Indigenous agriculture across American landscapes has traditionally been diverse and complex (Denevan 2001; Doolittle 2000; Whitmore and Turner 2001). In some cases, diversity of practices, including the creation of landesque capital, is seen as a hallmark of indigenous farming, and when coupled with wider subsistence strategies, this diversity may be interpreted to help manage socioecological risk in a variety of cultural and environmental settings (Homburg and Sandor 2011; Marston 2011; Zaro 2007; Zaro and Umire Alvarez 2005). In the prehispanic Andean region of South America, the focus of many landscape studies can generally be included under the rubric of landesque capital (for an extensive review of related works, see Contreras 2010), but the concept itself is rarely made explicit, and even less attention is paid to the complex processes that surround its creation or devaluation. Consequently, many studies focus on either the impetus for systematic investment in landesque capital or its total abandonment, with much less attention given to the historically contingent processes that lead to more complex outcomes like incremental landscape change or cases in which landesque capital may be only partially devalued without total abandonment.

As a research program, historical ecology treats landscapes as the primary analytical unit with which to evaluate the interconnectedness of humans and the environment in the context of dynamic change (Balée 2006). Landesque capital constitutes an important focus of landscape studies because it represents a form of human agency that often leads to both intentional and unintentional outcomes, which others have referred to as “land use legacies” (Foster, Frederick, Aber, Burke, Brokaw, Tilman, and Knapp 2003). However, given its temporal and spatial components, the value of landesque capital is subject to change according to both the cultural importance placed on such landscapes and the socioenvironmental conditions surrounding it.

This chapter takes an historical-ecological approach to evaluate the complex processes surrounding the creation and devaluation of landesque capital along the Peruvian south coast. The period of interest includes
significant socioenvironmental change, with European colonization representing the most pronounced cultural and demographic shift, and the generally arid environment experiencing both punctuated and prolonged changes in local parameters. As part of a more broadly diverse subsistence strategy, late prehispanic villagers invested in the construction and maintenance of stone-faced agricultural terraces and canals, whereas the most enduring feature on the coastal desert landscape today is the olive tree, first introduced to the region by European colonizers in the sixteenth century. The results of this study suggest that the degree to which landesque capital actually stockpiles labor or replaces/improves land for future use will vary in historically contingent ways. It also provides an example of the complex manners in which landesque capital can become devalued over time.

Creation, Management, and Devaluation of Landesque Capital

Here, landesque capital is broadly conceived, but it generally follows Blaikie and Brookfield’s (1987, 9) concept of “any investment in land with an anticipated life well beyond that of the present crop, or crop cycle. The creation of landesque capital involves substantial ‘saving’ of labour and other inputs for future production.” Terraces, irrigation canals, water impoundment tanks, and drainage systems all represent forms of “banked” labor, but less obvious types of investments can also include cultivated or managed trees and anthropogenic soils, both of which retain productive characteristics beyond the current harvest cycle (Brookfield 2001, 55).

Although a historical overview of the concept of landesque capital is not within the scope of this chapter (see Widgren 2007), several factors deserve mention here. First, it is fixed in space, and although some forms might increase resilience or mitigate certain kinds of historically contingent risks associated with farming, they may also be more susceptible to other kinds of risks, given their immobility within a dynamic socionatural environment. In some cases, available labor may be redirected toward other activities with greater flexibility in space, like herd management or fishing. Such economic shifts historically may signal periods of stress or risk mitigation (Marston 2011), or perhaps socioeconomic changes more broadly. Any critical study of landesque capital thus requires that it be contextualized within the total landscape.

Second, there is an explicit temporal component to landesque capital because it is inextricably linked to the notion that current labor applications are “stored” in landscape features for future use. Labor can be applied systematically in the construction of stone-faced terraces or in the planting of olive trees, with the expectation that such creations will require only minimal labor to maintain them once established. Such investments reflect long-term planning, because the intent of the practice
is to create a landscape for current and future use. However, agricultural landscapes may also change incrementally over time, and in some cases resulting in the slow creation of landesque capital, simply from repeated cultivation practices (Doolittle 1984). Such investments may not necessarily reflect long-term intent, but the outcomes might nevertheless be carried over beyond the current cropping cycle. Although it generally receives much less attention, the devaluation of such investments can also be systematic (abandonment, total loss) or incremental, in which specific components of landesque capital may continue to hold value while others are lost given changes in the socioenvironmental conditions surrounding its use. This underscores the importance of examining the complex and historically contingent processes that underlie the creation, management, and devaluation of landesque capital (see also Morrison 1994), and necessarily calls for greater attention to local and regional sequences of landscape change (Zaro et al. 2008).

