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To cite this article: Claudia Tomateo (2021): Indigenous land systems and emerging of Green Infrastructure planning in the Peruvian coastal desert: tensions and opportunities, Journal of Environmental Policy & Planning, DOI: [10.1080/1523908X.2021.1960806](https://doi.org/10.1080/1523908X.2021.1960806)

To link to this article: <https://doi.org/10.1080/1523908X.2021.1960806>



Published online: 30 Jul 2021.



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Indigenous land systems and emerging of Green Infrastructure planning in the Peruvian coastal desert: tensions and opportunities

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ABSTRACT

For many, Green Infrastructure (GI) is a modern ecological planning concept focusing on stormwater runoff. This paper argues for the importance of Indigenous Knowledge (IK) in GI planning and policy through the case study of the Tumbes Basin. The Basin serves as home to a diverse array of Pre-Hispanic Indigenous networked agro-ecological practices and landscape interventions guided by a worldview marrying humans and landscapes dating back to immemorial times of human habitation in the Americas (~36,000 BP). By 900 BCE–1100 CE this planned regional network was actively managing landslides, stormwater runoff, and riverine flooding, all challenges are currently being exacerbated by climate change and urban development. Today, this landscape-level network is one of the biggest GI systems in Peru and yet remains unacknowledged in emergent GI policy and planning. By examining existing Peruvian scholarship on landscape practices, and visualizing Pre-Hispanic landscape networks in the Tumbes Basin, this study makes the case for Peruvian GI policy to be guided by Indigenous Knowledge and governance systems. Such a transformation requires a deeper integration of Indigenous conceptualizations of GI with other infrastructure systems and regional urban planning and design.

ARTICLE HISTORY

Received 20 October 2020
Accepted 20 July 2021

KEYWORDS

Decolonization; Green Infrastructure; Indigenous Knowledge; design; typologies; Peru

1 . Introduction

The Peruvian coastal desert running over 1500 miles along the coast covers only 10% of the country's land area, yet is crossed by numerous river valleys cradling cities collectively housing over 50% of the population and varied geographical features setting the base for an incredible range of infrastructural elements. By the 'peak' of the Inca Empire (900 BCE–1100 CE), these acted as a network of multifunctional features across the coastal desert: (1) hydraulic terraces along the Andes growing food and mitigating landslides, (2) a vast network of channels called *Amunas* managing stormwater runoff, (3) sunken croplands and water gardens protecting crops from intense winds and mitigating riverine flooding, (4) agricultural terraces mimicking altitudinal level conditions providing food and medicine, the most famous examples found at Moray in Cusco known as a 'laboratory' for Inca agricultural research on crop adaptation, (5) seasonal landscapes such as Lomas harvesting fog, (6) underground spiral terraces storing water, such as those at Puquios in Nazca, and (7) a regional road transportation system stretching across the Inca empire known as Qhapaq Ñan.

Today, this Indigenous network constitutes one of the biggest GI systems in Peru, a system interacting with a variety of other infrastructures such as public space, transportation, and contemporary built environments. IK brings a robust traditional ecological framework from which we can analyze multilayered infrastructure systems (Hall et al., 2021). Rather than using IK in extractive ways (i.e. only serving scholarly knowledge production), this research argues for a need to center the authority and material needs of Indigenous systems of

governance and communities while decolonizing GI theory, policy and practice through the case study of the Tumbes Basin (Harding, 1998 ; Latulippe & Klenk, 2020).

With the objective to understand how GI has the potential to decolonize urban planning practices, this paper is structured in three parts. First, by reviewing the current status of GI planning and policy Peru through the lens of existing theories on pre-Inca and Inca landscape cosmo-visions (vision of reality), this study aims to illuminate more holistic and productive typologies for GI practices that have implications in GI policy in the region and beyond. Secondly, using the case study of the Tumbes basin, I point towards a research and policy framework that understands GI in all its layers throughout time and in relationship with other infrastructural systems. Lastly, through examining GI's colonial dimensions, and in the service of decolonizing GI, I re-conceptualize it by translating IK principles into planning-oriented concepts of scalar fluidity, de-standardization, and design adaptation-translation.

2. GI policy in Peru and relation to Indigenous cosmo-vision

In the Peruvian context, the term 'Green Infrastructure' is a concept under development. It has been introduced through a series of international funding programs to protect, plan, maintain and restore natural landscapes. Definitions vary from different organizations: The United Nations Environmental Program (UNEP) defines GI as a network of natural and semi-natural zones designed to provide ecosystem services and to protect biodiversity in both urban and rural contexts (UNEP, 2014). Forest Trends – a US-based non-profit organization dedicated to financing conservation projects – defines GI as the protection of the natural systems that complement, increment and replace gray infrastructure designed to provide water services (Forest Trends, 2021). In their GI strategies, these two organizations include interventions such as reforestation, forest conservation, reconnection of rivers with floodplains, water harvesting, wetland construction, conservation/restoration of grassland and prairies, wetland conservation/restoration, and the optimization of ancestral technologies. In 2015, the Association of drinking water and sanitation regulators of the Americas' (ADERASA) Green Infrastructure Working Group proposed a GI definition deeply related to water management and provision as a '*Set of activities, actions, and/or measures implemented in hydrological important ecosystems (for drinking water operators), with the goal of restoring and/or optimizing ecosystem's hydrological functions and guaranteeing the availability of drinking water for users*' (ADERASA, 2015).

Because of the geographic characteristics of the region and planning policies for implementation most of the conceptualization for GI in Peru uses natural systems and water provision as central anchors. The term is also closely related to the concept 'Natural Infrastructure' (NI) which has definitions referring to the conservation, restoration and recovery of different ecosystems forming a network of natural spaces providing various services (Peru Ministry of Environment). NI came into the Peruvian discourse in 2015 when the Ministry of Environment approved the law N° 006-2015-EF/63.01 (Ministerio de Economía y Finanzas, 2015) for the regulation and guidelines for public investment in biological diversity and ecosystem services. But, it only became urgent after the disastrous impacts from the heavy rains and resultant flooding and landslides caused by the 'El Niño' southern oscillation in 2017. Clear divisions between NI and GI definitions haven't been made, and their use corresponds mainly to the stakeholder familiarity with the term. Both terms relate to other emergent concepts, such as 'Nature-Based Solutions' (NBS) – a climate change adaptation oriented approach of using ecosystem elements, and 'Urban Ecological Infrastructure' (UEI) – or the collection of ecological components embedded within urban systems (Childers et al., 2019).

In Peru, most GI investment is through the drinking water and sanitation institutions. The National Superintendency of Sanitation Services (SUNASS) directs water operators to include 'environmental compensation' in their tariffs (Modernization of Sanitation Services Law, 2012) within the legal framework of the 'Compensation Mechanisms for Ecosystem Services' (MRSE), created by the Ministry of Environment. This framework allows the promotion, protection and voluntary restoration of environmental services through public and private stakeholders and within regional and municipal governments. Additionally, the CONDESAN has developed a 'Rapid Hydrological Assessment tool' to measure impacts over time and the Initiative for Hydrological Monitoring of Andean Ecosystems to prioritize investments in the country.

