Land access, land use, and agricultural practice: Political ecologies of servitude at colonial Ollantaytambo (1550–1770)

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Abstract

Researchers have long noted connections between the creation of property in colonial contexts and environmental and ecological transformations. These links are most clear in settler colonial contexts, especially where property formation operated according to logics of 'improvement' that alienated Indigenous peoples from their lands and devalued traditional land use. In this article I present a case study from the Ollantaytambo region of Cusco, Peru to argue that property formation was also an ecological force in Spanish colonial contexts. I draw on political ecology theories of land access to suggest that the creation of the hacienda system of landholding instantiated an *ecology of servitude* predicated on unequal access to land and the organization of unfree labor. This colonial ecology structured land use and reshaped the local environment in enduring ways.

Key Words: Colonial ecologies, property, Andes, agricultural practice

Résumé

Les chercheurs ont depuis longtemps constaté des liens entre la création de la propriété dans les contextes coloniaux et les transformations environnementales et écologiques. Ces liens sont particulièrement évidents dans les contextes coloniaux, notamment lorsque la formation de la propriété s'opère selon des logiques d'« amélioration » qui aliènent les peuples indigènes de leurs terres et dévalorisent l'utilisation traditionnelle des terres. Dans cet article, je présente une étude de cas de la région d'Ollantaytambo, à Cusco, au Pérou, pour montrer que la formation de la propriété était également une force écologique dans les contextes coloniaux espagnols. Je m'appuie sur les théories de l'écologie politique de l'accès à la terre pour suggérer que la création du système de propriété foncière de l'hacienda a instauré une « écologie de la servitude » fondée sur l'inégalité d'accès à la terre et l'organisation d'une main-d'œuvre non libre. Cette écologie coloniale a structuré l'utilisation des terres et remodelé l'environnement local de manière durable.

Mots clés: Écologies coloniales, propriété, Andes, pratiques agricoles

Resumen

Los investigadores llevan mucho tiempo observando las conexiones entre la creación de la propiedad en contextos coloniales y las transformaciones medioambientales y ecológicas. Estos vínculos son más claros en los contextos coloniales, sobre todo cuando la formación de la propiedad operaba según lógicas de «mejora». Los pueblos indígenas fueron alienados de sus tierras y sus usos tradicionales fueron devaluados. En este artículo presento un caso de la región de Ollantaytambo, en Cuzco (Perú), para argumentar que la formación de la propiedad también fue una fuerza ecológica en contextos coloniales españoles. Me baso en las teorías de la ecología política sobre el acceso a la tierra para sugerir que la creación del sistema de haciendas instaló una

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«ecología de la servidumbre» basada en el acceso desigual a la tierra y la organización de mano de obra no libre. Esta ecología colonial estructuró el uso de la tierra y reconfiguró el entorno local de forma duradera.
Palabras clave: Ecologías coloniales, propiedad, Andes, práctica agrícola

1. Introduction

In the mountainous Andes, agricultural infrastructures such as terraces and walled fields enable agriculture in areas that would, given steep slopes, otherwise be unsuitable for cultivation. Many fields dating to the pre-Colonial era are still farmed. Others, however – perhaps up to 50% of the region's anthropogenic fields – are largely unworked and likely have not been intensively cultivated since the Colonial Era (1531-1824; see Denevan, 2001). This significant shift in land use under Spanish colonial rule is unsurprising: the imposition of new forms of social power in colonial contexts often causes dramatic environmental change. Colonists transform local ecologies by altering land management, including by prohibiting some practices (e.g., swidden, hunting, controlled burns, etc.) and encouraging others (e.g., animal grazing, intensive cultivation, forest clearing, etc.). In many cases, such changes in practice are underpinned by the ideological imposition of exclusionary property rights that enclose land for specific uses, such as farming, extraction, or conservation, while excluding Indigenous peoples and prohibiting traditional land use practices (e.g., Amith, 2005; Bessire, 2021; Butzer & Helgren, 2005; Greer, 2018; R. Hunter & Sluyter, 2011). Indeed, scholars have made links between colonial property formation and colonial ecologies explicit, especially in the context of European settler colonialism in the Americas and Australia (Banivanua Mar *et al*., 2010; Cronon, 1996; Griffiths & Robin, 1997; Roberts, 2019; Simmons, 2019; Kauanui & Wolfe, 2012). Yet, even as colonial land use changes in the Andes are obvious in the region's geomorphology, scholars of the region's environment have given less attention to the ecological role of property under Spanish rule.

Here I advocate for greater attention to ecologies of Spanish property by way of a case study of the town of Ollantaytambo, in Peru's Cusco region. Prior to the 1532 Spanish Invasion, Ollantaytambo was a royal Inka estate staffed by a mix of permanent and rotational workers who tended surrounding complexes of walled fields and terraces. During the colonial era, Spanish authorities grouped the remnants of this workforce together into a single consolidated *repartimiento* tributary community. Initially, this community collectively administered fields and pastures surrounding the town. Within a few generations, however, hundreds of hectares of terraced land in the region were derelict, and community landholding was largely supplanted by private Spanish landowners – men who created the region's first *haciendas* (Burns, 1999; Glave & Remy, 1983; Hunter, 2021). Haciendas were expansive agrarian estates, often comprising many hundreds or thousands of hectares: a new form of property that concentrated land and social power. They are generally understood as estates with low capital inputs, controlled by aristocratic landlords and managed to furnish an income commensurate with their owner's status rather than to accumulate wealth. By contrast with smallholdings or independent farms, hacienda owners performed little to no agricultural labor. Rather, haciendas were worked by Andean people who live in servitude as tenant farmers or indentured servants (Edelman, 2018; Keith, 1977; Macera, 1971; Wolf & Mintz, 1957). In this sense, the hacienda was a racialized property structure that articulated land and labor in specific constellations of unfreedom.

In this article I draw on environment data, archival records, and digital surveys of agricultural infrastructures to trace shifts in land use and broader agro-ecological transformations that followed the consolidation of hacienda landholding at Ollantaytambo. By "agroecology" I refer to the interwoven relationships amidst and between land, people, animals, and plants that facilitated and structured local and regional agricultural production. By "ecology," I mean relationships between humans and non-humans in a particular place as constituted by flows of energy and matter and as shaped by social and political arrangements. I take the "environment" to be the biophysical milieu that is both shaped by, and shapes, regional ecologies.

Studies of environmental and ecological transformation in the Colonial Andes often emphasize the abandonment of fields and terraces. Initially, such studies followed the lead of Esther Boserup (1965) in connecting agricultural deintensification to demographic collapse, or situated causal power in factors such as

decreased temperatures during the Little Ice Age and enforced colonial resettlement (Brooks, 1998; Guillet, 1992; Donkin, 1979). More recently, researchers have nuanced these "prime mover" models by explicitly querying the political valences of colonial land management. For instance, Wernke's (2010) study of colonial land use in the Colca Valley of southern Peru indicates that Andean farmers in that valley experienced social and climactic shifts during the colonial period differently depending on endogenous politics of community affiliation. As Wernke argues, in a context where it is apparent that agricultural intensification is inherently political, socio-political questions must necessarily apply to decisions to reduce the intensity of production. Moreover, as Plekhov and colleagues (2021) note, framings of colonial agriculture that overemphasize the abandonment of fields risk masking agricultural decision making: seemingly "abandoned" fields are – and were – often intermittently cultivated, used as pasture, or used for low-intensity cultivation. To this point, I would add that the question of land dis-use and abandonment in the Colonial Andes is especially complicated because those very categories were deployed by colonizing Spaniards to justify land seizures. In this sense, the colonial use or dis-use of land is a profoundly political question, inherently linked to struggles over possession and the creation of new property forms. Different ways of interpreting the entanglement of dispossession and de-intensification do not just shape our understanding of historical land use, but also our grasp of the politics through which land use was negotiated.

My analysis of shifting agricultural practices and colonial property holding at Ollantaytambo is based on a political ecology perspective that foregrounds the ecological valences of property, which I define as the enforceable allocation of particular use rights, in this case, to agricultural land (Macpherson, 1978; Prudham, 2015). Much political ecology research on property creation builds on Marxist analyses that link the enclosure of land, the commodification of agricultural products, and the emergence of a landless proletariat (e.g., Thompson, 1966; see Prudham, 2015). While this research has a distinctly European historical perspective, the same Marxist foundations underlie a related body of literature on property formation and indigenous dispossession in Latin America. Broadly speaking, this work demonstrates that in the Andes, as across much of Latin America, the privatization of land created a system of enduring paternalism rather than the preconditions for capitalist production: Andean people did lose control of their labor, however they exchanged it for tenuous usufruct rights to marginal fields rather than wages; the hacienda did not create a landless proletariat, rather it created a bonded peasantry (e.g., Burga, 1976; Glave, 2009; Mariátegui, 1974; Orlove & Custred, 1980; Van Young, 2006; Van Rankin-Anaya, 2022). While initially, some of these accounts tended to characterize peasant workers passively, further analyses have demonstrated how peasant workers shaped the hacienda system from within, clarifying that even within the oft-onerous circumstances of servitude the hacienda could nonetheless be a space of vibrant cultural reproduction and active peasant politics (Cossin, 2019; Grieshaber, 1979; Martínez Alier, 1977; Thurner, 1993).

