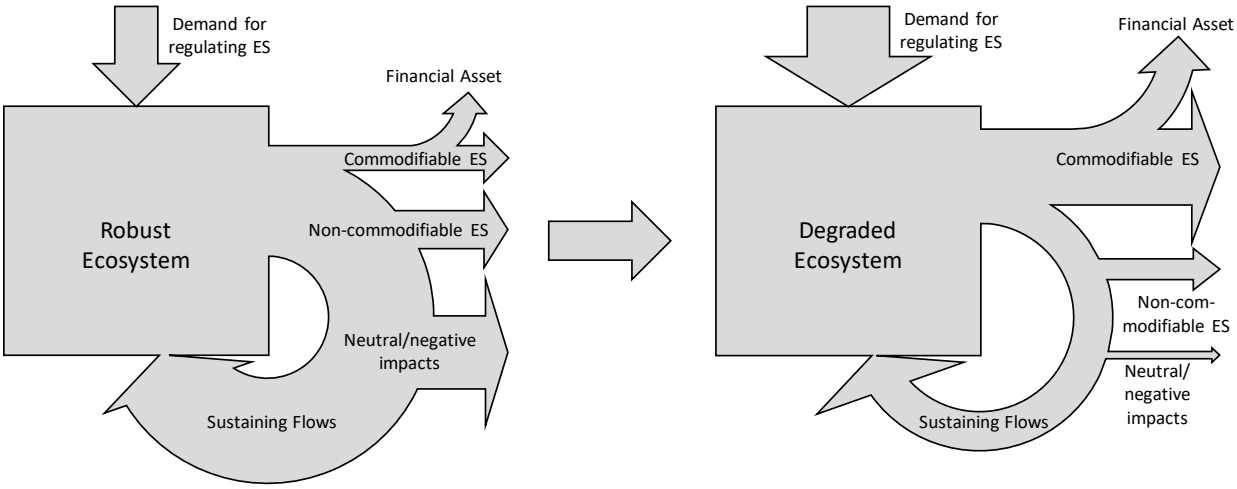
The necessity of net primary production (NPP) is evident in the large amount of global NPP appropriated by humans. Even the low estimate of Imhoff et al. (2004) that humans appropriate 14% of net primary production is wildly disproportionate. After all, the mass of humanity is just 0.01% of the total biomass on the planet (Bar-On, Phillips, and Milo 2018), and we are just one of an estimated 1 trillion species (Locey and Lennon 2016). Human reliance on net primary production persists despite a massive expansion in the built environment. Anthropogenic mass has grown tremendously since 1900, mostly in concrete and aggregates such as gravel, and since the early 2000s has exceeded total living biomass (Elhacham et al. 2020). Some anthropogenic materials have undoubtedly replaced biomass, such as steel and plastics in place of wood. Yet, there has not been a wholesale substitution of biomass. Instead, human appropriation of biomass and production of anthropogenic materials have expanded in tandem.

These two examples – water and net primary production – highlight the importance of ecosystem function to human well-being. They provide what the Millennium Ecosystem Assessment (2005a) termed provisioning, regulating, and cultural ecosystem services. They are essential to human function, but also supply a wide range of other human uses, some of them economically valuable. As is the case with many ecosystem services, they are at best

marginally substitutable and, while renewable, are available in limited quantities at any given time.

While ecosystem provisioning and cultural systems are often visible to the humans who value them, regulating services – such as waste processing or absorption of CO_2 – often are not. Moreover, as emphasized by the Millennium Ecosystem Assessment, lying behind all three types of services is a massive and largely unseen complex of *supporting* services. As illustrated in Figure 1, the pursuit of economic value – that is, net income – from ecosystems tends to increase flows of commodifiable ecosystem services at the expense of others, which are either neglected or actively suppressed. Together with increased demand for regulating services as a result of rising wastes and byproducts, the consequence is ecosystem degradation and compromised ecosystem function.