Due to the lack of access to services and poverty experienced by the majority of the Peruvian population, GI is also heavily relied upon for food through sustainable agriculture, along with shaping access to water and energy. Colonial perspectives on culture and nature continue to shape the way governments allocate resources. Usually, ‘improvements’ in Indigenous communities do not fit neoliberal standards of what is ‘valuable’ and as policies fail to respond to Indigenous conditions, their settlements and territories are considered as part of undeveloped ‘nature,’ and therefore become voiceless and extractable resources for ‘development’. Plans are laid out over their territory (urban-rural redevelopment and resource extraction), profoundly affecting their socio-economic conditions and relationships with the land. For example, current plans for Tumbes include incentives to the private sector to fish the mangroves, without taking into consideration the Indigenous communities settled in the area. These forms of colonial planning intersect with other forms of dispossession and layers of oppression suffered by Indigenous communities, such as racism, violence and state oppression during bouts of terrorism in the 80s and 90s (Zapata, 2017) or the killing of two Indigenous People in the Amazon this year (Fowks, 2021).

In 2017, the Peruvian census included a question about Indigenous communities and around 10,000 distinct communities were identified, bringing light to its vast diversity, the most spoken languages are Quechua (4601 Indigenous communities) and Aymara (625 Indigenous communities). However, only 55 (Ministry of Culture, 2020) have been recognized legally as Indigenous communities, with all of them only located in the Andes and in the Amazon. Despite the diversity of Indigenous communities located in the Coastal Desert, and the rich infrastructural system in place, is not acknowledged by the existing government.

Peruvian Indigenous communities have been systematically impoverished and isolated, they are usually placed in the margins of planning processes, and at the forefront of the struggle for climate justice. Some efforts, such as the project ‘Proyecto Infraestructura Natural para la Seguridad Hídrica 2019–2023’, a collaboration between the United States Agency for International Development (USAID), the Canada Government, the Peruvian Society for Environmental Law, Ecodesición, and researchers from the Imperial College in London has begun to recognize Indigenous landscape interventions, communities and agriculture gender gap. International NGO’s often offer consultancies and financing including Indigenous GI across different Peruvian regions. All too often, the projects romanticizes effort to ‘help’ and ‘educate’ Indigenous Peoples and to ‘include’ their GI efforts into the ‘formal’ infrastructural system. But the project fails to provide a critique of current planning systems, address the ongoing political marginalization of Indigenous governance, or propose more ‘radical’ solutions such as the re-claiming of land by the Indigenous communities. Trying to fit Indigenous GI into the current system standards – without theorizing planning’s own cultural position – is just another colonial strategy (Porter, 2010). To decolonize current urban planning and design practices, it is absolutely essential to understand place-based Indigenous cosmo-visions, only then plans and policies can reflect ‘development’ within Indigenous terms.

To study existing pre-colonial interventions in the Peruvian coastal desert, we need to revisit the idea of landscape. From the western perspective, landscape exists as long as it has a distance from the individual. Authors such as Alain Roger define landscape as a cultural construction meaning that it only exists within human perception and an aesthetic view. Others emphasize the need for contemplation (Berque, 1995), introducing temporal as well as physical distance, the wilderness (Cronon, 1996); bringing elements such as memory and defining landscape as what is kept in your mind after you stop looking (Bird Rose, 2012; Clément, 2012; Eigen & Martin, 2018; Schama, 1996). More complex definitions such as James Corner’s recognizes the instrumentalization of landscape defined by the capacity to keep and express ideas actively involving the mind. Within the urban planning discipline, ‘Cultural Ecosystem Services’ (CES) defined as ‘non-material benefits people obtain from nature’ (International Union for Conservation of Nature, 2015) perpetuates extractive ideas over the landscape and reinforces the unidirectional relationship between humans and space (space providing benefits to people).

Nevertheless, ‘cultural landscapes’ studies start to break the division between the observer and the object observed, and between the urban and the rural. They introduce the concept of landscape as a result of interactions between people, culture and place – working and living as a community – through this interdependence, the landscape is constructed within people’s shared identity and meaning, putting in evidence its

intrinsic collective qualities (Wilson & Groth, 2003; Jackson, 1984). Even if scholars try to unveil the complexities of those relationships a fundamental problem persists, the idea of ‘natural landscape’ informed by ‘cultural’ ones: ‘The division of forms into natural and cultural is the necessary basis for determining the areal importance and character of man’s activity’ (Sauer 1925, p 37). Through Indigenous perspectives, all landscapes (‘natural’ and ‘cultural’) are part of the same and are conceptualized in a multi-scalar systemic view, which means that landscape is part of one’s self.

Another problem with ‘cultural landscape preservation and conservation’ is that is based on the idea of land as property (Birnbaum, 1994; Taylor, 2002); within the framework of settler colonialism, the land is extremely valuable, settlers made Indigenous land their own and their main source of capital, violently disrupting Indigenous ‘epistemic, ontological and cosmological’ connections with landscape (Tuck & Yang, 2012), establishing then a system for oppression.

Moreover, ‘cultural landscape’ studies recognize the importance of visual information when reading the landscape, however, they also highlight visual information that is not necessarily visible, such as ‘spatial information’ (Groth, 2009; Wilson & Groth, 2003). The idea of nonvisual sensory inputs brings the ‘cultural landscape’ concept closer to Indigenous perspectives, meaning that they both consider underlying organizations and interrelations of space at different scales. However, within Indigenous cosmo-vision – the system through which Indigenous Peoples understand reality – the interrelations of space are not linear (i.e. the regional scale contains the city and local scale), but multidimensional, numerous objects - mapping immediate or distant landscapes – represent complex relationships; in this case, the ‘landscape units’ are not spatially homogenous elements (Steiner, 2008), but flexible heterogeneous containers.

On complex geographical relationships, Mitchell (1996) makes an effort to ‘meld landscape studies with labor history’ arguing that:

‘the morphology of a place is in its own right a space that makes social relations. It is a produced space. In the most general terms, it is part of the human condition that we continually produce and transform landscapes’. (Mitchell, p. 6)

Mitchell draws on Marxist views of people’s labor as a metabolism for human and nature, establishing then a symbiotic relationship; because labor, through its social and spatial conditions, creates space. In so, dictating how space design-making can perpetuate colonial practices or act as an agent of decolonization.

Within Peruvian literature, there is an extensive body of work about pre-Hispanic architecture focused on buildings as symbols over the territory (Alvino, 2016; Belaúnde, 1950; Campana, 1970; Canziani, 1989, 2003, 2007; Fung & Williams, 1977; Gunther & Lohmann, 1992; Guzmán, 1988; Harth-terré, 1921, 1933, 1964, 1977; Marussi, 1979; Moser, 1987; Velarde, 1946; Williams, 1981). However, if we look into the historiography of the Peruvian landscape architecture theory, it has not been explored to its full extent, important works analyze the landscape – for architecture and urbanism – through: aesthetic views and landscape taxonomies (Ludeña, 1997, 2008), cultural landscape lenses (Canziani, 2007), symbolism criteria (Gastelumendi, 1963; Guzmán, 2016), and the ‘breeding’ of elements (Crousse, 2016); resulting in a sparse intellectual production of landscape architecture for the Peruvian context.

Indigeneity is diverse and place-based, nevertheless, we can trace parallels between ‘landscape’ conventional definitions and Indigenous concepts for an easier understanding. However, the point is not to define the Indigenous landscape and cosmo-vision in non-Indigenous terms – especially considering that the academic representation is mostly white and privileged – but to communicate Indigenous concepts and relationships from Indigenous voices as precisely as possible considering the challenges of language/meaning barriers between Quechua (Indigenous language) and English (Coulthard, 2010).