**The Peruvian South Coast**

Though often overshadowed by the neighboring highlands, the Andean desert coast is quite ecologically diverse and has historically offered a plethora of opportunities under the right socioecological conditions. Along the Tambo-Ilo intervalley coast of southern Peru, a diverse strategy that incorporated marine, freshwater, and lomas (inland fog-fed forest) resource bases seems to have been productive and sustainable for periods of time (Zaro 2007). Today, however, the area is littered with abandoned field systems, with only a few scattered farmsteads and historic olive groves surviving into the present. Many of the inland hills remain desiccated as well, but remains of woody and herbaceous plants and trees testify to a more vegetated landscape in the past. Historic records mention a thriving lomas four to five centuries ago in the Ilo region, noting that they were once some of the most productive of coastal Peru (Rostworowski 1981; Vázquez de Espinosa 1942[1618]). However, lomas contraction was notable by the early eighteenth century, with historic accounts attributing much of their decline to deforestation (Frezier 1982[1713]). Continued collection of woody material in the present era has contributed to the barren landscape observed today, which has been, in many respects, dominated by an industrial scale copper smelter since the 1960s.

Water is a limiting factor in any desert setting, but along the Andean coast its presence on the surface is very patchy and usually results from either runoff from highland precipitation, excavation down to ground water aquifers, or freshwater springs. Between the Tambo and Ilo rivers, springs have historically constituted the primary source of fresh water, but they are characterized by low flow and often confined to incised channels. Rain falls only rarely and typically results from recurring, though infrequent, El Niño episodes (Maasch 2008). Particularly strong events can be catastrophic (Moseley and Keefer 2008), but the resultant precipitation
also helps to spawn growth among inland stands of lomas and improve pastureland for domestic and wild herbivores (Oficina de Información Agraria 2000). Aquifer recharge in the study area has not been intensively investigated, but it may relate to fluctuations in highland runoff (Clement and Moseley 1991), variation in the strength and frequency of El Niño events (Magilligan et al. 2008), or a combination of the two.

Analyses of ice (Thompson et al. 1994) and lake sediment (Abbott et al. 1997) cores from the high Andes suggest considerable variation in highland precipitation over the past 1,500 years, including drier than average conditions from the tenth through fifteenth centuries, followed by relatively wetter conditions from the late fifteenth through the seventeenth centuries. Along the coast, the geomorphic record provides evidence for at least two potentially catastrophic El Niño events in the fourteenth and seventeenth centuries, respectively (Moseley and Keefer 2008), but historic accounts also suggest recurrences of El Niño over the past four centuries (Quinn and Neal 1992). Unfortunately, the spatial extent of coastal rainfall varies considerably, and the local impact, if any, of specific events is difficult to gauge.

Although there is evidence for farming in the area early in the first millennium A.D., (Owen 2009), the ephemeral nature of the archaeological record immediately following this early period suggests that population levels subsequently declined and remained relatively low or absent for several centuries (Owen 1993). Beginning around A.D. 900 or slightly earlier, the region began to support a number of farming and fishing villages that formed part of the Chiribaya señorío, a culture group of moderate socioeconomic and political complexity (Lozada and Buikstra 2002; Umire Alvarez and Miranda 2001). Chiribaya farmers constructed major canals and terraces within the Ilo river valley, whereas villages closer to the river’s mouth focused predominantly on fishing. Chiribaya material expression persisted for about 5 centuries, and based on the total size of habitation areas, the lower river valley appears to have experienced population growth, possibly substantial, from early to late Chiribaya periods (Owen 1993, 526).