To extend my analysis of the relationship between peasant workers and the hacienda as property form to questions of agricultural practice, land management, and ecological change I combine structuration theory (sensu Giddens 1986) with Ribot and Peluso's (2009) theory of resource access. For those authors, access is the ability to draw benefits from a resource. By contrast with analyses that emphasize rights to resources, access assumes that rights are just one factor amongst many that shapes resource use: hence, access melds together questions of rights, social power, and ecology. By merging access analysis with structuration theory, I develop a framework that accounts for the shifting environmental milieu of the colonial Andes alongside the creation of new property forms to attend to politics of land use at the level of practice. In Colonial Ollantaytambo, a context where jural patterns tended towards Indigenous dispossession and hacienda consolidation, this access-forward approach calls attention to the ways in which new agricultural practices, although contoured by a range of factors – including climactic shifts, population loss, and the availability of new taxa – were fundamentally patterned by the consolidated hacienda property regime. My analysis of this process begins in the 1550s, with the first colonial land appropriations, and follows through the late 1700s. This period encompasses the emergence of the hacienda property form, the consolidation of hacienda control over the majority of land in the Ollantaytambo region, and the era of hacienda operation as profitable enterprises. It concludes prior to economic and social crises of the late eighteenth century that made haciendas less profitable and shifted the logics of hacienda land management (Glave & Remy 1979).

In what follows I trace how the creation of the hacienda refigured land access, and in doing so, restructured patterns of colonial land use. I show that, like other Andean regions, Ollantaytambo's Colonial-era farmers worked the land less intensively than their Inka era counterparts. However, at Ollantaytambo, this pattern was highly variable: some fields were continuously cultivated intensively to produce high-value grain for urban markets; other fields, especially at high altitudes, were consistently used as pastures and for subsistence production by agricultural workers. By contrast, hillside terrace complexes deteriorated before and during the era of hacienda management. I argue that this pattern of land use was the result of multiple social and ecological forces that shaped and re-shaped land access and land use during the colonial period; ultimately, however, these forces were all structured by hacienda landholding, and in particular the way the hacienda bound together land and unfree labor in what I term an "ecology of servitude." Servitude is a fundamentally political social construct; by proposing this analytic I am to foreground what I view to be the dominant structure that shaped Ollantaytambo's colonial political ecology. My aim is not to explain away other social and environmental factors that shaped shifts in land use, nor is it to rank the importance of those factors, which included climactic cooling, the introduction of new agricultural taxa, changes in labor availability, and the emergence of new markets. Rather, my argument is that the ways in which these factors were combined at Ollantaytambo was a product of the specific land/labor nexus of the hacienda system. Changes in land tenure and land use were not simply coeval; the creation of a land-tenure system predicated on servitude made changes in land use inevitable. By levying this argument, I aim to refocus attention on the dual appropriations of land and labor fundamental to the sociohistorical process of colonialism.

2. The ecological logics of colonial property

The imposition of new forms property in colonial contexts was, and is, a mechanism of governance over people and land through which colonial power was, and is, expressed on the environment and colonial subjects categorized (Nichols, 2020). As Bhandar (2018) argues, colonial property holding was, and is, an index of "civilized" life. By categorizing people and things together, property laws create "racial regimes of ownership" that instantiate inequalities legally and materially. As such, property is a means of subjectification through which colonial power is operationalized over territory (Benton, 2002; Greer, 2018; Herzog, 2015b; Owensby, 2008). Many colonial property regimes are undergirded by ideologies with explicitly ecological valences. They mandate specific relations between humans and non-humans, associating rights to land with specific uses of land. This ecological aspect of colonial property is clearest where property claims operated via logics of "improvement" that distinguish between "cultivated" land and "wasteland" and predicate ownership on the improvement of land for sedentary agriculture – logics forcefully articulated in Lockean theories that hold that property-rights are acquired by combining labor with land (Winchell, 2022, 2023). In some contexts, these logics of improvement were anchored by *terra nullius* doctrines that naturalized and erased native ecological interventions and instantiated myths of precolonial pristine environments (Denevan, 1992; Simmons, 2019; Whatmore, 2002). In others, as in Bhandar's (2018) case study of British Columbia, Indigenous land use was acknowledged but devalued relative to sedentary agriculture. Given that "improvement" for sedentary agriculture might mean draining wetlands, irrigating deserts, or removing forest, ecological regimes of property ownership materialized social hierarchies in landscapes and ecologies. For instance, Cronon's (1996) classic study of Colonial New England demonstrates how Indigenous evictions and the enclosure of land by yeomen farmers encouraged forest clearing and intensive permanent cultivation. Today, the meshwork of stone walls that lace New England's regrown forests speak to the extent of those colonial enclosures and attendant ecological transformations, as well as the tenacity of property as a material-ecological form that persists through time (e.g., Ives, 2023).

The ecological character of dispossession, appropriation, land-grabs, enclosure, and property formation is a well-established theme in political ecology. For example, scholars demonstrate the ways that 'nature' is deployed conceptually to justify exclusions for conservation (i.e., 'green-grabbing': Braverman, 2023; Benjaminsen & Bryceson, 2012; Fairhead, Leach, & Scoones, 2012; Orozco & King, 2018), and trace the ecological consequences of dispossession through land-grabs and enclosures (e.g., Rousselin, 2018; Stahl,

2010). An important theoretical inspiration for political ecology research on dispossession is David Harvey's (2005) 'accumulation through dispossession,' the ongoing enclosure of resources by and for capitalist profiteering (e.g., Büscher & Fletcher 2015; see Fent 2020). While this concept is most directly applicable to capitalist contexts, the political ecology scholarship it guides offers several key insights that inform this study. Most fundamentally, dispossession is an inherently ecological act that rearranges relationships between humans and non-humans. The resulting transformations – including those that follow colonial and imperial interventions that disrupt longstanding land relations – are often naturalized, that is, depoliticized and obscured (Borgias, 2024; Bastos, Lima & Kmoch, 2021; Leff, 2015). As a result, understanding the ecological dimensions of dispossession requires examining the social dynamics that underlie appropriations and critical attention to the juridical and discursive practices that mask those politics.

Broadly speaking there has been less attention to property-as-ecology in the Spanish Americas than in British or the French settler colonies. In part, this may be because Spanish colonial policies do not align neatly with settler colonial models. In contrast to the genocidal logic of Indigenous elimination characteristic of settler-colonial projects, Spanish colonists frequently aimed to maintain colonized populations as a tributary workforce, even if in thoroughly degraded conditions (VanValkenburgh, 2021). Spanish invasions and colonization of places like the viceroyalties of New Spain and Peru also predate modernist property forms associated with emerging agrarian capitalism (Bastias Saavedra, 2018). Moreover, ecological transformations in the Spanish colonies have been naturalized and understood in depolitical terms. Melville's (1997) influential study of grazing and land degradation in New Spain, for instance, emphasizes the role of "ungulate interruptions" in the overgrazing in the Valle de Mezquital while affording less attention to the politics of colonial land occupation and native dispossession that enabled grazing (Hunter, 2009).

Yet, Spanish colonists did understand property rights in ecological terms, and Spanish property holding had ecological consequences. Spanish imperial logics dictated that Spaniards had rights to land (just as Spain had rights to an empire) that was uncultivated or underworked (Pereira 1972). Within this logic, where inhabitants of colonized regions "abandoned" or "underused" the land, they showed that that they had no need for it, rendering it available for appropriation (Herzog, 2013, 2015; Muldoon, 1991). As Tamar Herzog (2013) notes of conflicts over land in the Quito region, Spanish judges grounded rights to land on continuous occupation and ongoing productive use, where "productivity" premised permanent cultivation and pasturing (Herzog, 2015, 114-119). Uncultivated land, or lands put to other uses, including pursuits such as hunting or gathering, were often declared *tierras baldias*, vacant or empty lands, and could be justifiably – in colonial terms –usurped (Amith, 2005; Owensby, 2008). The result of this logic was that even where "improvement" of land did not carry the same colonial-capitalist valences as in later settler colonies, legitimized landholding was nonetheless at least nominally predicated on specific forms of land use.

In colonial Peru, the implementation of Spanish appropriative logics and implementation of *dominio* landholding meant that the creation of new property rights frequently rested on claims that lands were abandoned, empty, and unused, that is, *tierras baldias*. This was certainly the case at Ollantaytambo, where Spaniards who privatized land frequently staked their claims on premises of disuse and abandonment. And indeed, many fields likely were unworked following the collapse of the Inka state. However, those lands do not account for the entirety of Spanish claims to *tierras baldías.* Indeed, colonists noted the exhaustion of such lands within just a few decades of the invasion (Burns, 1991; Ramírez, 1986). Aspiring Spanish landowners often created vacant land through the violent expulsion of Andean farmers or by re-categorizing plots via legal sleights-of-hand (Burns, 1999, 51–54; Covey, 2020; Hunter, 2021; Ramirez, 1996). Thus, in addition to land that was not intensively cultivated or fields simply sitting fallow, so-called "abandoned land" often included land worked by squatters, extra-legally rented fields, and plots worked by people who did not hold rights allocated by the colonial state. Hence, rather than describing a natural progression of land use in the context of factors such as climate shifts, demographic change, or biotic introductions, "abandonment," especially as denoted in archival claims, is a decidedly political category operational at the level of legal-juridical discourse. As a result, claims of abandonment obfuscate colonial shifts in land use and ecological transformations. Understanding shifts in colonial ecologies demands analysis more closely attuned to questions of agricultural practice.