In *‘Paisajes y paisajismo peruano. Apuntes para una historia crítica’* (2008), Ludeña argued that to experience and transform the landscape in the Indigenous world it needs to be explained in terms of a particular materialization of a ‘*mythopoetic vision of reality*’. *‘Landscape and cosmovision represents in the pre-Inca/Inca world, a unity*’. In so, Ludeña proposes a typological classification of the Peruvian landscape, based on morphologic structures and their impact on landscape transformations:

- (1) Surface landscape – weft and relief: characterized by rock and soil elements built over rock and soil. They can be three-dimensional or dimensional objects in a variety of sizes, structures and uses. For both utilitarian and sacred purposes.
- (2) Surface landscapes-line: an extensive network of Inca and pre-Inca roads.
- (3) Rock and water landscapes: water worship is essential in the Andean worldview as a source of life and fertility. Here is where hydraulic engineering emerges for practical, aesthetic and sacred uses.
- (4) Soil, water, and wind landscapes: Inca gardening as a utilitarian and contemplative activity.
- (5) Evoked landscapes – miniature landscapes to play and dream: the pre-Inca and Inca civilizations produced a vast array of objects, some have been identified as micro-landscapes. Through carved rocks, they represented imaginary landscapes, a sort of cartography of sacred structures distributed along the territory.
- (6) Underground landscapes: the subterranean elements, secret passages and tombs represented spatially the relationship with their ancestors and eternal life.

By classifying the Andean landscape through the nature of the elements emerging as texture over the territory (Greslou, 1991), this classification aligns within Indigenous cosmo-vision standards, where there is no principal matter as the protagonist but conceptual categories implying fluid spatial imaginaries (Stensrud, 2016). This is then the basis to think through a productive categorization for Indigenous agro-ecological features as drivers to decolonize urban planning. Through embracing a comprehensive typological categorization focused on types as frameworks of change, meaning and adaptation, GI interventions in Peru have the potential to challenge and re-frame systematic colonial practices in urban planning (Section 4; Figure 1).

In this research, Indigeneity is defined along the lines of Ludeña's reading of the Indigenous landscape, a marriage between humans, landscape and the Indigenous cosmo-vision, understanding all as an indivisible multilayered unit; where you are, is the same as who you are. In so, we must acknowledge, that the Indigenous – as a relational space – conflicts with corporate capital and neoliberal states, and 'nature' under colonial perspectives, is political (De la Cadena, 2010). In Peru, we can see these tensions present in the Tumbes Basin where natural protected areas, contested sites, archaeological sites, Indigenous water management infrastructure, ancient agricultural practices, and colonial-driven urban plans overlay.

3. The Tumbes basin

Tumbes is a coastal province located in the Peruvian northwest, near the border with Ecuador and has 224,863 ha total. It was occupied during pre-Inca times by the Tumpis and after the 1400s the Inca Pachacutec made it an integral territory of the Inca Empire. Four areas compose the morphological zones of the region: the delta of the Tumbes and Zarumilla rivers, an alluvial plain north from the Tumbes River, ancient terraces in Mancora, and the Amotape mountain range in the east and south. Fifty percent of its territory is covered by three protected natural areas: The Tumbes Mangroves National Sanctuary, the Cerros de Amotape National Park, and the Tumbes Reserved Zone (Figure 2).

The region has significant Indigenous infrastructures integrating human technologies, landforms, ecosystems, and land uses – inter-valley channels, observatories, shrines, tombs – The development of agricultural technologies increased the use of productive land during pre-colonial times. Channels were built by the community to redirect water to the 'pampas' (plane areas), sometimes channels brought water laterally, longitudinally across the valley, or even from one valley to another (inter-valleys). These sophisticated earthworks utilized different construction materials including soil and rock to control the speed at which water is transported along the way.

Through the case study of the Tumbes basin, this analysis provides a comprehensive multilayered reading (geographical, infrastructural, political and social) through digital mapping and document analysis to understand contested forces in the territory and inform future urban policy in the region.

The Indigenous channels in the Tumbes basin are located parallel to the Tumbes river on both sides. They start at the 'Estrecho del Tigre', the west channel crosses the 'Lomas of Plateros', ending in 'Pueblo Viejo' and

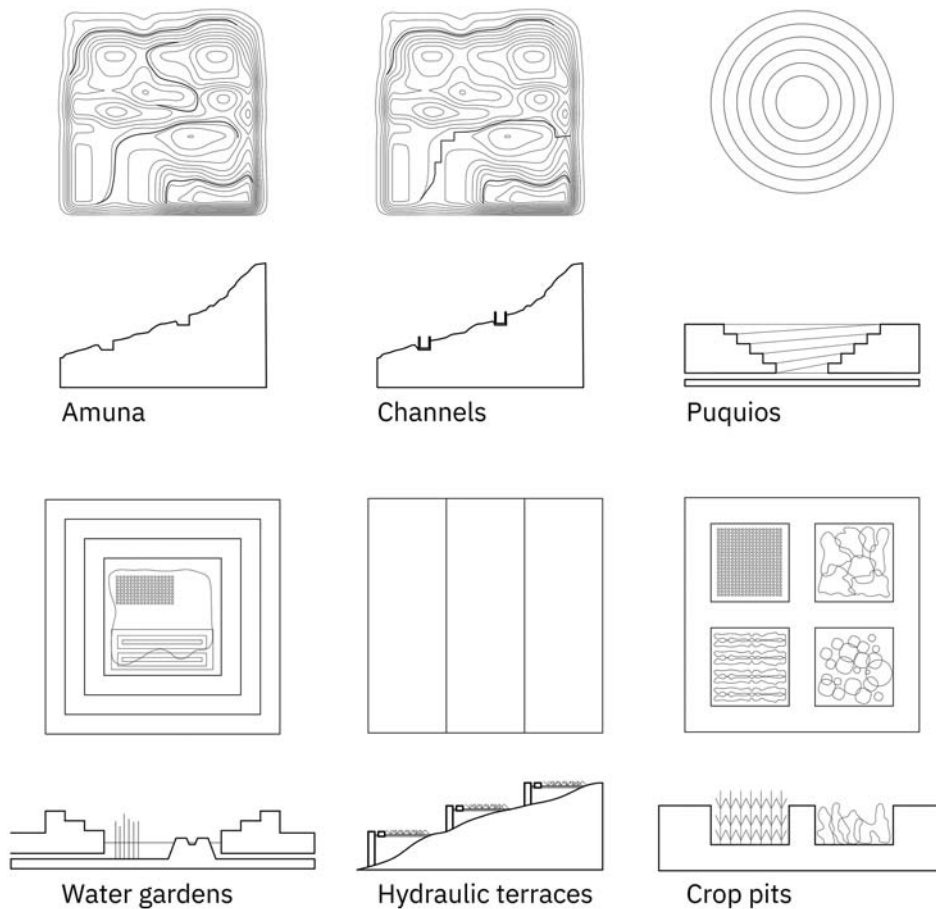


Figure 1. Drawing showing Indigenous agriculture strategies plans and section view. Tomateo, C (2019). *Indigenous Strategies* [Drawing].

flowing out through the ‘Corrales River’ and the east channel turns right before arriving at Tumbes City and irrigates the ‘Corral Pampa’. Each channel has a linear distance of 70 km and provides an arable area of 9 thousand hectares.

Figure 3 shows ‘landscape infrastructure’ elements in space, channels and sub-channels going on both sides of the Tumbes River, serving all of the agricultural land and accompanied by archaeological places along the valley. As addressed above, the Tumbes basin holds a vast variety of ecosystems, temporal in nature, transforming landscape performance and appearance constantly. In contrast, Figure 4 shows the ‘hard’ infrastructure in the basin such as mining, roads, unpaved roads, electricity, airports, ports, and population centers at risk. The main infrastructure gravitates along the Panamericana Norte (main highway) parallel to the coast, along the whole country and crossing into Ecuador.