Along the intervalley coast, the most pronounced archaeological component dates to the late Chiribaya phase (A.D. 1200–1400) and consists of habitation, mortuary, and agricultural sectors organized around localized springs (Zaro et al. 2010). Individual complexes were noticeably smaller than those of the Ilo valley, but combined, they formed a significant component of the overall Chiribaya cultural landscape. Intervalley villages pursued an explicitly diverse set of economic activities that included agriculture, fishing, and herding; but the relative strength of these may have varied from one location to another. The convergence of a massive late fourteenth century El Niño with prolonged drought may have catalyzed the disappearance of Chiribaya cultural expression (Satterlee et al. 2000), but farming in intervalley contexts seems to have
persisted for decades longer before widespread abandonment in the middle of the fifteenth century (Zaro et al. 2013). The region remained largely depopulated during the subsequent Andean Late Horizon (~A.D. 1476–1532), the period preceding Spanish colonizaton.

In the sixteenth century, Spanish colonists initially organized wealth in the Andes through the *encomienda*, an institution used to extract surplus labor and resources from indigenous populations (Andrien 2001). As part of an encomienda in 1540, the small coastal village of Ilo consisted of a mere 20 native Andeans, a testament to continued population depression in the early colonial period (Adriazola Flores 1998, 40–41). By the seventeenth century, commercial agriculture on the Peruvian coast was anchored to wheat, wine, and sugar (Keith 1976, 65), but along the far south coast of Peru, historic era farmers managed olive groves in addition to small-scale subsistence agriculture, probably driven in part by the desire for European products (olive oil) and the growth of an economic trunk line across the Central Andes (Andrien 2001). Population in the area remained low until the latter half of the twentieth century, when Southern Peru Copper Corporation established its smelter along the intervalley coast, catalyzing significant growth in Ilo as a company town (Hall 1992). Only a few olive groves survive along the intervalley coast today, significantly reduced in number and capacity from the historic and more ancient agricultural landscapes.

**Landesque Capital and the Intervaller Coast**

Significant creation of landesque capital began during the late Chiribaya period, and many of those modifications endure, either as abandoned archaeological relicts or, in many fewer cases, as living fields (Zaro et al. 2010). Archaeological survey identified a total of 23 independent Chiribaya field systems, with an average size of only about 9 ha per system (Figure 11.1). Despite the modest size of each system, canals and terraces constitute the majority of physical remains of prehispanic farming in the area, although various furrowing strategies and other forms of soil management are also preserved under the right conditions. Specific components of these capital investments are described here, followed by a discussion in the context of socioenvironmental change outlined previously.

*Terracing and Irrigation, Twelfth to Fifteenth Centuries*

**Terraces**

Terrace construction creates planting surfaces, improves water retention, augments soil thickness, and reduces soil erosion (Denevan 2001; Homburg and Sandor 2011). Although soil fertility may not necessarily improve immediately following terrace construction (e.g., Posthumus and Stroosnijder 2010), it is often enhanced and maintained when combined
with other management strategies that include crop rotation, multicropping, irrigation, fertilization, or fallowing (Holliday 1992).

Following Treacy and Denevan (1994), several terrace types initially defined in highland Andean contexts are notable along the Tambo-Ilo intervalley coast, including valley bottom terracing (referred to here as channel margin terraces), bench or contour terracing, and grid terracing. Most are faced with small to medium blocks of pink granite and constructed to heights of about 0.5 to 1.0 meter. Chiribaya terraces most often exhibit a fairly homogeneous fill of silt, sand, and small gravels with very gradational changes between strata, suggesting that regardless of type, individual terrace complexes seem to have been constructed relatively systematically over a short period of time rather than incrementally over long periods (Zaro and Umire Alvarez 2005).

Channel margin terraces were commonly used to create cultivable terrain along the moderately sloping margins of coastal ravines (Figure 11.2), whereas contour terracing is generally found on steeper terrain away from primary channels, or in isolated discontinuous blocks among hills or desert plains between ravines. Their primary purpose was likely to generate a level planting surface and create a deeper soil horizon. Spacing of terraces appears to be related to slope: the steeper the slope, the more
closely spaced the terrace walls. In some cases, layers of small cobbles had been placed at the base of terrace fill, possibly to facilitate drainage. Many constructions also contain some element of grid terracing, though one site in particular includes an entirely gridded field of roughly 35 x 60 meters. Its general purpose may have been simply to accommodate underlying geomorphology: As the terrain undulated, grid terraces were able to maintain relatively small, quadrangular planting surfaces.