Figure 1. Market demand for ecosystem services (ES) tends to degrade ecosystems



Source: Kemp-Benedict and Kartha 2019.

Ecosystem degradation resulting from the pursuit of profit is a classic case of an economic externality. The classic remedy is to expand the scope of markets to include more and more aspects of ecosystems. However, robust eco-systems are complex dynamic systems that thrive outside of active human management. Indeed, they are much more complex and opaque than the "spontaneous order" of the market as described by Hayek (1976).

1. The Market, the Economy, and property

In this section, two competing approaches to economic theory will be contrasted. The first, associated with both Austrian and neoclassical theory, is that of the Market with a capital "M" or, as Hayek termed it, the catallaxy (Hayek 1976).[1] The Market operates through prices, which, by "clearing" markets – that is, by reconciling supply and demand – convey information about relative scarcity to widely dispersed actors.

The Austrian view plays a mainly rhetorical role in contemporary policy debates, where the Market is presented as uniquely suitable to coordinate diverse activities while respecting essential freedom. Milton Friedman was not an Austrian economist, but he used Austrian rhetoric when he claimed, "Fundamentally, there are only two ways of co-ordinating the economic activities of millions. One is central direction involving the use of coercion – the technique of the army and of the modern totalitarian state. The other is voluntary co-operation of individuals – the technique of the market place" (Friedman 1962) . In contrast to this rhetorical role, neoclassical theory provides a theoretical grounding through the Fundamental Theorems of Welfare Economics, which are discussed below.

The second approach to economic theory will be termed in this paper "the Economy". Populated by both large and small firms linked by exchange of intermediate goods and services and sustained by financial institutions, the Economy can be thought of as a "going concern" (Means 1957). This vision is broadly compatible with post-Keynesian (Lavoie 2014), Sraffian (Aspromourgos 2004), and evolutionary (Nelson et al. 2018) economics. In the Economy approach, prices are (normally) set to cover costs, but do not clear markets. For most goods and services, competition features both price and non-price factors, and firms have considerable freedom to set wages and prices, so in this approach political economy considerations play an important role.

1.1 The Market and property

The theoretical argument for the central role of markets (and the Market) in ordering economic outcomes is based on the two Fundamental Theorems of Welfare Economics. In their most compact form, the first theorem states that a Walrasian equilibrium is Pareto-efficient (Moore 2007 Theorem 7.22), while the second states that for any Pareto efficient outcome there is a corresponding Walrasian equilibrium (Moore 2007 Theorem 7.38). In practice, the first theorem is taken to imply that in voluntary markets, with a full set of spot and futures markets for all goods (no externalities), in which everyone starts with an initial allocation of goods to which they have secure rights to dispose of as they wish, where every market participant seeks their own benefit (rationality) and cannot be coerced, and everyone has full information, the equilibrium presumed to be reached through market exchange will be Pareto-efficient. The second theorem is taken to mean that, under the same conditions, any Pareto-efficient distribution can be

[1] A capital "M" will be used to distinguish the Market as an approach, while markets as an object of study will be denoted with a lower-case "m". Below, a similar distinction will be used for what we call the Economy approach.

accomplished through an initial allocation followed by market exchange. The second theorem justifies "market engineering," in which new markets are created to resolve politically charged allocation problems.

Property rights of a particular kind are essential to the functioning of the Market as envisaged by the welfare theorems. Specifically, property owners must have the right to: put their property to use, exclude others from it, and alienate it – that is, to give it away or trade it in markets. Only then can markets be counted on to achieve an efficient outcome. Other forms of property rights are deemed "unproductive". For land, the ideal is fee simple ownership, which places essentially no restrictions on rights of use, exclusion, and alienation.