In order to analyze the way urban planning practices are shaping Tumbes province and opportunities for hybrids and productive intersections between Indigenous and ‘modern’ infrastructure, we must revisit the ‘Plan de Desarrollo Regional Concertado de Tumbes 2017–2030 (2017)’ (Concerted Regional Development Plan of Tumbes 2017–2030) done by the Tumbes regional government.

The document initiates with a statement about the priorities of regional policies such as gender equality, social inclusion, and wage gaps, as well as the objective of strengthening sustainable productive competitiveness by creating public–private partnerships for public service and to manage risks from landslides, flooding and heavy rain events. The plan offers a limited number of maps to ‘synthesize ideas’, but they only reinforce

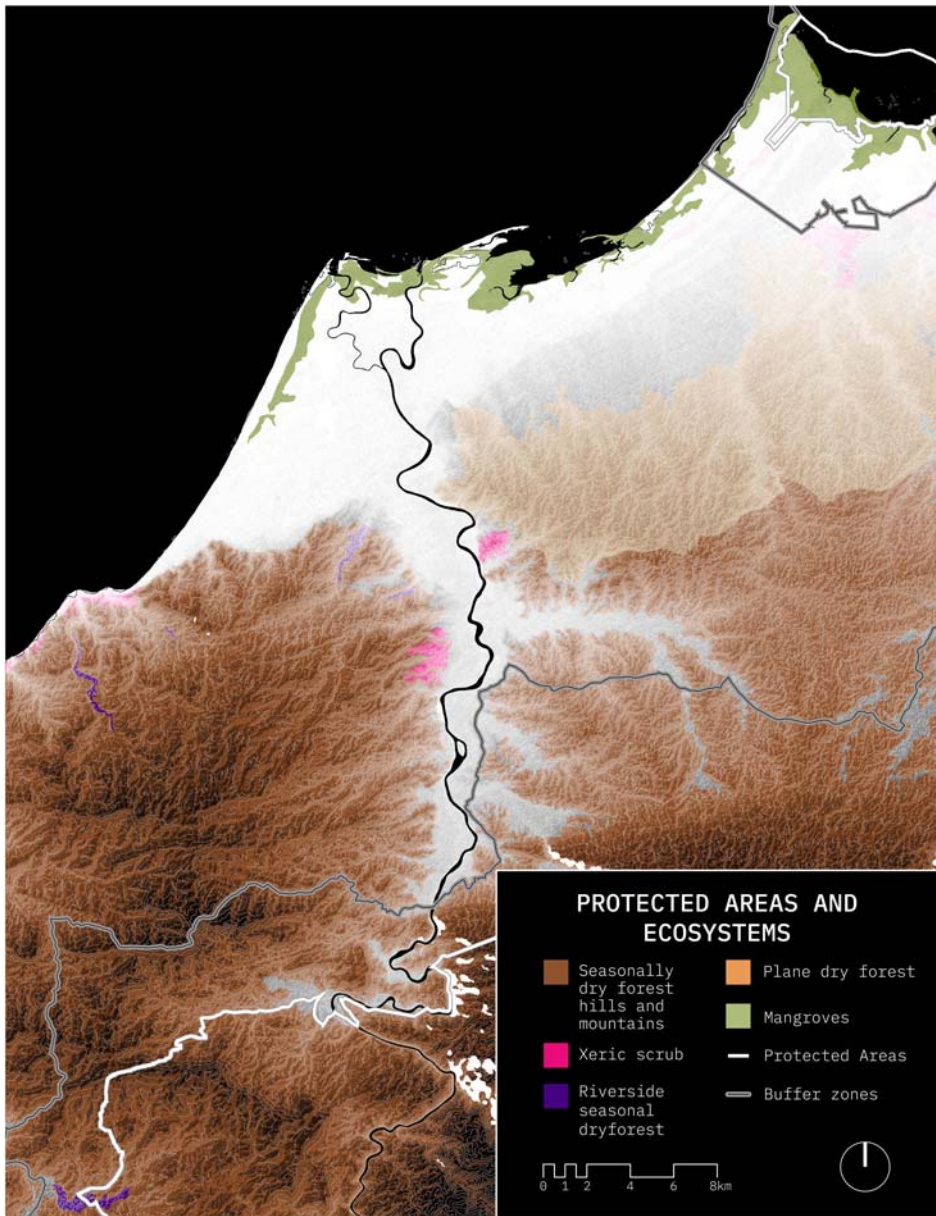


Figure 2. Protected areas and ecosystems of the Tumbes region. The Tumbes basin holds a variety of rich ecosystems, many of them facing extractive activities. Tomateo, C (2020). *Protected Areas and Ecosystems in Tumbes* [Map].

colonial urban planning practices. For example, the map N1 ('Desired Model of the Territory', p. 7) divides the province into extractive practices such as: financial activities, agriculture, exploitation of mines and quarries, and fishing, a simplistic approach for such a rich landscape.

In the appendix, the city offers an interesting geospatial approach to classify population centers, where the most populated settlements (17) are placed along the coast and therefore along the most served area in terms of hard infrastructure not only in Tumbes, but nationally, because of the Panamericana highway, a road that goes through the entire coast (most wealthy areas of the country). While less populated settlements (51) are