In most locations, terrace fill is generally darker than apparently uncultivated lands, and moderate amounts of carbon, marine shell, and other cultural refuse were also commonly observed. Though not a ubiquitous practice, indigenous Andean farmers traditionally integrated domestic refuse into field systems or practiced a form of mixed farming, in which herd management (camelids and, later, livestock) and manuring were important components of cultivation practices. Both strategies introduce high amounts of organic waste into cultivated terrain, contributing to the general health of soil maintenance (Sandor and Eash 1995).

Under conditions of optimal lighting and good preservation, ancient furrows are also visible. In most cases, specific patterns cannot be distinguished, but several examples on abandoned terraces and pampa surfaces around Cola de Zorro may reflect box furrows morphologically similar to waffle gardens (Doolittle and Neely 2004), or sinuous *caracoles* that are common elsewhere in the Andes (Denevan 2001). Pollen and macrobotanical remains from Wawakiki and Cola de Zorro suggest that maize, beans, and squash/pumpkin were probably common crops among Chiribaya field systems (Zaro 2007; Zaro et al. 2013).

**Irrigation**

Irrigation complexes along the intervalley coast are much smaller and more localized than those of principal river valleys of coastal Peru. The longest irrigation system among intervalley complexes stretched only about 2 kilometers, and most operated on an even smaller scale of a few hundred meters. All terraced fields were irrigated by spring water, either directly through canals, or by first storing water in impoundment tanks and subsequently redirecting it to cultivated surfaces. The few surviving farmsteads today rely solely on impoundment tanks because low spring discharge precludes its transport for any great distance. Chiribaya farmers also occasionally drew from multiple spring sources to irrigate single units of land, a strategy that would have been more resilient in the face of dynamic spring flow (Zaro and Umire Alvarez 2005).

**Abandonment, Fifteenth to Sixteenth Centuries**

The paucity of Late Horizon artifacts coupled with available radiocarbon dates are broadly suggestive of widespread abandonment of the intervalley coastal region sometime in the middle of the fifteenth century and
Figure 11.2 Abandoned channel margin terraces at Cola de Zorro.
well before Spanish colonization (Zaro et al. 2013). Without continued maintenance, the intervalley agricultural landscape was subject to broader geophysical processes of decay; predominantly wind, gravity, and occasionally water.

Olive Groves and the Changing Landscapes of the Seventeenth to Twentieth Centuries

Terraces and Olives

Although many terraces of more gently sloping terrain remained relatively intact at the time of Spanish arrival, the retention walls of those on steeper hillsides had been breached in various locations, leading to considerable erosion (Zaro 2005). Spanish colonial land use was organized around existing infrastructure, but in most cases, a degree of contraction is evident, leaving many distal terraced fields to continue the process of decay. However, there is little indication that Spanish colonial farmers utilized even more intact terraces in the same manner as indigenous farmers. On the promontory at Wawakiki, for example, geologic profiles identified late Chiribaya terrace walls and fill buried by thin stratified deposits of sand and gravels with very sharp contacts between layers, suggesting that punctuated and recurrent alluvial episodes led to their incremental accumulation over time. A thin lens of Huaynaputina tephra dated to A.D. 1600 is also visible in profile, providing good chronological control between strategies.

Olive trees became a primary economic focus of many coastal spring systems, with smaller subsistence crops cultivated at distal ends of these groves. Semicircular stone terraces were sometimes constructed around individual trees, no doubt drawing on materials, in part, from available prehispanic terraces (Figure 11.3). Deliberate deconstruction of prehispanic agricultural terraces in the historic era was most evident at Cola de Zorro, in which a number of retention walls were stripped of their stones and redirected toward the construction of a large corral around the former fields (Figure 11.4). Dung and other remains of only European introduced herbivores (caprines, equines) were identified in excavation and surface inspection of this corral, although smaller enclosures elsewhere at the site were used to pen camelids in the early fifteenth century (Zaro et al. 2013). Limited farming after A.D. 1600 is apparent, but there is no evidence of olive cultivation at the site.