3. Political ecology, land access, and land use

To attend to colonial land use at the level of practice, I follow Blaikie and Brookfield's (1987, 16) foundational suggestion to focus on relationships between "land-users, land managers, and the land itself" (e.g., Lohse, 2013; Morehart, Millhauser, & Juarez, 2018; Vásquez-León & Liverman, 2004). My analysis of land use practices is informed by structuration theory (sensu Giddens, 1986), and especially use of those theories in Andean political ecology (e.g., Grant & Lane, 2018; Wernke, 2013; Zimmerer 1991). Within this framework, land use practices emerge from the interplay of land-user's objectives (i.e., agency) and the constraining force of broader political, socio-cultural, and ecological circumstances (i.e., structures). Social structures that shape land use include factors such as use-rights, power relations, and socially mediated values. For instance, in the Colonial Andes, some Andean lords opposed the cultivation of wheat because of the high cultural value of maize (Gade, 1975). In addition to social factors, land use is also structured by biophysical and environmental concerns like water availability, elevation, and temperature: in the mountainous Andes, temperature declines as elevation increases and specific plants are confined to distinct ecological tiers. Hence, maize is very rarely cultivated higher than 3,500 meters above sea level in the Cusco region, whereas frost tolerant crops like tubers are regularly planted at high altitudes. Agricultural practice ultimately emerges from the confluence of social and environmental factors and practitioner and group agency (Mayer, 2002; Wernke, 2013). Even as practice is shaped by structures, those structures are also recursively re-constituted by practice. Hence, social structures are both endogenous and exogenous to social life, are formed in interactions between social groups and individuals, and are a domain in which domination, accommodation, and resistance are constantly negotiated (e.g., Wernke, 2013).

Just as social structures are remade through practice, environmental structures are also subject to recursive reconstruction. People remake land to better suit their needs, including by building infrastructures like terraced fields and canals. In the Andes, such interventions are the foundation of what Mayer (2002) terms "production zones": environmental modifications to facilitate production that demand coordination at the supra-household level and thus intertwine environment, ecology, and politics. Wernke (2013) builds on these ideas to argue land use in Peru's Colca Valley is shaped by dual structures of community – kin-based *ayllu* lineages – and landscape. For Wernke, land use is simultaneously "constructed culturally and constricted ecologically" (2013, 33), and farmers' decisions are situated within imbricated fields of ecological constraints, value systems, and power; in short, the specific socio-ecological context. Because social and ecological structures alike are recursively transformed by the agency of land users, land is not a static agricultural variable. In effect, for users, land is a process rather than a fixed material and is both the product and the medium of practice (Grant & Lane, 2018; Kosiba & Hunter, 2017; Hecht, Morrison, & Padoch 2014).

As I detail below, among the most significant structural transformations that shaped agricultural practice in Colonial Ollantaytambo was the creation of new kinds of property, vested in Spanish individuals and church institutions. Like other structures, new property forms were recursively shaped by those who participated in their creation and reification; norms of colonial property holding were improvised and invented in negotiations set in both Spanish courts and on the turf of Andean fields (Greer, 2018; Graubart, 2017; Herzog, 2015a; Hunter, 2021). The norms of property holding that emerged in the Spanish colonies were distinct, and decidedly amodern (Bastias Saavedra, 2018). For Spaniards, property rights were understood according to the legal concept of *dominio,* roughly translated to dominion or sovereignty. *Dominio directo* possession conferred an almost absolute right of control over land – subservient only to king and god – that conferred rights to the produce of land, as well as the right to alienate, sell, rent it, or neglect it (Bastias Saavedra, 2018; Guevara-Gil, 1993; Pagden, 1990). Generally (with exceptions for erstwhile Inka nobles), this form of landholding was limited to Spanish descendants. Because of this, landholding became increasingly racialized over the colonial period. By contrast with *dominio directo* holdings, the majority of Andeans worked land under conditions of *dominio util*, a limited and tenuous right of usufruct. As a result, people in differing social positions experienced the instantiation of *dominio* rights in varying ways. For landlords, it enabled the accumulation of land, commercialized production, and assertion of elevated social status; for agricultural workers, the contingency of

insecure possession compelled servitude; for independent indigenous communities, encroaching privatized holdings threatened self-sufficiency.

In Colonial Ollantaytambo, land use on newly privatized fields was shaped by the interplay of landlord aims, the agentive labor of unfree Indigenous workers, and the structuring role of ecological context, including vestigial agricultural infrastructures developed by the Inka state. As a result, attending to rights allocated by property holding only partially explains factors that shaped land use. For a more encompassing perspective I follow Ribot and Peluso's (2003) suggestion to analytically foreground access – the ability to derive benefit from a resource – over resource rights. As those authors highlight, the right to a particular benefit – here, a right implied by property-holding – does not necessarily confer the benefit. Property rights and access are linked, but not inherently; the right to grow maize on a particular plot of ground means little without, for instance, access to capital and labor required to keep the land productive, and markets to sell the crop. As such, property rights are just one factor within a broader matrix of "institutions, social and political-economic relations, and discursive strategies" that shape who benefits from a resource (Ribot & Peluso 2003, 157). Understanding access requires attention to mechanisms of access, which are often mediated by other actors. Hence, as an analytic, access emphasizes that property relations are relationships between people (rather than people and things) and are fundamentally about the exercise of social power. Indeed, Ribot and Peluso suggest a "bundle of powers" approach rather than the "bundle of rights" approach common to property rights analysis (Ribot & Peluso, 2009, 173; Stahl, 2010).

As applied to land, access-as-analytic focuses attention on relationships between people in particular socio-ecological contexts. This is to say, in addition to labor, markets, and capital, actualizing a benefit flow also requires suitable ecological and environmental circumstances. To wit, at Ollantaytambo commercial maize production is largely impossible on high altitude fields and is very difficult without irrigation; hence, commercial maize production requires not just land in the abstract, but the right kind of land, which must be coupled with labor and irrigation water according to the specific seasonality of the crop. In turn, this circumstance demands maintaining both material infrastructures – canals, terraces, etc. – and the sociopolitical configurations that make those infrastructures function (Kosiba & Hunter, 2017; Hunter, 2021). Hence, access is a land-use analytic that links questions of rights, labor, and ecology, enabling the integration of biophysical factors (e.g., climate), non-human action (e.g., erosion caused by grazing), and sociopolitical concerns (e.g., labor coercion) into the same sociohistorical processes. Attention to access moves away from an undifferentiated view of land as a straightforward economic input – as property, or agricultural matrix – to account for ecological variability, the specifics of socially constituted value, the agency of both landowner and worker, and socio-political structures that both shape and are shaped by land use practices.

4. Land, labor, and agricultural deintensification at colonial Ollantaytambo

The Inka, Colonial, and contemporary settlement of Ollantaytambo is located 40km northwest of the city of Cusco at the confluence of the Urubamba and Patacancha rivers. In the Inka and Colonial periods, Ollantaytambo included lands stretching from the community of Pachar in the east to Sillque to the west, and from the Socma Valley in the south to the archaeological site of Markaqocha in the north (Figure 1, Figure 2. Hunter, 2021; Kosiba & Hunter, 2017). This region was closely articulated to the city of Cusco during both the Inka and Colonial periods. In the Inka era, elites who ruled from Cusco built a palatial estate along the banks of the Urubamba in the town. This estate included a dramatic anthropogenic landscape of walled fields and terraces that stretches across the region. These rich fields were highly valued in both the Inka and Colonial Periods, and in the Colonial period were aggressively appropriated by Spaniards who sought lands in the region's comparatively mild climate. Proximity to Cusco's urban markets made Ollantaytambo's fields especially valuable to these colonists (see Glave, 2009).

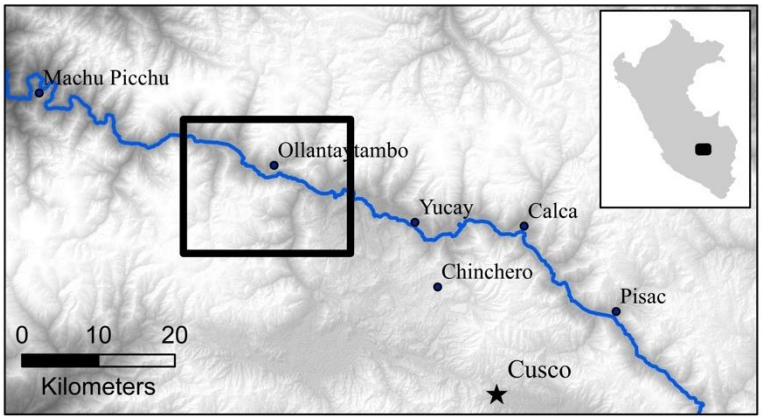

Figure 1: The Urubamba Region, indicating locations of Inka Royal estates. Insert corresponds to area of Figure 2.

The agricultural core of the landscape is the floor of the Urubamba Valley, at approximately 2800masl (Figure 3, Figure 4). Here, deep alluvial soils offer ideal conditions for the cultivation of crops like maize and wheat (Kosiba & Hunter, 2017). Colonial farmers noted the valuable characteristics of these lands, which they described as level, free from frost, and irrigated. In addition to fields on the valley floor, the Inka developed terrace complexes that sweep up onto adjoining hillsides. Maize can be successfully cultivated on lower elevation terraces, but on higher fields cultivation is restricted to cold-tolerant crops like tubers or quinoa. In the colonial era, farmers drew sharp distinctions between hillside fields that were irrigated and those where only dry farming was possible; as the colonial era advanced and canals deteriorated, the latter category grew in extent (Hunter, 2021). Finally, high altitude grasslands above the walls of the valley – referred to as *puna* – are only suitable for pasturing animals or tuber cultivation. Farmers value the *puna* depending on the frequency of frost, slope, and quality of pasture.