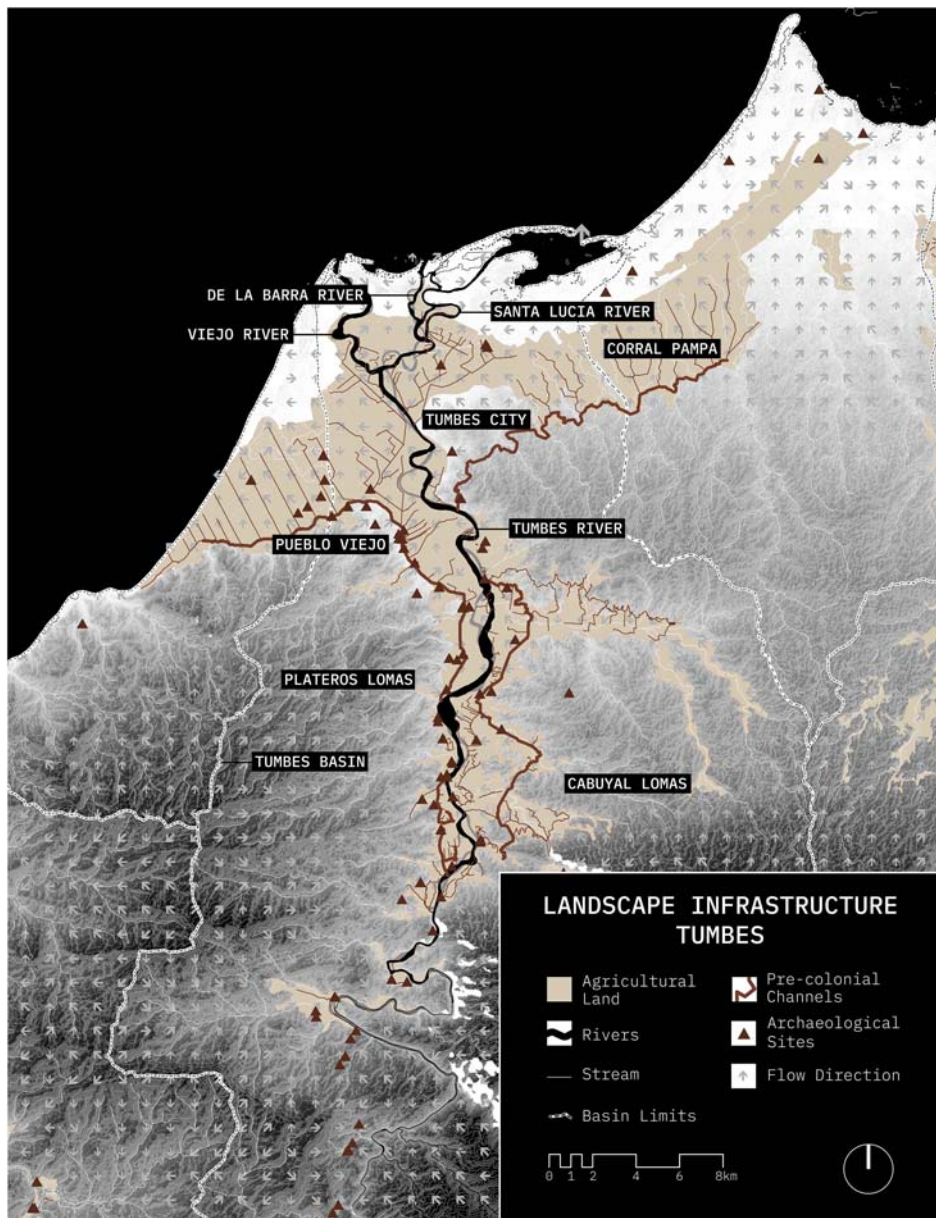


Figure 3. Landscape Infrastructure in the Tumbes Region. Tomateo, C (2020). *Landscape Infrastructure in Tumbes* [Map].

located along the transversal road axis (mostly by unpaved) but hugged by the rich landscape infrastructural features of the territory, although neither landscape or Indigenous infrastructural pieces are recognized in the entire document. The unpaved roads haven't received much investment allocation as the document implies because they easily get affected by heavy rain events and of course another reason (not stated in the document) is that those roads serve small (mostly rural) communities that do not represent an 'asset' for the region (Figure 5).

Regarding risks related to flooding and landslides, the plan shows a special concern about buildings in Tumbes (and this applies in general for the northern coast of Peru), because many are especially vulnerable

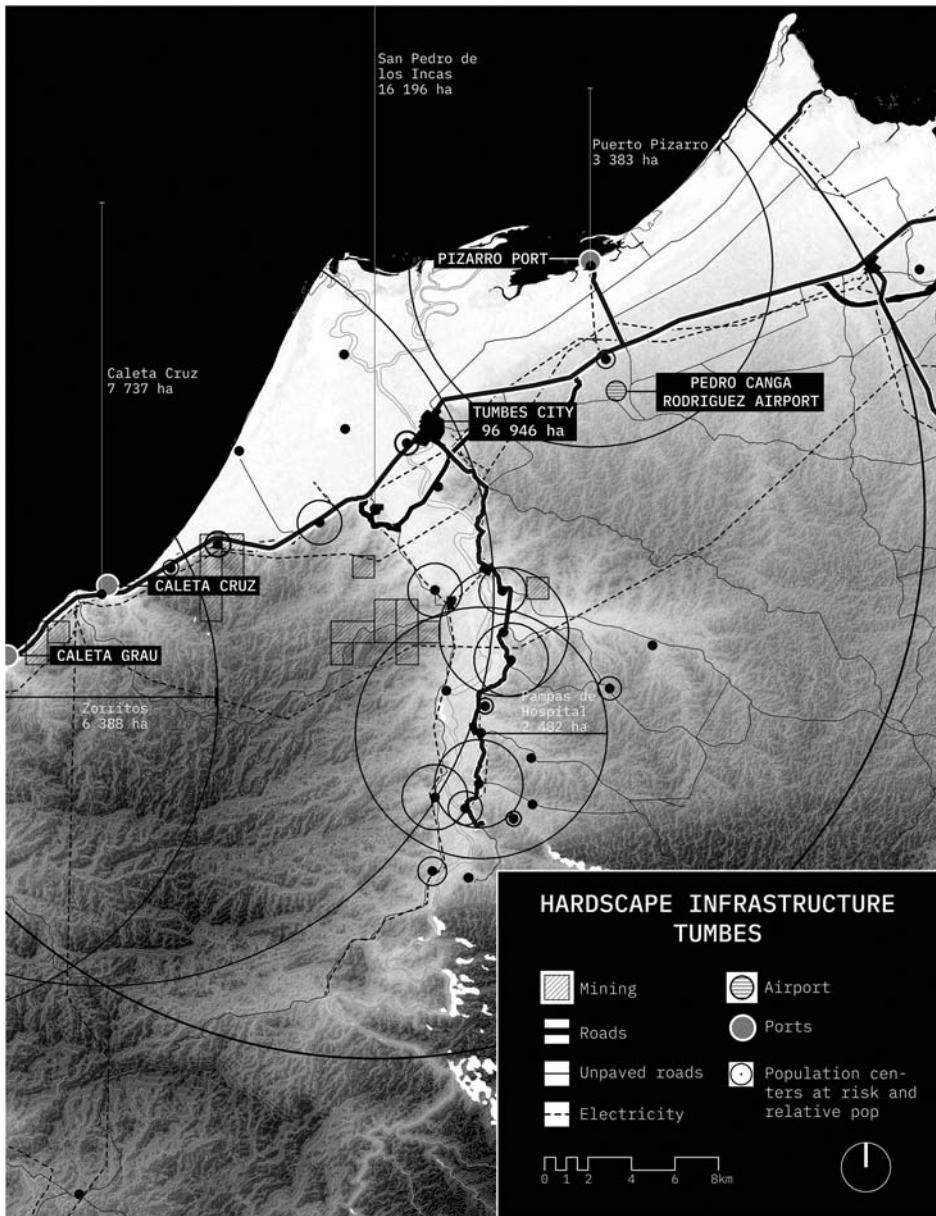


Figure 4. Hardscape Infrastructure in Tumbes region. Tomateo, C (2020). *Hardscape Infrastructure in Tumbes* [Map].

due to building materials such as adobe, vegetal fibers, and mud. In the capital city of the province of Tumbes, Tumbes City, about 50% of housing uses adobe as its main material and in other population centers, the percentage can go up to 80%.

Finally, it is surprising that despite using words such as ‘social vulnerability’, ‘local actors’, ‘concerted project’, ‘environmental capacity’ and others along those lines, the proposed plan fails to recognize on one hand Indigenous culture, people and land, and on the other hand any glimpse of Green/Natural/Nature-Based/Urban Ecological Infrastructure. It is no coincidence though that when talking about the mangroves, the plan considers its ‘richness’ but only in the context of the market for seafood products (extraction), and