Spanish colonial fields often buried late Chiribaya terraces, which in some cases makes possible a stratigraphic comparison of cultivated soil. As noted previously, abandoned prehispanic soils visibly contain carbon, marine shell, and other cultural refuse, but post-A.D. 1600 soil horizons are noticeably lacking in these additives (Zaro 2005).

Furrowing strategies can rarely be identified specifically for the Spanish colonial period, but several fields that were likely abandoned in the late
Figure 11.3  Olive grove at Pocoma.

Figure 11.4  Historic era corral constructed around prehispanic agricultural terraces. Stones used in corral construction were apparently stripped from terrace walls.
nineteenth or early twentieth century exhibit elements of more traditional Andean farming strategies, and they may represent reintroduction of those practices in the Spanish colonial or modern era. Furrowing patterns tend to be visible at the distal ends of olive groves, with the most pronounced patterns reflecting E-type furrows or sinuous caracoles (Figure 11.5), both of which have a long history in the Andes and have been identified in both prehispanic and historic contexts (Denevan 2001).

**Irrigation**

Because water is the limiting factor in desert agriculture, it is not surprising that historic and more recent fields have been tethered to agricultural infrastructure of greater antiquity. Unfortunately, few excavations within irrigation canals have been performed, but one at Wawakiki suggests that historic era farmers renovated and reused at least one primary canal that had been abandoned in the late fourteenth or early fifteenth century (Zaro 2005, 85–87). It is also clear that although specific practices in the Spanish colonial period are difficult to glean from available information, farming into the present era continues to utilize strategies that include water impoundment tanks and multiple spring sources to irrigate units of land. In some cases, impoundment tanks were reduced in size, probably to accommodate decreases in spring discharge (Zaro 2005). Similar modifications can also be observed in more recent tanks at Alastaya grove.

**Discussion**

It is unclear what precipitated Chiribaya expansion into the intervalley coastal region in the twelfth or thirteenth century, but a growing population in the context of an intensifying drought may have placed added stress on the specialized, exchange-based economy of Chiribaya farmers and fisherfolk settled along the Ilo River. What is clearer, however, is that Chiribaya villagers expanded into a relatively depopulated region and explicitly pursued a diverse strategy that integrated farming, fishing, and herding. Although a diverse economic strategy alone may be evidence of risk reduction, the specific kinds of agricultural investments and the diversity with which they were implemented also permitted intervalley farmers to manage risks associated with this hyper-arid region, particularly as they relate to water security and soil. The employment of multiple terracing strategies in unique geomorphic contexts along the Tambo-Ilo coast permitted local farmers to increase the diversity of contexts in which farming could be implemented. Ultimately, the importance of terrace construction, canal engineering, and soil management lay in their integration: Indigenous farmers implemented these investments in concert to manage an array of diverse land forms along the coast, creating an assorted agricultural landscape that remained productive for several centuries as part of a more broadly diverse economic strategy.
Figure 11.5 Plan of late nineteenth or early twentieth century caracoles at Wawakiki.
Terrace and canal construction served to physically transform desert regions into agricultural farmland. Canalization of water meant that farming would not be restricted solely to the drainage channels themselves (most of which are deeply incised and offer no arable land), but rather were engineered along the channel margins or across pampa surfaces away from the channels. In effect, the combination of canals and terraces permitted the systematic creation of an agricultural landscape (capital) that would otherwise have been impossible during most years. The construction of such infrastructure may have required considerable labor investments initially, but there is no indication that it was done so under the direction of a larger central authority. Most intervalley spring complexes were small in scale and highly localized. In contrast, lower Ilo Valley agriculture was predominantly linked to a single 9-kilometer-long canal and likely required more coordinated effort to construct or repair (Reycraft 2000). The archaeological record suggests a sense of permanence with respect to Chiribaya villagers along the intervalley coast because most agricultural complexes were also associated with domestic/residential sectors and formally bounded cemeteries, both of which may signal a degree of territoriality (Zaro et al. 2010). This also implies sufficient onsite availability of labor to construct and subsequently manage investments in an engineered agricultural landscape, including terrace maintenance, canal cleaning, and the regular introduction of organic refuse into cultivated soils. The systematic construction of such a landscape certainly implies confidence in long-term stability and the intentional stockpiling of labor for future use.