Unfortunately for the Market view, there are problems with every aspect of the welfare theorems: theoretical, empirical, and normative. The key theoretical problem is that there is no economically plausible way to reach a Walrasian equilibrium – the formal proof of the theorems presumes the equilibrium has already been reached. Perhaps the most thorough attempt at finding an equilibrium process was made by Franklin Fisher (1983), who showed that equilibrium could be reached from a disequilibrium situation through the actions of independent economic agents only if the possibility of sudden and optimistic revisions in expectations is negligible (a condition termed "No Favorable Surprise" by Fisher). But such surprises frequently occur in actual economies, and for a large economy may even be incessant, as different actors innovate and discover new possibilities. Moreover, in Fisher's analysis, agents are presumed to act on the basis of perceived supply and demand curves. Yet, empirical research has shown that industrial firms do not act this way, as they cannot assess the relevant demand curves (Coutts and Norman 2013).

Some empirical problems arise with the pre-conditions of the welfare theorems. Property is often insecure, as reflected in the concern for security in the law and economics literature (Barzel 1997). Information asymmetry is widespread, a problem that has led to a voluminous literature and a Nobel prize (Stiglitz 2002). The definition of rational behavior in the welfare theorems has almost nothing to do with how actual humans behave (Karacuka and Zaman 2013). And futures markets are rare (Williams 1986, 180); they are only suitable for flexible prices (Gray and Rutledge 1971, 85), while most prices are managed by firms (Means 1972; Lee 1999; Coutts and Norman 2013). A further empirical problem arises with the presumed price mechanism. In contrast to the underlying assumption of the welfare theorems, consumers do not reliably view prices as neutral signals. Instead, they actively consider whether a price is fair, including social factors, and act on the basis of that judgment (Maxwell 1995).

The main normative problem with the first welfare theorem is that Pareto efficiency is presumed to be a desired outcome. But as Amartya Sen noted, Pareto efficiency "is not as such a momentous achievement from the point of view of social welfare. A person who starts off ill endowed may stay poor and deprived even after the transactions, and if [that] is all that competition offers, the propertyless person may be forgiven for not regarding this achievement as a 'big deal.'" (Sen 1977, 320). Further normative problems arise, particularly with the second welfare theorem, around the initial allocation. As a unique equilibrium is not guaranteed, the starting point can matter a great deal. In practice, market engineering founders at