During the Inka Period, Ollantaytambo's lands were cultivated by a workforce of Inka subjects who produced vast quantities of maize, tubers, and other crops. Yields stocked imperial storehouses, provisioned armies, and furnished opulent feasts. Within the Inka cosmological order, sovereignty and authority were predicated on rulers' ability to provide for subjects (Ramírez, 2005). Hence, a portion of estate yields was redistributed amongst laborers (Hunter & Huamán Mesía, 2023; Hu & Quave, 2020; Quave, 2012). Through the recursive loop of labor, agricultural production, harvest, and redistribution, the basis of Inka authority in the capacity to provide was emphasized and reemphasized in the seasonal and day-to-day rhythms of agricultural practice. In turn, the cosmological demands of this recursive cycle meant that intensification was an always on-going process: Inka power was demonstrated through their absolute control over and intensive management of the agrarian landscape (Kosiba, 2015; 2018). Paleoenvironmental data from a stratigraphic core at Markaqocha, approximately 10km north of Ollantaytambo, demonstrate this intensive management of the Inka-era landscape: high concentrations of *Alnus* (alder) pollen suggest Inka-directed agroforestry on hillsides surrounding the lake. Maize pollen at high altitudes suggests that crop was cultivated even on marginal fields. Relative concentrations of ambrosia – a ruderal proxy for erosion – are low in this era, suggesting that Inka land management stabilized the landscape for intensive cultivation (Chepstow-Lusty *et al*., 2009; Chepstow-Lusty *et al*., 2007; Chepstow-Lusty & Winfield, 2000).

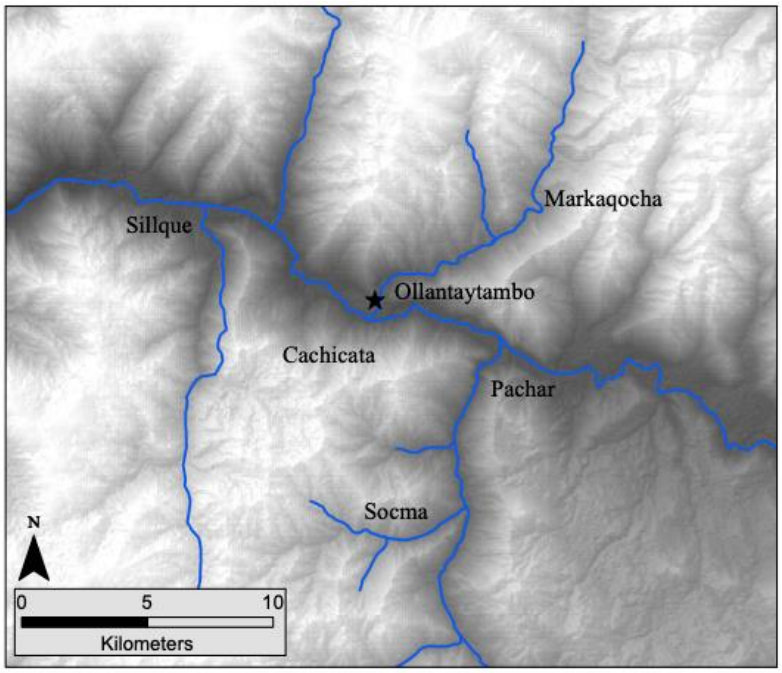

Figure 2: The study region, centered on the town of Ollantaytambo. The Urubamba River runs in a northwesterly course through the study area.

Figure 3: Drone photo of Ollantaytambo, showing walled fields and terraces radiating from the town center.

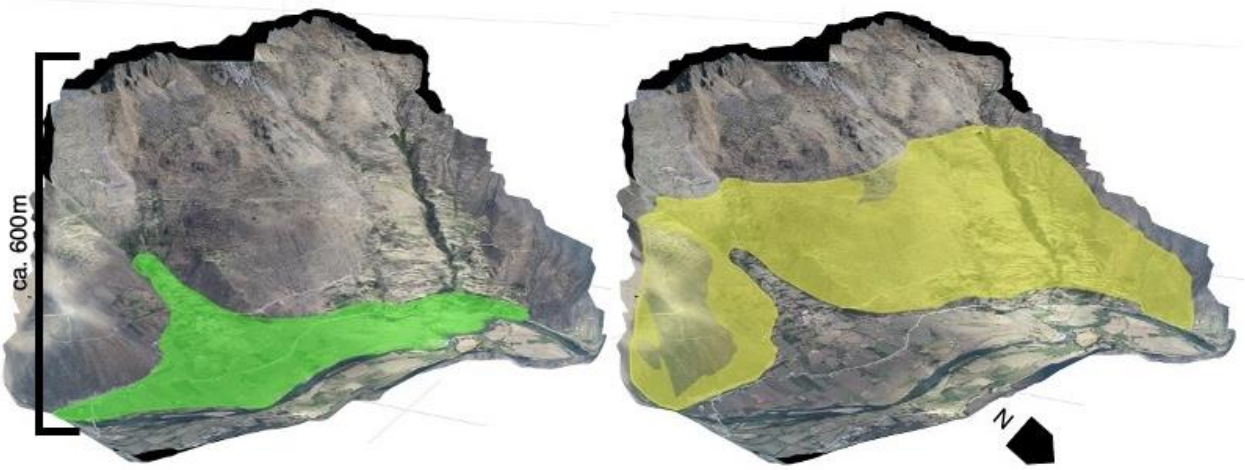

Figure 4: Heuristic models of land in the Cachicata area: at left, valley floor fields at approximately 2800masl; at right, potential area of hillside fields. High altitude pasture and tuber production zones are located on steppe above the valley wall. [2]

Like other places in the Inka heartland, Ollantaytambo was cast into chaos by the 1532 Spanish invasion: many of the people living around the town fled, and many others were killed. In the mid-16th century Spanish administrators grouped the Andean people who remained – now understood to be Spanish imperial subjects – into the *Repartimiento de Tambo*, an officially delineated tributary community. Colonial management fundamentally shifted agricultural practices on the region's fields in subsequent decades and centuries: labor was reorganized, land tenure was transformed, new animals and plants afforded new agricultural opportunities, and the land itself changed due to climactic shifts and new management practices.

Demography and agricultural labor organization

Like other Andean towns, Ollantaytambo's population fell precipitously through the 16th and 17th centuries due to intertwined colonial violences of forced resettlement, compulsory labor, and deadly pandemics. Cadastral surveys and tribute assessments track dramatic localized demographic decline (Figure 5). Based on a 1549 survey, Julien (2000) estimates that between 180 and 240 households lived in the town. By 1639, the *repartimiento* consisted of only 19 tributary households (Cook, 1975; Glave & Remy, 1983; Kosiba & Hunter, 2017). While the violence of these colonial-demographic shifts should not be underemphasized, the population of the officially delineated repartimiento – so-called *naturales* of the town – does not represent Ollantaytambo's total agrarian population. During the Colonial Period, land around the town was also worked by Andean, Spanish, and mestizo farmers who illicitly rented fields, including '*forasteros*' (migrants from other Andean regions), enslaved Africans, and – the largest group – Andean people who assumed servitude on privatized lands as either *yanacona* (indentured servants, so-called after a similar category of Inka-era laborers) or as tenant farmers known as *arrendatarios*. As early as 1555, Ollantaytambo's *Kuraka*, or town leader, complained that his subjects were fleeing onerous communal tribute demands to become *yanacona* (Julien, 2000), and the phenomenon increased in frequency through the Colonial Period3/26/2025 9:29:00 PM (Quave, 2014; Wightman, 1990). These agrarian workers appear only obliquely in the archive. For instance, the 1594 title to a grazing *estancia* at Markaqocha notes only in passing that several *yanacona* and an African slave labored on the estancia (*ARC*: F: *Colegio Educandas*, L: 02, 1568-1722). Thus, while there is no doubt that Ollantaytambo's

[2] *Cachicata* is also often spelled 'Kachiqhata.' Here I use the spelling most common in colonial-era documents.

population fell in the colonial period, the character of the region's agricultural workforce also changed as workers increasingly labored in servitude on consolidating private holdings.

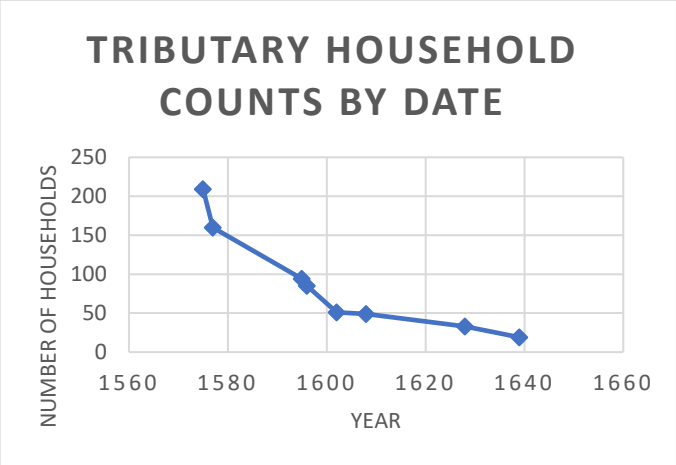

Figure 5: Number of Ollantaytambo tributary households by year. More detailed population data are available in Glave & Remy (1983) and Kosiba & Hunter (2017).