The archaeological record is consistent with widespread abandonment along the intervalley coast sometime around the middle of the fifteenth century. The reason for this is unclear, but an intensifying highland drought may have adversely impacted coastal aquifers and limited freshwater availability beyond the resilience of multispring irrigation systems and water impoundment tanks. Expansion of massive terrace and irrigation field systems under Inca management in the adjacent upper Moquegua/Ilo drainage at sites like Camata (Dayton 2008) during the Late Horizon may have also contributed to declining runoff and subsequent aquifer recharge along the coast. The presence of water does not necessarily precipitate farming in a desert environment, but the lack of water would most certainly guarantee its absence.

A wetter period from about A.D. 1500–1720 (Thompson et al. 1994) may have fostered conditions once again favorable for small-scale farming, but along the intervalley coast land use appears to have remained relatively inactive until the late sixteenth or early seventeenth centuries. Much like the situation encountered by late phase Chiribaya farmers, Spanish colonists, albeit few in numbers, also encountered a landscape that had been relatively abandoned for a century or more. Most farmers took advantage of a landscape already naturally equipped with canals and
From Terraces to Trees

terraced fields, though with a much-reduced supply of labor and more expeditious mentality toward land use. Farming was often diminished in scale and apparently with little labor applied to existing terrace infrastructure. The absence of even moderate organic contents in historic fields also suggests that Spanish colonists did not engage in similar fertilizing strategies as indigenous Andean farmers, which might be explained by the general difference in settlement between indigenous Andean communities and Spanish colonizers. Indigenous Andeans were generally more dispersed about the landscape and engaged in rural lifeways. In contrast, Spanish colonial populations were much more urban focused and tended to reside in nucleated centers (Keith 1976). The Chiribaya domestic, fishing, and herding components that accompanied many intervalley agricultural complexes meant that there would have been a ready supply of organic waste and other refuse for field systems. This has not been the case since before late sixteenth century recolonization of the region, where resident populations along the intervalley coast have remained sparse, with the majority centered in principal river valleys. Thus, a change in population and settlement distribution may partially explain the lack of significant organic inputs and labor applications to post-1600 fields.

Temporal studies of landscape change at Wawakiki (Zaro 2005) and Carrizal (Clement and Moseley 1991) suggest that since the seventeenth century, the extent of land use at these springs has declined incrementally into the twentieth century, and possibly an indication that spring discharge has been slowing. Furthermore, a comparison of sixteenth century ethnohistoric records and historic era descriptions with the current situation among the inland hills suggest that the lomas also may have incrementally declined into the present day. Farther north along the Andean coast, Canziani (1998) argued that deforestation and overgrazing (European-introduced herbivores) of the Lomas de Atiquipa since the Spanish colonial period were primary factors in the desertification of that landscape. It is unclear what role European-introduced herbivores have played in lomas desiccation along the Tambo-Ilo coast, but historic era corrals are found at many locations among current and former agricultural complexes and among the inland hills.

**Immovable vs. Mobile Capital and the Intervalle Valley Coast**

In general, the infrequency of coastal precipitation coupled with the dynamic nature of low discharge springs has necessarily made farming along the intervalley coast a particularly risky endeavor. The spatially fixed nature of landesque capital means that agroecological systems are either resilient to such risks in their current location or subject to abandonment. Chiribaya farmers mitigated risks in several ways: They utilized multiple spring sources to irrigate single units of land, captured low-discharge spring water in impoundment tanks for its subsequent distribution, and created an assorted agricultural landscape in various
geomorphic settings. Importantly, they maintained these investments in the context of a diverse subsistence economy that included camelid herding and fishing. Indeed, the very construction of an agricultural landscape expanded the limits of vegetation and may have made herding more tenable along the desert coast. In the Mediterranean, the inclusion of livestock in a broader subsistence strategy is argued to buffer subsistence stress precisely because of its mobility (Butzer 1996, 143). Hence, with the appropriate labor availability, Chiribaya combined significant investments in immovable capital (canals and terraces) with those of greater mobility (herding and fishing) to navigate the socioenvironmental dynamics of the Peruvian south coast.