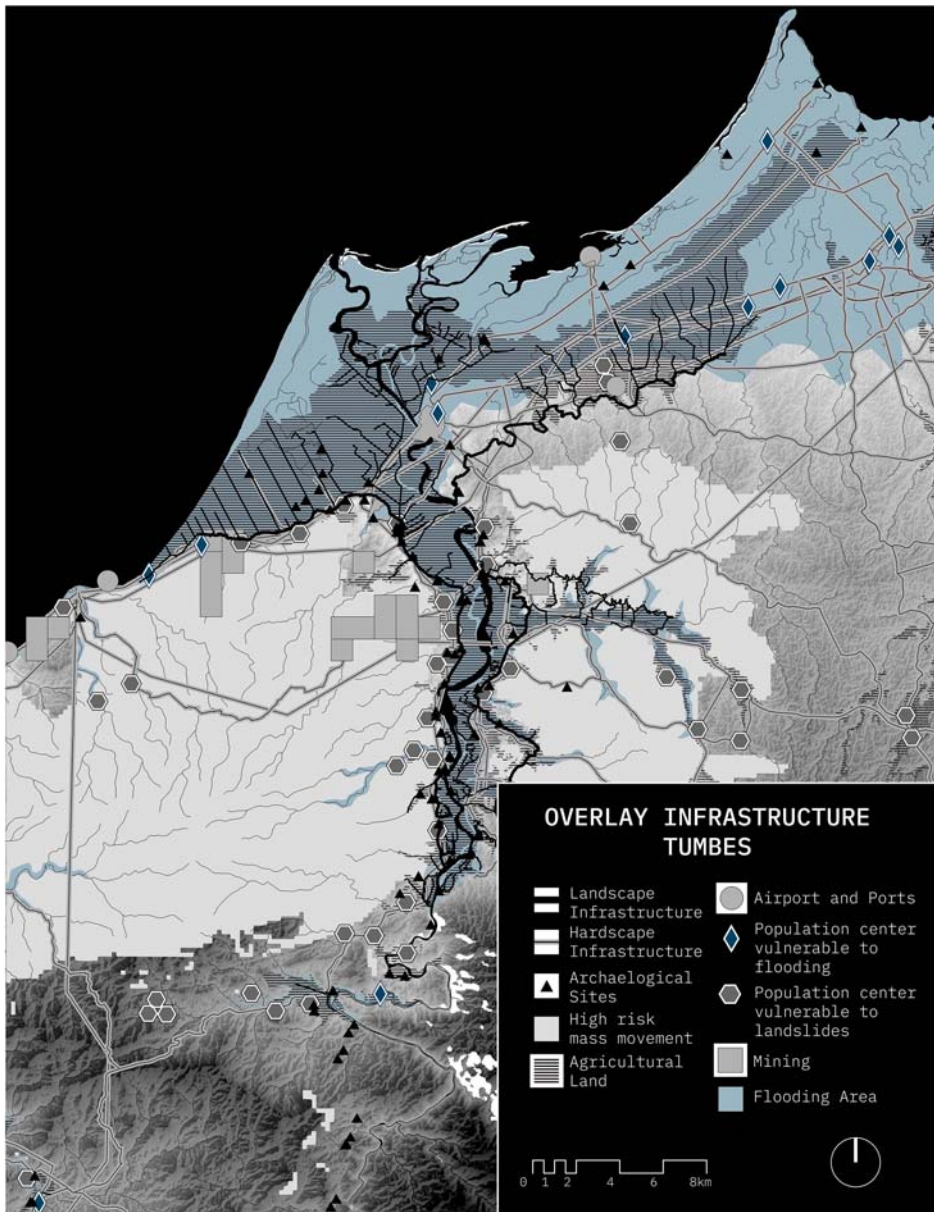


Figure 5. Overlay of landscape infrastructure and hardscape infrastructure in the Tumbes region. Tomateo, C (2020). *Overlay Infrastructure Ecosystems in Tumbes* [Map].

lists the US (47.09%), Spain (28.45%), France (19%) and South Korea (2.47%) as the main export destinations. It is worrying that there is no concern about the vulnerability of ecosystems to proposed development activities, namely pollution and excessive fishing, especially given the ongoing conflicts between extractive industries and native communities.

The Tumbes basin shows how natural protected areas, contested sites, archaeological sites, Indigenous water management infrastructure, ancient agricultural practices, and colonial-driven urban plans relate to one another to affect the qualities of the regional GI network. The question becomes; how would an

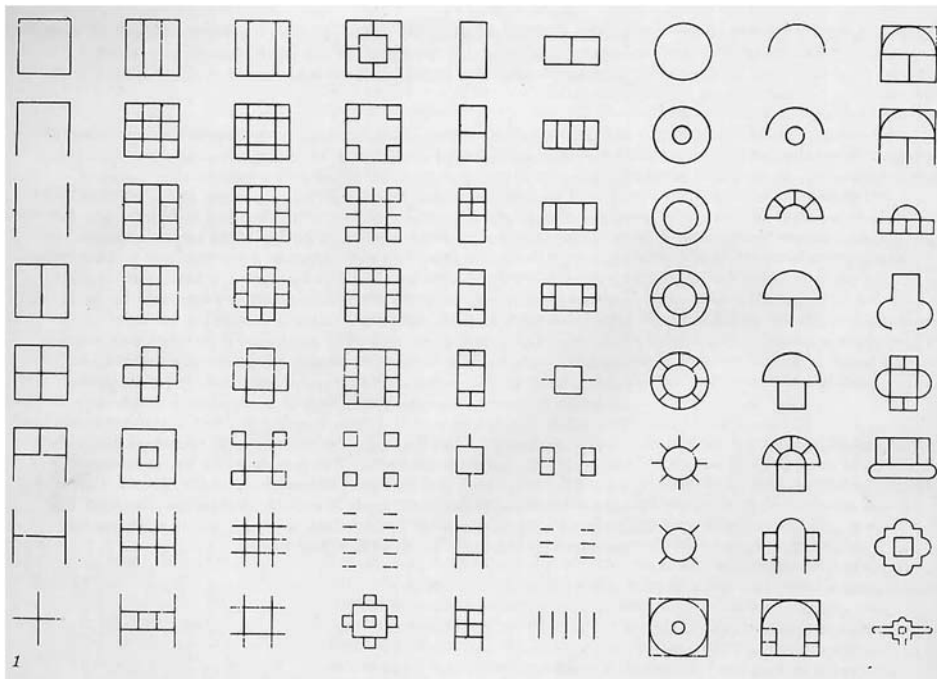


Figure 6. Frontispiece, Building forms, J N L Durand, 1809 from "On Typology" by R. Moneo (1978) Oppositions 13, 22–45

Indigenous and decolonized articulation of GI create an alternative framework for GI planning and policy in the region and beyond? Through decolonizing GI, policies can start to recognize relational conditions beyond performance, and integrate practices that are not only ecological but symbolic and technological as well. This has the potential for radical transformation, able to re-formulate relationships – including the worldviews and assumptions guiding policy decisions – across infrastructural objects and people's relationship with land.

4. Decolonizing GI, Towards an Indigenous typology

Often, science overlooks, or actively disregards ancient knowledge from Indigenous communities. Because it is not part of common scientific discourse, experts fail to understand the lineage of concepts that today we argue to be 'modern' (Deloria Jr, 1991). IK cannot be seen as a resource for information to be deciphered and adopted by any discipline. Within urban planning and design, as we have seen in the case of the Tumbes Basin, we see 'strategies' claiming to see from less powerful positions and in reality, they are just appropriating their vision (Nygren, 1999). Moreover, we must recognize that knowledge is in constant production (Haraway, 1988), Indigeneity then, is not going back to ancestral practices, but to understand their meanings today, not necessarily about undoing, but about transforming the variety of superimposed colonial layers.