Land tenure

Early in the Colonial Period, the community of remnant Inka laborers and local people at Ollantaytambo that became the *repartimiento* assumed administration of formerly royal lands around the town. Community leaders allocated fields to households according to their subsistence needs and collective obligations. Through subsequent decades, the area of land worked by the *repartimiento* dramatically fell while the area of privately claimed lands increased. The full extent of *repartimiento* holdings in the earliest decades of Spanish rule is difficult to assess – my approximations are predicated on already speculative population estimates (Table 1). However, the area allotted to the tributary community declined from as much as 1600 *topos* in the 1550s to only 258 *topos* by the 1620s (the *topo* is an Andean measurement that varied in extent, but roughly equated 1/3 of a hectare in this context, see Glave & Remy, 1983). This assessment includes lands allocated to individual households, as well to support the local parish, fraternal organizations, orphans, and the elderly. The erosion of community landholding was paralleled by an increase in private possession. While Andean people in the pre-colonial era did have forms of individualized landholding – arguments to the contrary overstate the case – it is nonetheless clear that *dominio* landholding instantiated a decisive shift in rights inferred by possession (Burns, 1999; Puente Luna, 2021; Ramírez, 2017; Author, Year). *Dominio* landholding, and the hacienda system it undergirded, was a qualitative change in the relationship between land-users and the land they worked.[3]

Land privatization at Ollantaytambo was a complex, contingent, and drawn-out process of appropriation (Hunter, 2021). Spaniards claimed fields around the town as early as the 1550s, however, early claims were limited to scattered plots on the valley floor that were – at least according to claimants – former holdings of the Inka and thus understood to be inherently vacant (Burns, 1999; Hunter, 2021). Through the next decades, land claims increased in frequency, especially following colonial programs of resettlement in the 1570s and *composición de tierras* surveys beginning in the 1590s that formalized procedures to evict Indigenous land

[3] The changing meaning of the *topo* as unit is instructive here. Initially, the extent of that measurement. varied according to ecological productivity. Rather than each topo covering equivalent *space*, each was equivalently productive. Over the course of the colonial period the area of the topo became fixed spatially, such that by the 1600s the fixed dimensions of the topo could be measured using special cords or chains.

users and enabled Spaniards to assume title of newly emptied land (see articles in Carrera Quezada & Pérez Zevallos, 2022; Guevara-Gil, 1993; Hunter, 2021). The effect of these programs is evinced by a spate of Spanish levied claims following the first *composición* in 1594, the majority of which were explicitly to establish grazing *estancias* (ranches, Figure 6).

Date	Estimated Area of Repartimiento Land (topos)
1549	~1260–1680
1575	~1463
1594	598
1629	258

Table 1: Area of land held by the Indigenous repartimiento, by year. Figures for 1549 and 1575 are estimated from population, assuming an averaged ratio of 7 *topos* per tributary household as allotted in subsequent surveys.

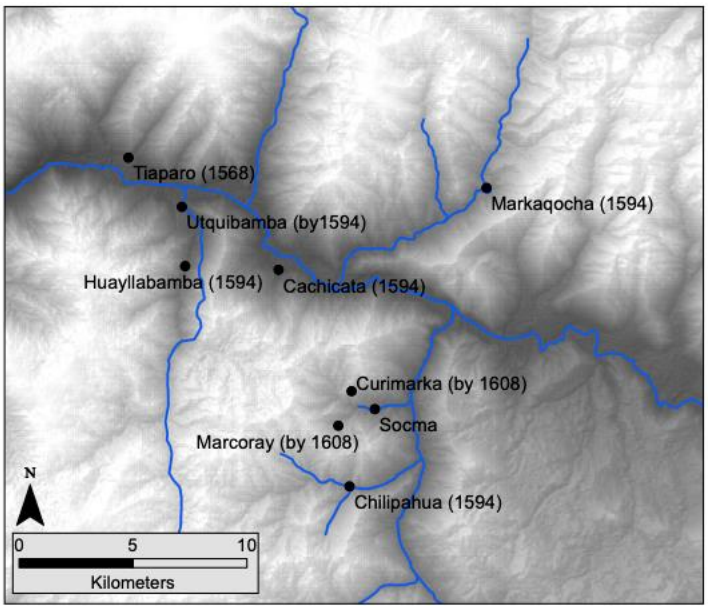

Figure 6: Early *estancias* at Ollantaytambo. Parentheses indicate year land was titled.

Even as land claims increased in frequency through the Colonial Period, until the mid-17th century there were no large contiguous tracts of privately held land – a key characteristic of the hacienda system – at Ollantaytambo. Rather, landowners possessed small parcels dispersed across the region, and often depended on tracts of common land for pasturing. For instance, a landowner named Luis Vizente claimed *estancias* at Cachicata, Phiri, and Markaqocha in the 1590s: field complexes scattered across the region both north and south of the Urubamba. Vizente also grazed animals on pasture intended for common use (ARC: F: *Educandas*, L:

02; ARC: *PN*, N:260). In the mid-17th century, however, a handful of Spaniards began consolidating ownership of the region's most valuable land. Within decades, they had largely secured the valley-floor and were aggressively pursuing ownership of hillside *estancias* and high-altitude pasture and tuber production zones (see Glave, 2009). For instance, the nuns of Cusco's Santa Clara Convent claimed hundreds of hectares of highland pasture above the maize fields of their hacienda at Pachar (Burns 1991, *ANP, Leg. 24, Cuaderno 54*). By the 18th century, in addition to the region's best maize land, these consolidated haciendas controlled vast expanses of hillside fields and high-altitude pasture. The difference in extent between hacienda and repartimiento holdings was stark: in 1629 tributary members of the *repartimiento* each held usufruct to between one and three *topos* of the community's collective 258 *topos*, by comparison, at the end of that century the holdings of Cusco's Augustinians – just one of the region's haciendas – encompassed approximately 1,500 *topos* of irrigated land and nearly twice that amount of unirrigated hillside fields. By the mid-17th century, even as the *repartimiento* retained fields clustered around the core of the town and small pockets of land were farmed by independent smallholders, hacienda holdings extended along the floor of the Urubamba Valley, through adjacent valleys, and across hillside fields and high-altitude pastures.

New flora, fauna, and technology

Spanish colonists introduced new flora, fauna, and agricultural technology to the Andes, creating new agricultural obligations and opportunities in the context of the emerging colonial political economy. For instance, wheat – a high value crop suited to colonial tastes – became an increasingly important component of Ollantaytambo's agroecology through the 16th century. As a robust grain that can be cultivated on sloping fields with minimal irrigation, its availability prompted some Andean farmers to claim previously uncultivated lands on unirrigated hillsides – in effect, an extensification of production (Kosiba & Hunter, 2017; see also Covey & Quave, 2017). Initially, wheat also enabled the *repartimiento* to participate in the emerging market economy. Between the 1550s and the 1570s, Ollantaytambo's Kuraka made agreements with several entrepreneurial Spaniards to form wheat producing *compañías*, the proceeds of which were supposed to finance tribute obligations (Burns, 1999; BNP, *Manuscritos*, A-300). Over time, however, access to markets was increasingly restricted to wealthy landlords who controlled sufficient land and capital to produce and transport grain at scale. Ultimately, a glut of wheat in the 17th century reestablished maize as the most important commercial crop. Landlords derived consistent profits from maize cultivation through the 1770s when collapsing prices fundamentally transformed the Andean agrarian economy (Glave & Remy, 1983).

New animals also enabled new agricultural practices. In the broader Cusco region, introduced animals became fundamental to the regional economy from the 1560s, when demands for meat and fiber led to a proliferation of *estancias* (Quave, 2014; Covey & Quave, 2017). By the turn of the 16th century, sheep, cattle, goats, pigs, and horses were common at Ollantaytambo, and private landowners increasingly claimed land explicitly to establish grazing *estancias*. These *estancias* were generally located on hillside fields; grazing on these terraced lands marked a substantial shift in localized agrarian practice. At Cachicata, for instance, the aforementioned Luis Vizente ran a herd of several hundred goats on Inka terraces (ARC: *PN*, N:260, 1618-1619). Pasturing animals disincentivized the maintenance of infrastructures such as canals and terraces that enabled intensive production, and indeed threatened those infrastructures directly – farmers complained that their canals and fields were trampled by marauding *ganados* (e.g., ARC: *BP, Legajo*. 46). When damaged, such infrastructures often went unrepaired in conditions of fragmented land ownership that undermined the political cohesion required for maintenance (Hunter, 2025). As Spanish landholding expanded in the region, the new technological complex of ox and plough also enabled new modes of labor on broad, flat, fields on the valley floor, however, it also demanded that land be set aside for animal maintenance. The Hacienda Sillque, for instance, required grazing land for 60 ox teams in the 17th century (Glave & Remy, 1983).