The importance of herbivores in the prehispanic, Spanish colonial, or even more contemporary Tambo-Ilo cultural landscapes is difficult to quantify, but the material record seems to reflect a greater number of historic era corrals than prehispanic camelid pens (Zaro and Umire Alvarez 2007). This may signal an increase in the relative importance of domestic animals in the local economy since Spanish colonization, particularly in the context of agricultural contraction and significantly lower population levels. Gade (1992) has noted that significant population decline more broadly across the Central Andes may have catalyzed rapid adoption of European livestock, citing their more manageable labor requirements than those for maintaining terraced field systems. Along with cultural values that were tied to an emerging European economy in Peru, the relatively diminished labor availability along the Tambo-Ilo coast may not only have led to more expedient methods of farming and the devaluation of terrace constructions but also to a greater importance of livestock in the local and regional economy.

Landesque Capital and a Process of Devaluation

Agricultural landscapes are constantly in a state of development, and in general they are created through a mix of both systematic and incremental additions. Chiribaya farmers in the twelfth through early fifteenth centuries systematically constructed networks of canals and terraces, but they also regularly integrated organic refuse into fields that incrementally contributed to the general health of soils. On the other hand, the most enduring agricultural landscape feature of the Spanish colonial era is the olive tree. Olive trees, which can live for centuries, may be viewed as systematic investments, particularly because they require several years before producing a first crop of fruit, but annual maintenance in pruning and irrigation literally cultivates capital incrementally over the lifespan of a tree.

Similarly, the devaluation of landscape modifications may also be rapid or incremental, where components of constructed landscapes may retain value long after others have fallen out of favor. The devaluation of canal and terrace systems in the fifteenth century was rapid because the entire intervalley coast appears to have experienced a century or more period
of abandonment. As noted previously, the reasons for this are unclear, but the combination of precipitation variability and upper valley irrigation practices may have created considerable water shortages for even the most resilient coastal spring systems to manage. Spanish colonial and historic era farming was also organized around coastal springs, and although some prehispanic canals were renovated and reused in the colonial period (continued appreciation), most terraced fields were not valued in the same manner. In an extreme case, retention walls from prehispanic terraces were stripped and redirected toward the construction of a corral. In many cases, however, portions of prehispanic agricultural fields were utilized for farming, but apparently without any investment in terrace maintenance. Consequently, older terraces deteriorated and were simply buried from sight after years of cultivation. Limited labor availability may be partly responsible for the continued devaluation of terrace systems throughout the colonial and historic era, but because water is the limiting factor for desert farming, foregoing canal construction or renovation was not an option.

**Conclusion**

In a historical ecological framework, the integration of humans and environment are manifested in landscapes. Consequently, a focus on landesque capital necessarily reveals the complexity of relationships between people, environment, and climate. In the context of non-equilibrium dynamics, change is historically contingent and therefore demands that landscapes be studied on local and regional scales, in multiple cultural and environmental settings. Archaeology can provide a unique perspective on this process—indeed, the physical nature of landesque capital generally leaves physical markers—but the coarse chronological resolution normally available to the archaeologist limits the discussion to broader, centuries-to-millennia-scale, overviews or trends. However, in doing so, such studies can point to potential relationships among key variables that surround landesque capital.

The approach taken here combines the archaeological and historic records with the contemporary landscape to evaluate the historical ecology of enduring modifications. Indeed, landesque capital may be viewed as “banking labor,” yet it does not do so indefinitely and may undergo a complex process of devaluation as socioecological conditions vary. In an extreme desert environment like that of southern coastal Peru, water availability has been a key variable in the spatial distribution and extent of farming in the region. However, the archaeological record suggests that the process of socioenvironmental change over the past eight centuries was complex, and that relationships between settlement, labor availability, and culturally defined practices of resource management were also of great importance in the continued appreciation or devaluation of landesque capital.
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