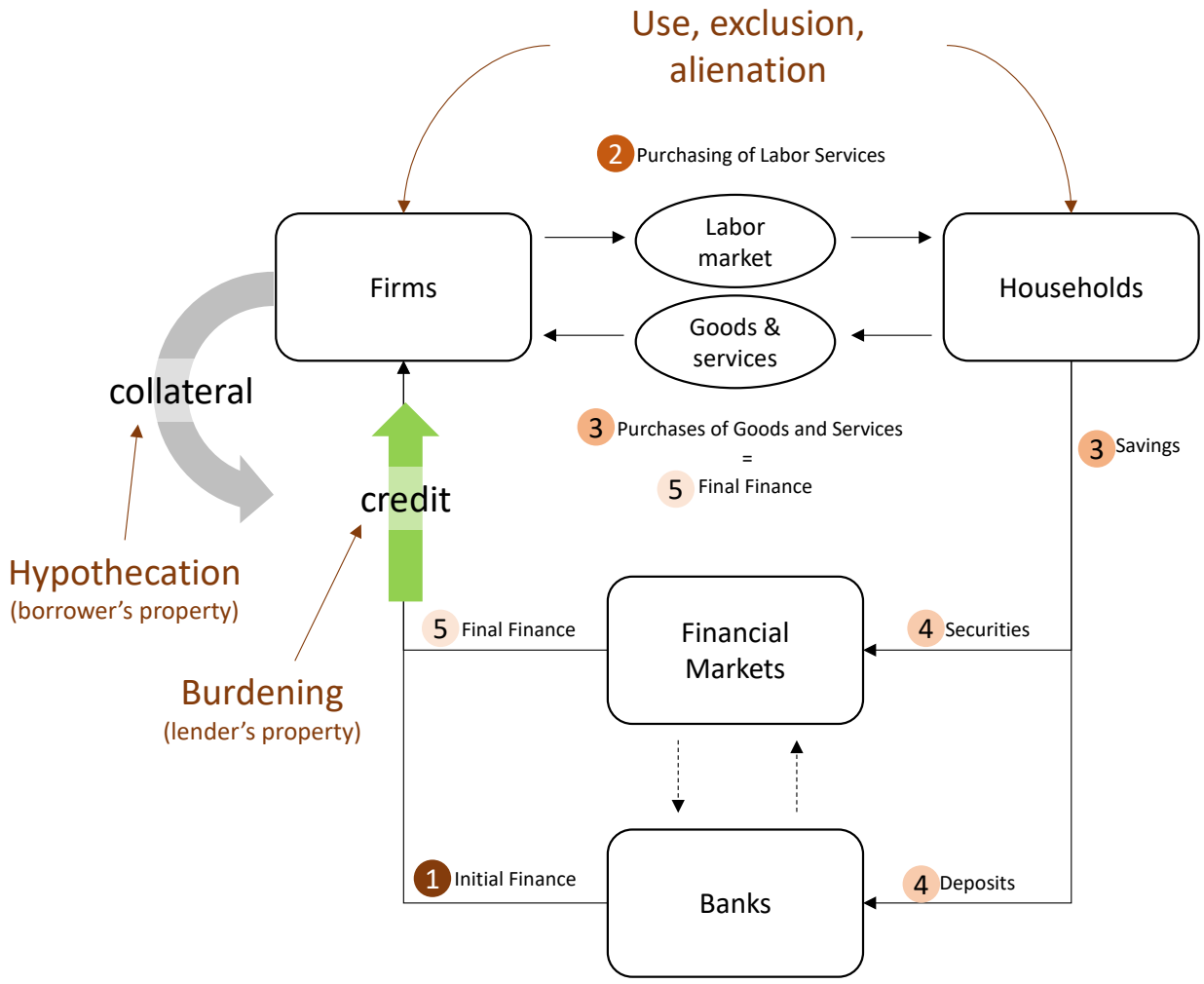
precisely this step (e.g., for water markets see Wheeler et al. 2017; for carbon markets see Narassimhan et al. 2018).

1.2 The Economy and property

Theoretical traditions that center the Economy rather than the Market rarely discuss property rights. Instead, they presume that production and trade involves property with the same rights as in the Market view: use, exclusion, and alienability. The main distinctions are: first, that the scope of the rights is limited to the economy proper, while non-economic interactions make up much of social life; second, that property ownership conveys economic power. However, an explicit role for property has been proposed (Heinsohn and Steiger 2006; Heinsohn, Steiger, and Decker 2012) in a theory of endogenous money (Lavoie 2011).

Heinsohn and Steiger's theory is compatible with the theory of the monetary circuit, which explains money creation through the supply of loans to firms (Graziani 2003). As illustrated in Figure 2, Heinsohn and Steiger place property at the first stage of the monetary circuit, the supply of loans. One widely-recognized corollary of the right to alienate property is that it can serve as collateral – in legal terms, it can be hypothecated. When property is posted as collateral, the owner retains rights to use and exclusion, but cannot alienate it, as it is must be retained to secure the loan. The property has thus become burdened (or encumbered) in the specific form of hypothecation.

Figure 2. Property rights and the monetary circuit



Less widely understood, and a major point of Heinsohn and Steiger's theory, the lender *also* burdens their property, because they must retain ownership in case they are not repaid; people with no resources cannot make loans, and lenders cannot lend in infinite amounts. That means that a lender is constrained when undertaking further contracts, whether as lenders or borrowers, on the strength of their burdened property.

In this theory, the value of property, however determined, sets the scale of economic activity (Heinsohn, Steiger, and Decker 2012, 69). Accordingly, any property rules that lower the value will, other things remaining the same, shrink the monetary base of the economy. While property valuation may not act as an absolute upper bound, it is an economic fundamental that tends to tether activity. Under fee simple ownership, there are almost no bounds on use, but property is often burdened, for example through zoning restrictions, easements, or liens. In these cases, society has implicitly traded off the goal of maximizing wealth against other social goals.