Ecological change and the geography of deintensification

These shifts in agrarian organization at Ollantaytambo interacted with broader environmental shifts to change the local ecology. At the macro scale, Spanish colonialism corresponded with the climactic cooling of

the Little Ice Age. As modeled by Kosiba and Hunter (2017), the most intense cooling of the LIA (ca. 1550-1850) likely lowered the altitudinal limits of maize cultivation at Ollantaytambo by approximately 80m relative to pre-1550 levels. This had little effect on fields along the Urubamba River, but it reduced the area of suitable maize land in tributary valleys by approximately 20%, provoking conflicts over land in those valleys. At the local level, data from the Markaqocha core indicate changes in land use: charcoal concentrations indicate a sustained increase in fire frequencies through the 17th century, suggesting labor-saving field burning. Through the same period pollen signals of tree cover steadily decrease and concentrations of ruderal plants rise steadily, indicating deforestation, an increasingly unstable landscape, and erosion (Chepstow-Lusty, 2011; Chepstow-Lusty *et al*., 2009). In short, data from the core indicate that by comparison with the Inka Period, Ollantaytambo's landscape was *less intensively* managed during the era of colonial rule.

However, agricultural deintensification was clearly not a uniform phenomenon, as the commercial importance of grains like maize and wheat made for their continued intensive cultivation on some fields around the town. To investigate the geography of deintensification at Ollantaytambo, I digitally surveyed the southern bank of the Urubamba across the Cachicata, Simapuqio, and Muyupata areas using high resolution orthophotos and 3 dimensional models.[4] By mapping agricultural infrastructures and distinguishing between infrastructures that are still used and those that are dilapidated or otherwise unmaintained – a proxy for agricultural deintensification – it is possible to estimate the specific geography of deintensification. Comparing these maps with toponymic surveys of the region (Kosiba & Hunter, 2017; Cusco Ministry of Culture) and archival records of hacienda production (Glave & Remy, 1983, 334) enables differentiation between lands that were farmed by haciendas for commercial production and those that were not.

The results of this work indicate that deintensification was concentrated on hillside fields well above the floor of the Urubamba. At Cachicata, for instance, the orthophoto (12.6cm/pixel) survey indicates a total of approximately 50 Ha of dilapidated infrastructures, plus an additional 84Ha that are currently cultivated but were not used for maize production by the hacienda according to 18th century records (see Figure 7, the precise area of these fields is impossible to ascertain given the ambiguous boundaries of terrace complexes). Derelict terraces at Cachicata are concentrated on the side of the valley (Figure 8). By contrast, valley floor lands are still intensively cultivated, and were used for maize production through the colonial period according to hacienda records (Glave & Remy, 1983, 334).

It is highly probable that the disuse of hillside infrastructures corresponds with the dereliction of associated canals (e.g., Wernke, 2010). Radiocarbon dates from deposits in a reservoir at the Muyupata field complex—the terminus of a canal that flows across the entirety of the Cachicata region—indicate this occurred at the close of the 16th century (Hunter, 2025) Pollen from that reservoir suggest nearby cultivation may have shifted from maize to tuber growing around that time, a pattern consistent the deintensification of production (Hunter, 2025). The documentary record confirms this: in 1659 surveyors described terraced lands at Muyupata as rocky and unsuitable for cultivation (ARC, CC, *Legajo* 26). Notably, these micro-scale findings are temporally aligned with regional data from the Markaqocha core (Chepstow-Lusty, 2011). These data suggest that deintensification in the colonial period was concentrated on hillsides and mid-altitude fields, where terraces developed by the Inka just generations before were allowed to degrade even as fields on the valley floor were continuously cultivated.

[4] The total surveyed area encompasses approximately 700 ha. This area was divided into 5 segments for data capture, which was accomplished using a DJI Mavic Pro drone. Data were processed using Agisoft Metashape into 3d models and orthophotos, and were digitally evaluated in ArcGIS. Distinctions between cultivated and uncultivated terraces were determined based on the presence of crops (the area was photographed after seasonal planting) and, to ensure fallow lands were not misclassified, via interviews with local farmers.

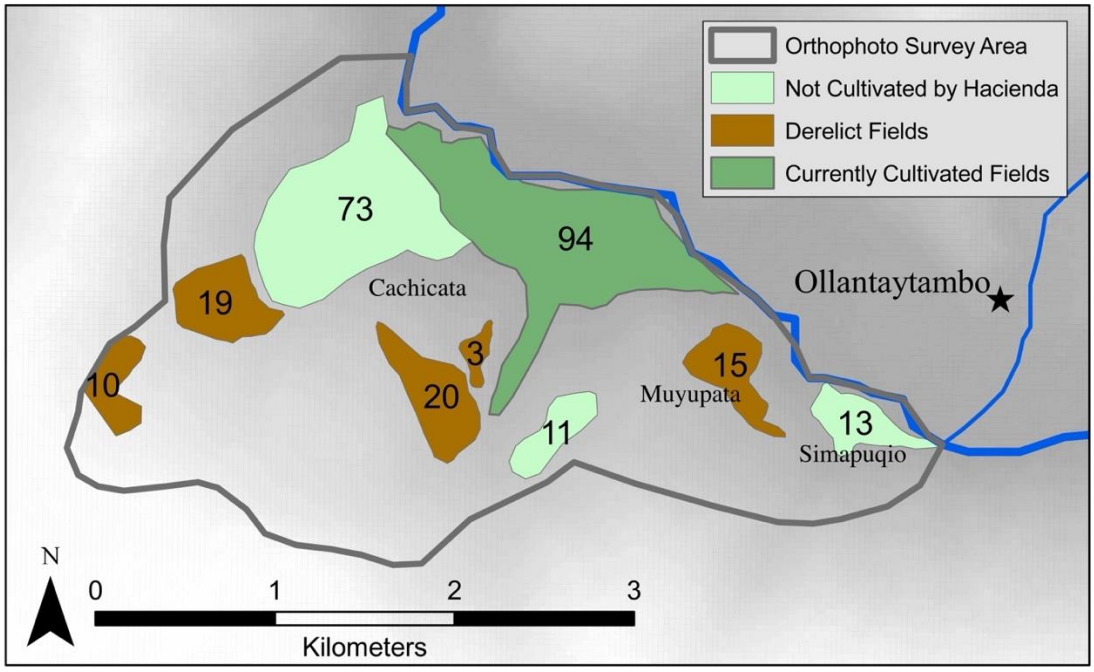

Figure 7: Orthophoto survey results, indicating lands currently cultivated (dark green), currently derelict (brown), and currently cultivated but not listed as core hacienda fields (light green). Numbers correspond to approximate field areas in hectares.

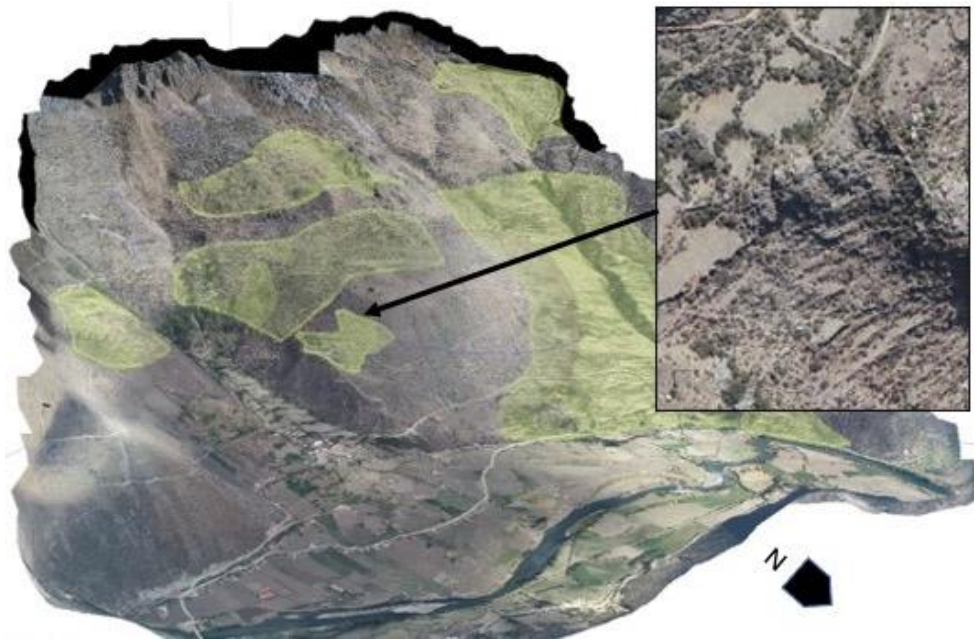

Figure 8: Model of the Cachicata area used for digital survey, indicating areas of hillside terracing. Inset is detail from orthophoto showing derelict terracing.

5. Land access, land use, and Ollantaytambo's ecology of servitude

Why didn't colonial farmers intensively cultivate hillside fields, even as they sustained intensive cultivation on the valley floor? What factors gave rise to patterns of land use at colonial Ollantaytambo that coalesced in hillside deintensification? The climactic cooling of the LIA offers one possible explanation. Cooling certainly lowered effective limits to cultivation, reducing the suitability of many fields for maize cultivation. However, broad climactic cooling fails to explain land use at places like Muyupata, at a relatively temperate 3000masl, or indeed, other similarly situated field complexes in the Cachicata region. Another possible explanation is the expansion of pastoralism in the 16th century (deintensification in and of itself). Roaming animals certainly damaged some infrastructures, and attendant erosion likely marginalized some fields. This though, does not explain why those fields were not repaired or brought back into intensive cultivation when subsequently brought under hacienda ownership—especially as haciendas *did* make major infrastructural investments to valley floor fields, including reclaiming new land from the river's floodplain (Glave & Remy, 1983). A Boserupian framework assuming a correlation between the reducing population and intensity of production might account for regional agricultural deintensification, but such a relation fails to explain the specific pattern of hillside deintensification. My contention is that deintensification was multi-casual: the LIA *did* shift parameters of production, population loss *did* reduce the agrarian workforce, and new taxa – wheat, and especially animals – *did* change the land by opening new agricultural opportunities and exacerbating erosion. However, these factors were patterned by the hacienda, a relation of production that structured access to land for workers and landlords alike within an emergent ecology of servitude.