Indigenous communities are extremely diverse and in some countries like Peru, where 30% (5.9 million) of the population identifies as Indigenous and 60.2% (13.9 million) as 'mestizo' (mixed race with Indigenous – according to the 2017 census) they are a major demographic and political force. However, the current government manages to prevent their full recognition, restoration, and sovereignty through what Corntassel calls 'politics of distraction' via (1) the implementation of 'rights' to elaborate an illusion of inclusion, (2) 'reconciliation' as a concept that doesn't trace actions back in history because it is understood as forgiveness through a third party (like 'God') and (3) the reclassification of land as an asset to produce resources. The objective of those strategies is to disconnect intrinsic relationships and introduce dualities: private vs. common, nature vs.

culture, and land vs. people (Alfred & Corntassel, 2005; Corntassel, 2012; Cajete, 2000; Deloria Jr, 1991; Pewewardy, 2001). GI is not the exception; clear analogies can be traced in the way the urban planning disciplines conceptualize and standardize GI as stamped on the territory without recognizing its interdependent cultural and political relations beyond ‘functions.’ In fact, in the global south, GI has been used as a strategy to control nature, and by extension to control people (Carse, 2012). As any piece of infrastructure, GI has political implications and it can either be used as a tool for colonialism or for decolonization. We have to ask ourselves, what are the concepts dictating GI urban planning? Whose voices/knowledge are being considered? And, what are its relationships with people and land?

As explained before, the Indigenous concept of ‘landscape’ (for the lack of a better word) differs widely from non-Indigenous perspectives. And in the context of urban planning ‘infrastructure’ seems like an adequate word to carry through the Indigenous land systems concepts into ‘built’ projects, because it implies that can be both rural and urban, multifunctional, with a presence in space and in interaction with people. Still, we cannot aim to find in a colonial language a perfect word for Indigenous concept, but we can choose words strategically to decolonize urban planning practices.

If we treat GI as complex elements in the territory, the concept has the potential to be a vehicle for decolonization *if* we trace back its history and understand its relationship with contemporary urban systems. GI planning could bridge different jurisdictions, democratize processes (bringing a variety of people to the table for decision making), be genuinely multifunctional, and be co-designed. Its intrinsic relationship with natural systems, the flexibility of its definition, and applicability represent a good vehicle and experimental ground to test decolonization practices, if as I show here, its roots can be traced back to Indigenous forms of land relations and governance. GI as a planning concept brings to the table not only issues of property, capital, and control, but, as in the case of Peru, its reformulation (as elements intertwined with people’s lives) opens conversations about classism, racism, gender violence and patriarchy, and considering Peruvian conservatism, this has significant potential. I would like to imagine GI as seeds sprouting from Peruvian Indigenous identities and relations, growing into the future through decolonizing praxis. Here I confront the different layers of colonization by (1) Arguing for the implementation of Indigenous systems of governance, (2) The reclamation of indigenous lands, and (3) Offering a GI typological reading.

Implementing Indigenous systems of governance: Indigenous infrastructure emerged together with a communal apparatus of governance (Tuck, 2009, Vitry, 2001). For example, the ‘ayllu’ was a land-owning social unit composed of several households. The dynamics of the ‘ayllu’ were around agricultural production, each member of the community is assigned to work in the community’s land (communally owned) in exchange of the ‘ayni’ (a form of labor tax). Accordingly, the community supported the individuals in tasks such as house construction and other needs. This illuminates how the creation of combined technologies, landscape management, and coherent systems of governance, Indigenous infrastructure can persist in current conditions, especially if connected to common Indigenous practices like communal land ownership – the only condition through which Indigenous People relate with land. Today, initiatives such as the ‘The Red Deal’ (2019), articulated in a series of digital publications by The Red Nation (NGO) argue for Indigenous liberation through the reclamation of land. By recognizing the ‘struggle for material and structural transformation,’ they raise the fact that landscape practices are not only ecological but symbolic and technological as well, constituting forms of infrastructure. Thus, it is not only a matter of visibility and representation in urban planning, changes in material conditions and relationships are fundamental for deep transformation (Tuck & Yang, 2012). The re-inscription of traditional landscape practices as GI may have positive material consequences for Indigenous communities and landscapes if larger structural issues of political power are addressed because decolonization in a settler colonial context includes not only the repatriation of lands but the acknowledgement of how relationships with land can vary.

The reclamation of Indigenous lands: Land use spatial planning is fundamentally rooted in ‘property discourse’, where the property is considered as such only where use and improvement can be measurable and recognized, perpetuating racist, violent, and colonial claims over territory. This is because colonialism has a particular way of seeing space (ontologically and epistemologically), resulting in specific spatial practices such as ownership and extraction. Indigenous Peoples and Indigenous land is treated as the ‘other’ through

politics of difference and identity, ultimately giving way to dynamics of dispossession requiring the erasure of Indigenous presence and knowledge. Urban planning must be unlearned, its values reformulated, and we must question the way it treats knowledge, analyze its agency, and make power and domination focal points of research for the discipline. We need to recognize the colonial past that shapes today's conceptions to not fall into 'new forms' of colonial oppression (Dunlap, 2020; Porter, 2010; Swyngedouw & Boelens, 2018). 'Thus, abolition is likewise twofold, requiring the repatriation of land and the abolition of property (land and bodies)' (Tuck & Yang, 2012, p. 30)

Colonial property claims, rooted in capital value through land use and extraction, are visible in 'El Bendito,' a small town (500 ha) in the district of Zarumilla in the province of Tumbes, Peru. It is located just at the border of a natural protected area holding mangroves and dry forests on the north coast of the country, not so far from the Peru-Ecuador border. The production value of the mangroves is about 25 million dollars a year due to shrimp and other shellfish extraction. There is a constant conflict between the shrimp companies and the 'El Bendito' community, the former accuses the community of not taking care of the mangroves, while the later argues that the shrimp companies want them out because of businesses interests (extraction and potential touristic development). People in 'El Bendito' state that they are a native community called 'Los Walingos' established in the area long before extraction activities began and living through the natural resources that the mangroves give them. In the face of these challenges, 'Los Walingos' continue to fight to gain the official recognition of 'native community' with the help of the 'Comisión de Pueblos Indígenas, Amazónicos y Afroperuanos, CONAPA' (Indigenous, Amazonian and Afro-Peruvian communities commission) and the 'Comisión de Pueblos Indígenas del Peru, COPIP' (Peruvian Indigenous communities commission) with the ultimate objective of recovering their territorial sovereignty.

'Los Walingos' case' exemplifies ongoing practices within urban planning: extraction, oppression, the inability to understand indivisibility of land and people within the Indigenous cosmo-vision, where there is no such thing as 'private property', meaning that someone has exclusive dominion over the parcel that is one's own without any consideration of how managing that parcel will affect others. For the Indigenous citizens, interventions over the territory were not a way to 'mimic' or 'restore' landscape, they were the landscape. GI, in this case, could for example serve as a vehicle for land reclamation and to restore Indigenous governance practices, new GI interventions can be 'plugged' into the Indigenous landscape forming a strong territorial system. Drawing some parallels with cultural landscapes literature, GI then can be a product of culture driven by decolonization practices.

Shifting GI typologies in GI policy: IK, cannot be transferred to different contexts without cultural immersion, by its nature it is situated knowledge (Whyte, 2013). Because of this situatedness, we cannot aim to produce strict standards for GI. Overall, there is a tendency to standardize GI types such as 'rain gardens', 'bioswales', 'planter boxes,' described by the US Environmental Protection Agency (EPA) as a sort of recipe for GI in cities. Others, such as the Green Surge Project offer an extensive collection of 44 strategies for GI including estuaries, canals, wetlands, shrublands, community and zoological gardens, among others ... but the fact that the list is longer, doesn't make it productive. In both cases, 'typologies' are seen as objectified ecological/utilitarian elements and not as dynamic relational entities. Even though there are clear benefits specifically in terms of implementation of standardized GI strategies, the simplification harms the concept, the design, and its potential. If anything, classification should be something that does not limit the understanding but provides a framework provoking questions and iteratively building more knowledge. As an urban designer, my input here is to encourage the urban disciplines to step back from GI standards and think about them through typological lenses. Classification must provide flexible typologies – along the same lines as Ludeña's classification of Indigenous landscape – '*fundamentally based on the possibility of grouping objects by certain inherent structural similarities*' (Moneo, 1978, p. 24), rather than a spatial diagram or an exemplification of a specific case.