The theory of Heinsohn et al. (2012) seeks to explain a variety of features of real economies, including interest rates and debt. For example, they argue that interest is compensation for the loss of ownership premium (Heinsohn, Steiger, and Decker 2012, 62). Moreover, they make a number of normative claims. However, in this paper we focus on the positive observation that loans are underpinned by property valuation for both lenders and borrowers, and do not engage with the broader issues of concern to Heinsohn et al.

Property and the law

In Roman law, and carrying over to today in the Western legal tradition, rights are distinguished between being "in rem" (against a thing) and "in personam" (against a person). Because law is about people, in rem rights are taken to mean the right of the property owner against an indefinite number of others, while in personam rights are with respect to individuals. In the US until the 20th century, property law was viewed as the law of things, and property rights were rights in rem (Merrill and Smith 2001; Smith 2012). That remains the case in most of the world (Smith 2012, 1691), but the US began to diverge in the early 20th century.

The move away from in rem rights in the US was initiated by the politically progressive legal realist movement. That movement saw property law as unhelpfully bound by formalism and recast property as a "bundle of rights" that might differ from one property to another. The bundle-of-rights view of property was adopted and expanded by the Law and Economics movement (Alchian and Demsetz 1973; Merrill and Smith 2001), a neoliberal program that now dominates US legal thought, and which began at the University of Chicago (Mirowski and Plehwe 2015). True to its roots in Austrian and neoclassical theory, Law and Economics is deeply committed to the Market view.

The bundle-of-rights view of property makes property law little more than applied contract law. However, Merrill and Smith (2001) argue that this is a mistake. Property rights, they claim, are special because they are about things rather than people, and are rights against anyone in the world. For example, when people come upon a sign saying "Private Property", they know immediately that they cannot enter without permission, cannot take items from that property, and so on. They may not know that the property has an easement that gives a neighbor the right to drive on a track, or that the owner has received payment to leave some part of the land undisturbed. Nevertheless, there is a limited core of rights in rem that, aside from exceptions in personam, hold equally against everyone in the world.

Bell and Parchomovsky (2004) have sought to reconcile different approaches to property law, arguing that, "property law as a legal institution is organized around creating and defending the value inherent in stable ownership," and interpreting value broadly. In their theory, property rights are in rem whenever the taking of a thing would deprive the owner of the value that could be derived from that thing (Bell and Parchomovsky 2004, 574). We adopt this approach to property law for reasons discussed below.

1.3 A Law and Political Economy approach to property

The central position of Law and Economics in US legal thought has always been questioned, and a nascent Law and Political Economy project is attempting a coherent challenge (Britton-Purdy et al. 2019). Law and Political Economy scholars argue that under the influence of Law and Economics, the law is now split into two spheres: the economy, where technocratic practices rule; and the rest, where the economy is an unquestioned part of the landscape. They charge that this separation has hidden structural inequality. The law shapes economic fortunes, and those fortunes determine relative power outside the economy proper, but that link is made invisible.

Whereas Law and Economics is compatible with economic theories of the Market, Law and Political Economy is compatible with theories of the Economy. In such theories, the economy is one of many loci of social interaction and oligopolistic competition characterizes most sectors, where firms have broad but not total discretion in setting prices and wages and in distributing profits. The affinity between Law and Political Economy and theories of the Economy holds regardless of the specific economic school of thought or area of law under consideration. For property law specifically, we note that the theory of Bell and Parchomovsky (2004), while it aims to be consistent with Law and Economics, aligns with the economic theory of Heinsohn et al. (2012), in that the essential characteristic of property for the operation of the monetary circuit is its (monetary) value. Further alignment is found in the insistence of both Heinsohn et al. and Bell and Parchomovsky that ownership must be clearly distinguished from possession, in one case to understand the operation of capitalist economies, and in the second in comprehending the law.