To explain this argument, I turn here to a more detailed consideration of the internal ecology of the Hacienda Sillque, located approximately 7km northwest of Ollantaytambo. Sillque, among the region's largest and richest haciendas, originated via a process of property acquisition orchestrated by a man named Pedro de Soria, who established the hacienda following the 1629 *composición* and held it until his death in 1654. Subsequent landlords aggressively expanded Sillque by acquiring adjacent properties (Table 2). In 1698, Cusco's Bethlehemite friars purchased the hacienda and accelerated these acquisitions. In 1713 they consolidated ownership of a vast expanse of highland *puna*; in 1723, they purchased the adjacent Hacienda Cachicata; in 1728 they acquired the Hacienda Pachar – both large properties in and of themselves (AN, *L.24, c.454*). Surviving titles – which refer to vaguely described landscape features and long-since destroyed boundary markers – make it difficult to determine the precise extent of hacienda holdings, especially in the *puna*, however, by the close of the 18th century, *not including Pachar,* Sillque's holdings encompassed some 2000Ha of land, including the entirety of the Cachicata region (Glave & Remy, 1983).

Landlord	Tenure	Approximate Hacienda extent and annexations
Pedro de Soria	~1630-1654	Fields on the east bank of the Sillque river
Alonso de Soria	1654-~1675	No major change
Constanza de Soria	~1675-1680	No major change
Monastario del Pardo	1680-1685	No major change
Juan Cetano	1685-1698	Aggressive annexation of the western bank of the Sillque River
Bethlehemites	1698-	Consolidation of *puna* (1713); Addition of Cachicata (1723); Addition of Pachar (1728). Hacienda extends across nearly the entire southern bank of the Urubamba in Ollantaytambo

Table 2: Colonial era landlords of the Hacienda Sillque, and main acquisitions.

Like Ollantaytambo's other haciendas, Sillque's principal crop was maize. The enormous yields from Sillque's fields were directed for commercial sale and were redistributed to guarantee internal economic and social relations. For instance, in 1690 the then landlord Juan Centeno sold roughly 90% of Sillque's crop. The remaining portion was distributed to workers and allocated to business partners (Glave & Remy, 1986, 241-243). During the period considered here, maize agriculture was consistently profitable. The hacienda devoted as much land as it could to the crop and made investments to boost production, resulting in a steady increase in yields through the 17th century and into the 18th. Between 1752 and 1762 the Bethlehemites produced an average of 3,578 fanegas annually (The fanega is a volumetric unit equivalent to approximately 60kg of grain in this context) (Glave & Remy, 1986, 476).

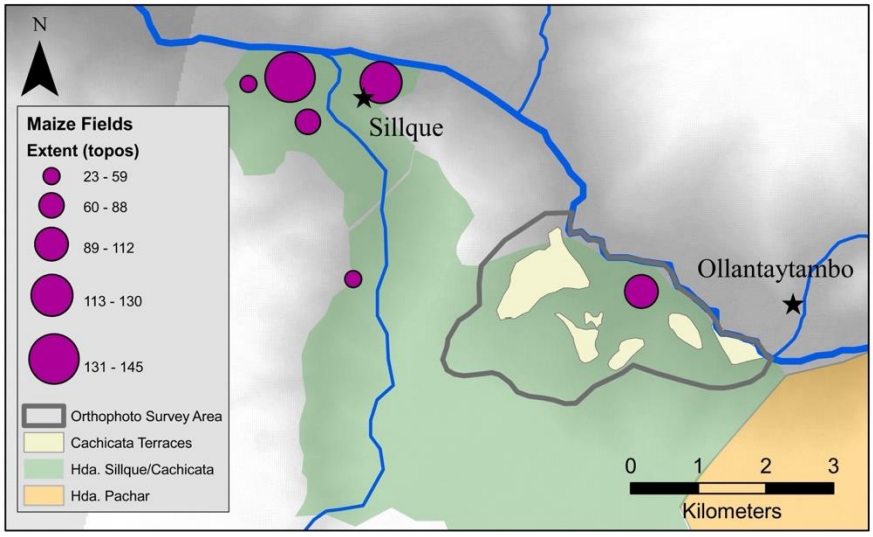

Figure 9: Distribution of Sillque's principal maize fields at the close of the 18th century. Magenta bubbles represent maize field size, but not exact location or field boundaries, which are opaque in titles that list only toponyms and areas.

Even at its zenith, however, maize cultivation only ever occupied a fraction of the hacienda's land. For instance, in the late 18th century only some 170Ha of Sillque's 2,000 hectares were used to grow the crop (Figure 9). The limited area used for maize was shaped by environmental factors, as well as the need to set aside fields for grazing the large herds used for transport, traction, meat, dairy, and wool production: during Juan Cetano's tenure the hacienda kept some 200 cattle, 1,000 sheep, and 90 ox teams (Glave & Remy, 1983). However, for Sillque, *labor* – that is to say, the availability of unfree laborers – was a more pressing constraint on production. Sillque always required more labor than was available; landlords complained of a lack of workers throughout the colonial period, and at times turned to violence to ensure a workforce. For instance, in 1648 Alonso de Soria directed his workers to attack a group of Andean smallholders to force them to labor on his fields (see Kosiba & Hunter, 2017). Labor constraints were exacerbated by the unique demands of maize cultivation, which required a large workforce during planting and harvest, but only a small number of workers through the remainder of the growing season. For haciendas, this posed a problem: how to ensure worker availability for planting and harvest without incurring costs of worker maintenance during less demanding seasons?

In Sillque, the solution was to maintain only a small number of permanent indentured *yanacona* alongside a considerably larger workforce of *arrendatario* tenants who joined *yanacona* in maize fields during

demanding seasons of planting and harvest (Glave, 2009).[5] These *arrendatarios* were effectively a low-cost labor reserve. To maintain this reserve, the hacienda allocated significant areas of agricultural land as usufruct plots. A few *arrendaterios* were allotted small maize fields – and owed a portion of their yields to the hacienda – but the majority were assigned land only marginally suited to the crop on hillsides or at higher altitudes. Indeed, a major motivation for hacienda expansion into the *puna* in the first decades of the 1700s was the elimination of independent smallholders and expansion of the *arrendatario* workforce (Glave & Remy, 1983). Thus, in addition to fields used for commercial production and grazing land, large areas of land were devoted to worker subsistence. Sillque's internal ecology was constituted by the circulation of goods and labor between workers and landowners. Hacendados distributed low altitude products and consumer goods such as cloth to workers to maintain their indebtedness; in turn, workers labored on hacienda fields and paid rent in-kind from their usufruct plots. These circulations were structured in a way that made for a near monopoly on maize production by landlords, maintained circumstances of indebtedness and indenture, and confined workers to marginal fields. In this sense, although hillside fields were ancillary to commercial production (i.e. not used for cash-crops) they were nonetheless essential to hacienda ecologies.

These details from Sillque clarify the relationship between circumstances of land access and practices of land use within Ollantaytambo's hacienda ecology. For hacienda landowners, access to the benefits of land – here, the profits of commercial maize production – was contingent on property rights, but also ecological factors and the availability of coerced labor. Land management decisions were structured by the access-defining confluence of these factors. In practice, this meant that even as property ownership brought with it the assurance of *rights* to vast expanses of rich valley-bottom lands, terraced hillside fields, and high-altitude pasture, hacienda commercial production was largely limited to just the valley floor at Ollantaytambo. However, even as commercial cultivation was constrained by ecological factors and the availability of labor, the legal rights of possession landlords held to other fields secured their power over legally landless indentured servants.

For these Indigenous laborers, access to land was mediated by the hacienda as a landholding institution. Land access was predicated on labor that included planting, care, and harvesting of hacienda crops during the maize production season. Workers were compelled to labor according to hacienda demands: they might flee or withhold work (and did!) but such resistance invited retribution; in 1769, for example, Sillque's Bethlehemite owners jailed reticent laborers in a small cell on the hacienda (AAC, *Epoca Colonial, Legajo* XIV 5, 84, f 16v). In effect, workers yielded control of their own labor to gain access to lands for subsistence. The condition of servitude structured access to the benefits of land and structured their agricultural practice. It limited workers to hillside and high-altitude fields where low temperatures and the absence of irrigation infrastructures constrained production, maintaining their structural dependence on landlords and exacerbating conditions of debt. Servitude also limited worker's access to their own labor, especially during seasons in which they were compelled to work in commercial maize fields. Archaeological data from the site of Simapuqio-Muyupata, which was absorbed into Sillque in the early 1700s, demonstrates that hacienda workers living at the site consumed a less diverse assemblage of plants than their Inka-era counterparts and were especially reliant on tubers (Hunter & Huamán Mesía 2023). That site is located at a relatively low altitude amidst hillside fields that were ideal for maize cultivation. Given these circumstances, Hunter & Huamán Mesía argue hacienda labor demands that included planting, care, and harvesting of hacienda crops during the maize production season precluded independent grain cultivation by workers, even in places where maize cultivation was theoretically possible. Hence, even as haciendas made infrastructural investments into the fields they cultivated commercially, infrastructures on other fields were left derelict as production deintensified.