Despite GI being a concept arising from colonial scholarship frameworks, its proposals to transform landscapes show its ancient roots. Through the translation of Indigenous landscape driven concepts, I propose three further policy-relevant interventions to decolonize GI design:

- (1) De-standardization: Proposing standardized prototypes rather than conceptual categories for GI perpetuates rigid single-use infrastructure. For example, bioswales are linear features that retain and infiltrate stormwater, and their designed shape makes them ‘well suited along streets and parking lots’. The social impact of GI is usually approached as analysis of the effect of GI interventions landed in space and references of these prototypes in different neighborhoods across the country. Why don’t we think the other way around? How can we produce GI that by design provides a spatial justice discourse? Why don’t other infrastructure and GI coalesce by design? Some might argue that prototypes are a fundamental part of city planning and implementation, but perhaps a typological classification focused on the nature of GI spaces instead of prototypical examples, can open the concept to different functions, shapes, sizes and comprehensive design. Historically, urban design/architecture not only proposes solutions but more importantly ideals of life.

So, what is a typology? And what is the difference with terms such as ‘prototype’ or ‘model’? Here I will introduce the concept of typology as viewed from the discipline of architecture as it represents the nature of architectural work itself (intrinsic relationships with space) and can be easily translated into GI design. In architecture, objects are described and produced through types, throughout the process, designers bring in the typological elements to deliberately transform them into a single work – with characteristics that go beyond the type, making it particular for the context (Moneo, 1978). Typologies are designed to be transformed, and thus must be supported by policies that reflect the need for ongoing evolution and transformation of infrastructural forms (Grabowski et al., 2017). The type can be confirmed by different particular elements, but the way they interact is what defines their formal structure, thus types can be defined as ‘*frames within which change operates*’ (Moneo, 1978, p. 27) informed by the past and triggering visions of the future.

A typology can be transformed by changing its use, transforming its scale, engaging into formal conversations with other types, and using it in different contexts stemming from all the different possibilities that can come from people’s minds. In contrast, a prototype is the mechanical reproduction of an object/design; it is not meant to change or be altered significantly. Typologies introduce relational connections with forms and elements informing each other constantly, a collection of prototypes thus cannot conform to a typology because they do not recognize the balance of singleness versus shared features intrinsic in the type. If we apply this to GI, typologies (and not prototypes or standards) can start to accommodate fluid scales, intersections with other elements and variations of form within a *framework of change* (Moneo, 1978).

- (2) Scale fluidity: Through a comparison of Ludeña’s classification for the Indigenous landscape with GI typologies, it is easy to identify that while Indigenous reading presents categories without locking interventions into specific sizes or scales, many existing GI prototypes do. Infrastructures by definition need to travel across scales, and because GI is a platform that facilitates flows, scales need to be fluid. By stepping away from traditional classifications of scales ‘local’, ‘neighborhood’, ‘city’, ‘regional’, etc. GI definition should start to recognize scale as a spectrum. It is precisely the interactions in all the ‘intermediate scales’ what makes the system cohesive. Each element in a GI system must play a multi-scalar function or reference other parts of the network (i.e. Ludeña’s evoked landscapes) because, through the systemic threading, the network could be able to accommodate the unexpected.
- (3) Adaptation and translation: How GI can adapt and translate into different territories and cultures by design? As discussed above, GI could be adapted as a concept composed of a comprehensive typological set, flexible enough to accommodate a variety of placed-based Indigenous practices without losing the essence of each type. These new typologies should not include words with scale such as ‘garden’, or extractive language such as ‘harvesting,’ the nomenclature should have the capacity to coalesce interventions, landscapes, and humans into a whole. Here, I propose a conceptual typological set for GI, noting that categories are not exclusive, they can intersect with each other and act at different scales; designs can vary widely and many uses can be attached to them.

GI Lines: elements joining linear features of the landscape or urban environments such as structures along rivers or bioswales, and linear elements used to transport water/soil flows, such as channels.

GI Boxes: elements of varied forms spatially demarcating and inside and at outside. For example, pre-Hispanic ‘*gochas*’, Indian temple water tanks, Copenhagen floodable parks, planter boxes, etc.

GI matrices: textures built over other textures (usually soil, rock, green or pavement). For example, Nazca ‘*puquios*’, permeable pavement, green roofs, Inca terraces, etc.

If GI policy and planning recognizes the need for flexible typological elements to be woven into cohesive wholes across scales, then the policy will support appropriate contextual design practices that can bridge urban and rural areas, and through this, transform GI into a vehicle of decolonization. This is not a cure-all solution and many other battles need to be fought in the search for decolonizing the planning and design of GI in the Peruvian context.

At the time of writing this paper (4 June 2021), Peru is going through one of the most polarized presidential elections of its history. On June 6, Peruvians will decide between right-wing Keiko Fujimori, the daughter of the ex-dictator Alberto Fujimori who is now in jail charged of crimes against human rights, and left-wing Pedro Castillo a teacher from the town of Chota, Cajamarca. Castillo became very popular in the lower classes and Indigenous communities, especially because his plan prioritizes agriculture as the country’s main economic activity – something that immediately relates with Indigenous communities’ identities – He seeks to reconnected people with land, fight against large extractive corporations and give communities agency and ownership over their resources. Castillo often mentions the ‘breeding of water’ (a common practice within Indigenous communities since pre-Inca times, 2500 BC), an unfamiliar term for many. This is a clear example of how Indigenous land systems could be used as drivers of national policies transformations in Peru, both because of their distribution across the territory and the intrinsic relationships with Indigenous People’s identity and worldview.

I have to acknowledge that the task of decolonization is enormous. To decolonize means to question the entire system and all the people that benefit from it. The government’s fully recognizing Indigenous land and nations would require a purposeful transfer of power and questioning of their own territorial claims and jurisdiction – political processes at the root of setting and enacting policies and plans. Opening that door would force them to fundamentally re-formulate the systems of setting goals, defining, and making policies and plans for Green Infrastructure. Without such wholesale or synchronous systemic transformation, urban planning activists fighting for Indigenous rights, need to strategically intervene for decolonization.

5. Final thoughts

By tracing back GI history and its relationships with contemporary urban systems, it has the potential to be a vehicle for decolonization of urban planning and liberation for Indigenous Peoples. GI can be an active concept for the recognition of traditional landscape practices in regional and urban planning bringing with it, material consequences for Indigenous communities and landscapes. It is no coincidence that this research focuses on the definition of Indigenous landscape as a base for other concepts to arise because Indigeneity (sacred history, ceremonial practices, natural cycles, language, social relationships, economic activities) is deeply rooted in place, the landscape is everything.

Decolonizing through GI starts with recognizing the Indigenous ‘struggle for material and structural transformation’ (The Red Nation, 2019) and allow for liberation by confrontation of the colonial system (i.e. reclamation of land) and (re)introducing new forms of governance and new mechanisms on Indigenous terms (i.e. communal ownership of land). By doing so, GI can be the concept for a variety of spatial objects to arise (using de-standardization, scalar fluidity and adaptation and translation concepts) through the lens of Indigeneity, showing the situated opportunities to re-frame urban planning and policy practices.

Acknowledgements

The author thanks Zbigniew Grabowski for assistance in the editing of this paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).
‘No potential competing interest was reported by the authors.’

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