From these observations, we argue that a Law and Political Economy approach to property should start, as a matter of empirical observation rather than normative judgement, with the idea that *property law creates and defends the value inherent in stable ownership, which provides the means for a monetary economy to operate and at least partially determines its scale*. In practice, property law determines *who* is able to benefit from stable ownership and strongly shapes the distribution of income.

1.4 Property in indigenous law

Legal anthropologists take a very broad view of property. To accommodate the extremely varied examples of what might be termed "property" that they have observed across the world, they argue that property relationship have three components: 1) the social units that can hold property relationships; 2) the units of the natural and social environment that can be the object of a property relationship; and 3) the rights, duties, privileges, and possibilities of property holders (Von Benda-Beckmann 1995, 312). Crucially, the third item includes duties as well as rights; duties often feature in indigenous approaches to land.

The definition of "indigenous" is contested, although different definitions overlap substantially. Dannenmaier (2008) surveys a number of definitions, including ones in UN documents. The most compact comes from James Anaya: "the term *indigenous* refers broadly to the living descendants of preinvasion inhabitants of lands now dominated by others." However, this does not emphasize the importance of place. Dannenmaier cites Patrick Thornberry as offering four "strands" of indigeneity: 1) association with a particular place; 2) prior inhabitation; 3) a sense of original or first inhabitants; and 4) distinctive societies.

Indigenous peoples managed themselves under highly diverse systems prior to domination by others. Subsequently, they learned how to advance claims under the laws of their invaders, while continuing to manage their own affairs under continually changing legal systems (Belmessous 2012). Today, indigenous law remains diverse. It is also dynamic, evolving in response to internal and external pressures. However, in countries where indigenous rights are explicitly acknowledged, they are often found to be incompatible with prevailing Western conceptions. This has led to inconsistent judgements (Abrusci 2017), but arguably provides an opening for creative rethinking of the law (Egan and Place 2013).

While it is not possible to generalize indigenous law regarding property, one strand does appear to be the importance of duties, both to the land and to other people. For example, Pope writes of indigenous law in South Africa (Pope 2011, 327, emphasis in the original):

> The content of existing indigenous-law land rights is very difficult to articulate in language, even in the vernacular. For example, it seems that there simply are no terms for "a wife's *claim* to an agricultural plot." Rather, that a wife is *expected* to raise crops for the family seems to rest on the premise that she must have *access* to an agricultural plot. The *expectation of access* may not equate with a *claim* to a plot in the common-law sense. The implication is that the *expectation of access* to land ought not to be taken as the equivalent of a *claim to a real right* in land.

The right of access thus derives from duties to the family. Similarly, among the Cree in Northeast Canada, it is understood that people must feed themselves and their families, which entails both rights and duties (Berkes 1986, 152–53). Moreover, while a Cree "beaver boss" or "goose boss" may be said to own the land, as noted by Berkes (1986, 151),

> "Ownership," according to the Cree, involves keeping traditional law and order in that area, ensuring that the land is not abused, and overseeing the sharing of resources. Thus, it makes sense that "ownership" rests with the beaver or goose boss, the senior hunter, who knows the area best and is most able to fulfill these two functions. As the Cree point out, "the boss is really given not the animals but the responsibility for distributing the wealth of the land."