This is not to imply that the hacienda dominated every aspect of peasant life, or that Andean peasants did not shape the circumstances of their own lives. As other studies have demonstrated, this was decidedly not the case. Like other structures, Ollantaytambo's haciendas were contoured by the agents who lived within them, including workers in servitude (e.g., de la Cadena, 2015; Hu, 2022; Thurner, 1993). These workers resisted

[5] The hacienda also contracted with wage laborers from nearby communities during these seasons. Precise numbers of *yanacona* and *arrendatarios* are difficult to establish, and certainly varied. In 1753, however, the hacienda covered tribute obligations for 104 workers, offering a sense of the size of the *yanacona* workforce.

hacienda domination both covertly and overtly, including by launching legal complaints against landowners and by modifying their own subsistence practices to circumvent hacienda labor demands (Glave & Remy, 1983; Hunter & Huamán Mesía, 2023). However, it remains the case that hacienda workers did live in the context of an extreme imbalance of power. Indeed, the effects of hacienda landholding extended beyond hacienda boundaries. People living in neighboring communities were compelled to work for haciendas in especially demanding seasons of planting and harvest. In this way, haciendas as agrarian structures shaped the lives of even those were nominally unaffiliated, and Ollantaytambo's ecology of servitude extended beyond hacienda lands.

Clarifying this ecology of servitude explains the specific pattern of colonial land use at Ollantaytambo: valley bottom lands were continually used for commercial maize production, and high-altitude lands were consistently used for pasturing and tuber production. However, some terraced hillsides – like those at Cachicata – were instead transformed into pasture or used for dry farming. Haciendas did not cultivate these fields directly; rather, they used those lands to retain control over an unfree labor force. The indentured workers on the other side of that exchange relinquished control of their labor to the hacienda. The effect was such that even on hillsides where maize *could* have been grown, circumstances of land access made such intensive cultivation functionally impossible. The very modes of unfree labor that enabled profitable commercial maize production were guaranteed by limiting the intensity of production on hillside and high-altitude fields. Thus, even as the LIA reduced the area of suitable maize land around Ollantaytambo in the Colonial Period, and even as new agricultural opportunities enabled new modes of production, the concomitant concentration of landholding and social power characteristic of the hacienda system fundamentally structured the way those factors operated within Ollantaytambo's colonial agroecology. Land and labor were linked politically within an ecology of servitude predicated on unequal land access. Patterns of land use within this ecology were both conditioned by and a condition of servitude.

There are several points here worth emphasizing. First, the Ollantaytambo case reiterates a finding from many other studies of hacienda land management (Chevalier, 1963; Keith, 1977; Orlove & Custred, 1980; Wolf & Mintz, 1957): control over land and control of labor were not independent of one another; rather, control over land was the essential element of hacienda power that ensured control over labor. The colonial *dominio* landholding framework was the foundation of Ollantaytambo's restructured agroecology. That framework, which enabled landlords to accumulate vast tracts, made power over land the basis for power over people. As *dominio* rights were conceptualized differently for people of Spanish and Andean descent, the resulting power imbalance was broadly arrayed along racial lines. Indeed, the specific characteristics of Indigenous subjectivity (i.e., *yanacona*, *forastero* outsiders, *naturales*, etc.) within the colonial system was largely defined in reference to relationships to land. Hence, when Spaniards appropriated land they did not just replace Indigenous farmers (indeed, those farmers or their descendants often continued to work the land). Rather, Spanish landholding within the hacienda system was a qualitative change in the relationship between agricultural laborers and the land they worked. In effect, as in Covey & Quave's (2017) case study from the nearby Maras region, the attrition of Andean authority over land effectively transformed the region's Indigenous communities into a largely landless peasantry.

Secondly, this transformed relationship between land-users and land had decidedly ecological consequences, including deintensification. Deintensification was not a straightforward adaptive response to stimuli like population decline, rather, it was the result of *decisions* made by land users in response to particular social, political, and ecological conditions. As in Wernke's (2010) study in the Colca Valley, shifts in land use at Colonial Ollantaytambo were shaped by localized political circumstances as well as environmental factors such as climate change and the availability of new flora and fauna. Unlike in Colca, however, where those politics were largely endogenous to Andean communities, Ollantaytambo's colonial politics of land use were inherently tied to the imposition of hacienda landholding by foreign actors. Finally, the hacienda as a property form was anchored by colonial ideologies of conquest and appropriation. Thus, while colonial property in the Andes may not have had the specific ecological valences as colonial property in settler contexts, access-defining

modes of individualized landholding and the concomitant dispossession of Andean communities nonetheless instantiated a racialized ecology of servitude that fundamentally remade the Ollantaytambo region.

6. Conclusion

Confronted with the challenge of deciphering ever-shifting and overlapping land jurisdictions within the pre-Colonial Inka Empire, the Andean ethnohistorian John Murra advocated focusing less on questions of tenure-rights (i.e., *derechos a tierras*), and attending instead to the "regulation of the human energy that valorizes those rights" (Murra, 2002, 306). Although he argued in relation to the Inka Empire, Murra's point is applicable beyond that context: land and labor are fundamentally linked. Examining tenure-rights in isolation is less informative than examining how political power shapes land, labor, and the circulation of agricultural products. In effect, to consider land access: who benefits from land, and how. In the context of Colonial Ollantaytambo, focusing on land access clarifies the operation of a racialized *ecology of servitude* structured by the unfree conditions of labor inherent to the hacienda system. As elsewhere in the Andes, Spanish colonialism initiated a broad trend towards agroecological deintensification. However, the specifics of this trend were highly variable. Haciendas continued to intensively cultivate grain on valley floor fields for commercial sale. On high altitude lands, haciendas pastured animals and indentured workers farmed allotted subsistence plots. Hillside fields in between those zones – lands that were intensively worked generations earlier under Inka direction – were cultivated less intensively within the hacienda system. This pattern of land use is explained by the ways in which access to land was mediated by hacienda land management.

Attending to access, rather than rights conferred by possession, focuses attention on *practice*, on *social power*, and how those factors contributed to reconfigure Ollantaytambo's agroecology. The links between the politics of land access and attendant transformations in the land itself apparent in this case study reinforce the fundamental political ecology tenet that land management leading to degradation must be understood in broader social and political-economic context (Blaikie & Brookfield, 1987). As in Catlin and Bolender's (2018) study of Icelandic tenant farmers who maintained only low-intensity production due to their inherent precarity, hacienda servitude at Ollantaytambo conditioned land use by inhibiting infrastructural investments and imposing specific low-intensity cultivation practices. Analytically, access moves away from treating land as a blank slate or uniform economic input; rather, it considers the highly variable inputs and outputs fostered by an ever-shifting terrain of ecological micro-climates and socio-political circumstances. Hence, in Colonial Ollantaytambo, attending to ownership *rights* does not tell the full story of hacienda land access. For landlords, high altitude fields were useless for commercial grain production, but possession of those lands was a highly effective mechanism of ensuring access to labor. For Indigenous Andean farmers, hacienda consolidation initiated highly contingent circumstances of land access wherein access to land became a function of servitude. In effect, land access – and the land use it structured – was a consequence of racialized land tenure regimes. To be sure, colonial land use was shaped by environmental factors, including the exigencies of declining overall temperatures during the LIA (Kosiba & Hunter, 2017), and social factors that included forced resettlement and population collapse (Wernke, 2010). However, the pattern of colonial land use at Ollantaytambo, including deintensification and the nominal "abandonment" of land, indicates that the decisions farmers made about their fields were not simply responses to shifting environmental conditions or the province of inverted Boserupian population metrics but rather emerged from localized politics of land possession manifested in the institution of the hacienda.

As VanValkenburgh (2021) argues, understanding the operation of power in colonial contexts requires attending to the specific emplaced processes of colonization through which empire was actualized on the ground. In this article, I have focused on the immediate Ollantaytambo region to make a point about the relevance of the hacienda-as-property in the Colonial Andes and the Spanish colonial world more broadly. At Ollantaytambo, the hacienda, like colonial-capitalist forms of landholding created by colonizers in 18th and 19th century settler colonies, was a property form that created new patterns of land use and encoded fundamental environmental inequalities along consolidating racial lines. This was not necessarily a universal pattern; the importance of property in structuring land use varied in other Andean regions. In rural areas, distant from

colonial cities and markets, property may have been nearly irrelevant to land use. However, in the vicinity of cities and in coastal regions where broad tracts of land were privately held, property-holding, land-use, and ecological transformations were intertwined (Ramírez, 1996; Weaver, 2015). Because they were landholding institutions, haciendas and cognate property forms mediated land access. As the Ollantaytambo case study illustrates, property formation and attendant dispossession structured the many forces – including landowner desires, peasant agency, climatic change, demographic shifts, and newly available flora and fauna – that determined access to land and contoured agricultural practice. In other words, the hacienda as landholding institution channeled the political shifts that remade Ollantaytambo's agroecology under Spanish Colonial governance.

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