A boss that does not fulfill his expected duties can lose his authority (Berkes 1986, 152). The point is emphasized by Russell Means of the Lakota, who argued that duty is freedom, in sharp contrast to the neoliberal view of individual freedom: "Freedom means you are free to be responsible. No one has any rules or regulations for you to follow because you are a responsible individual: responsible for your own behavior, responsible for your generations, responsible for your Mother the Earth, responsible for every living being, and responsible for the universe. That's what freedom means." (Cited by Kowalski 2018, 27)

3. Protecting ecosystem function through property law

This paper has argued that the non-substitutability principle of strong sustainability implies that the nature and scale of economic activity must be compatible with robust ecosystem function. The arguments have been instrumental: non-substitutable ecosystem services that people value derive from mostly invisible and not intrinsically valued ecosystem function. However, this stance can be justified in non-instrumental ways as well. The ethicist Warwick Fox (2006) argues that we should value "responsive cohesion"; that is, a cohesive order arising from substantial mutually modifying interactions between constitutive elements. Ecosystems, societies, and economies are examples of responsive cohesion. Moreover, Fox argues that "if conflicts arise between biophysical, mindsharing [e.g., societies, institutions], and compound material [e.g., the built environment] forms of responsive cohesion, as they often do, then considerations regarding… the biophysical realm are ultimately more important…" Booth (2013) argues that this stance is consistent with deep ecology's emphasis on relations between humans and their environment.

We have gone on to argue that Western institutions of property rights undermine ecosystem function. That is particularly true in the US, where property rights serve to create and defend the value inherent in stable ownership (Bell and Parchomovsky 2004). Under the influence of Law and Economics "value" in practice typically takes the form of wealth maximization (Britton-Purdy et al. 2019, 1790). As illustrated in Figure 1, pursuit of (monetary) value tends to expand marketable ecosystem services, while impairing non-marketable services, resulting in degradation of ecosystem function. In Fox's terminology, the responsive cohesion of the ecosystem has been replaced by an inferior fixed cohesion imposed by a market.

Ecosystems are often better protected when they are under indigenous management (IPBES 2019); indeed, Kowalski (2018) argues that environmentalism is nothing new, having its roots in indigenous cultures. There is thus a strong argument for protecting ecosystems by expanding the area of land under indigenous management (Artelle et al. 2019). A possible basis for this shift is an apparent emerging legal doctrine of connection of indigenous peoples to land, which is being used to protect land in indigenous hands (Dannenmaier 2008).

A separate and complementary strategy is to learn from indigenous peoples and their management practices in order to transform Western-based legal systems. Thus, a movement to create "rights of nature" (Borràs 2016) is being informed by, and sometimes driven by, indigenous law (O'Donnell et al. 2020). However, the correspondence between indigenous philosophies and the Western legal notion of rights is far from perfect (Tănăsescu 2020), so this approach is more a transfer of lessons from one context to another than it is an implementation of indigenous legal norms.

3.1. Duties in rem toward ecosystems

We follow the strategy of learning and transfer in this paper, but with a focus on duties rather than rights. Specifically, we suggest that protecting ecosystem function is a duty in rem. In practice, enforcement of duties in rem with respect to ecosystems need not look very different to the way that rights of nature are enforced. Under rights of nature, citizens have standing to bring a complaint on behalf of nature; the same would hold under duties in rem. However, a duty-focused approach is less adversarial and, while distinctly Western, perhaps more in line with indigenous philosophies (Tănăsescu 2020, sec. 5). For example, when someone acquires land, with its attendant ecosystems, in a rights approach the right of the owner to realize maximum value can be weighed by a court against the right of those ecosystems to exist and flourish. Under a duties approach, accepting ownership entails taking on duties to care for the land on behalf of the rest of the world that supersede the right to maximize value.

Like rights in rem, duties in rem should be few in number and easily understood. Unfortunately, the key concept, ecosystem function, is not well defined (Jax and Setälä 2005). While it can be said that ecosystem function is different than ecosystem services provision (Peterson et al. 2010), that is a negative distinction rather than a positive statement. Nevertheless, lack of clear definition does not mean that duties in rem towards ecosystems cannot work in law. For example, there is a well-recognized "duty of care", defined as "The responsibility of a person or organization to take all reasonable measures necessary to prevent activities that could result in harm to other individuals and/or their property" (Legal Dictionary Content Team 2017). Consistent with this broad definition, Choi and Krauss (2014) have argued (controversially) that the duty of care is a duty in rem. As with rights in rem, such as the right of exclusion, imprecision at the level of a legal principle does not impair its use; specific meanings are created through case law.

Based on the foregoing, a tentative duty in rem with respect to ecosystems could be a duty to *maintain, restore, and improve ecosystem function*. Such a rule would have a ratchet effect. For example, the buyer of a property with a grass yard could install a pollinator garden populated with native plants, but could not do the reverse. Given the currently dire situation (IPBES 2019), a strong bias towards ecosystem restoration seems called for. However, as with any legal principle, it would not always be the primary consideration. A duty towards ecosystems could come in conflict with other principles, or even the same principle at a different scale. For example, wind energy can displace fossil fuel use – a global issue – but wind energy installations can threaten marine reserves (Karlõševa et al. 2016). An examination of the growing number of cases in environmental law and of indigenous law could shed light on how conflicts could be resolved in practice.

3.2. Duties as a burden on property

Meeting duties in rem towards ecosystems would limit the actions of a property owner. In the negative language currently in use, that would impose a "burden" and reduce its "value", but from the quote of Russell Means of the Lakota in the previous section, it could also be interpreted as defending the freedom

to be responsible. The duty of care is, after all, widely accepted and valued, even though it can be seen as burdening a property owner. That being said, the language of "burden" is the currently accepted terminology, and it connects to the prior discussion of the economic role of property.

If duties in rem towards ecosystems burden property, then they will, in the first instance, reduce the economic value of those property, thereby shrinking the monetary base for loans (see Figure 2). This argument has been developed by van Griethuysen (2012), and is consistent with calls for degrowth (Kallis, Kerschner, and Martinez-Alier 2012; Kallis et al. 2018; Weiss and Cattaneo 2017). However, that is not the end of the story. A second-round effect would be to raise the relative value of immaterial property and activities, including materially non-intensive services, creative products, and so on. The change in relative value *could* drive investment and economic activity in less material-intensive directions, which would then raise its absolute (economic) value. For example, it could raise the value of circular economy business models (Lüdeke-Freund, Gold, and Bocken 2019).

As a counterpoint, it should be emphasized that there is little evidence of a low-material transition happening at present. Services can be highly material intensive (Fix 2019), there is little to no evidence of absolute decoupling (Bithas and Kalimeris 2017; Parrique et al. 2019), and evidence base regarding the sustainability of circular economy business models remains weak (van Loon, Diener, and Harris 2021). As with case law, economic case studies could shed light on how firms, consumers, and financial institutions respond in practice to constraints on the use of property.

4. Conclusion

Starting from the strong sustainability principle of non-substitutability (Godin et al. 2022, 13), this paper has argued, on instrumental grounds, for protecting ecosystem function. Ecosystems are being degraded through economic activity, which can be traced, at least in part, to the economic concept of "productive" property rights. The economic theory is closely related to the Law and Economics legal movement, which has led to a particular approach to property law. The paper traced alternative approaches to property, in particular indigenous property law, and argued that generalized duties towards ecosystems – in legal terms, duties in rem – should take precedent over property rights. The recognition and legal enforcement of such duties would place a burden on property, thereby lowering its value. From the property-based monetary theory of Heinsohn et al. (2012), that would have the effect of reducing the monetary basis for loans, thereby curtailing economic activity.

While economic activity would be curtailed, it would be brought in closer alignment with the regenerative and productive capacity of ecosystems. The recognition of duties in rem towards ecosystems could therefore help to slow or reverse ongoing impairment of ecosystem function, including loss of biodiversity. Tentative evidence for this claim comes from the observation that duties in rem towards ecosystems aligns with some features of indigenous property law, and land under indigenous management has seen lower biodiversity decline than other lands (IPBES 2019).

Whether such an approach could work would depend on the responses of both legal and economic actors and institutions. Aside from conceptual and empirical explorations in each domain separately, the emerging area of Law and Political Economy could provide useful frameworks (Britton-Purdy et al. 2019).

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