

Ecological infrastructure and risk mitigation in a splintered urban transition



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Executive summary

Peripheral settlements in Lima's district of Pachacámac, named *Centros Poblados Rurales* (CPRs), are at the centre of an ongoing rural-to-urban transition in the context of urban expansion. Despite trends towards urban consolidation, residents are still underserved by infrastructure and services including water, sewerage and transport, and therefore experience health and livelihood risks.

This area is of high ecological value and provides ecosystem services to this desert city. It is home to the Lurín River and seasonal hill ecosystems (*lomas*), ecological infrastructures that help to reduce risk in the CPRs and in the wider city but that are under threat from uncontrolled urban expansion, industrial activity and incoherent land use changes, enabled by a lack of institutional clarity and responsibility.

These risk trends can be countered following a strategy that combines national-level environmental legislation, co-governance at micro and meso scales, and articulated programmes towards eco-recreation and improved sanitation, incorporating grey water re-use. Together, these work towards a vision of the local ecologies as a human-managed resource system that is accessible in an equitable and sustainable way. This requires commitment and sustained effort by multiple actors but is achievable and it would deliver economic and health benefits at multiple scales.

Introduction

Pachacámac, a peripheral district in southern Lima, is undergoing intense and uncertain processes of urban, ecological and land use change. Home to the ecologically rich *lomas* the area provides important ecosystem services, including groundwater recharge and cleaning Lima's air. With climate change already impacting lives and livelihoods, protecting the 'last green lung' of Lima has never been more important.

This report synthesises the existing and evolving risks that arise in the transition from rural life to urban consolidation. Its recommendations aim at improving the protection of the area and at setting a precedent to increase the resilience of Lima's peripheral settlements.

Context and methods

The Development Planning Unit (DPU) has visited Lima for 4 years (including Pachacámac for 2) through action-research projects related to environmental justice and everyday risk. Studies of the CPR Quebrada Verde (QV) in 2015 focussed on water-related risks and livelihood strategies. This year's research

builds on insights from this work, expanding it to include neighbouring CPRs El Guayabo and Picapiedra, and including the study of built and ecological infrastructures.

After desk research into the legislative, planning and historical background, field research was designed to uncover local experiences and perceptions around water, sanitation, ecology and livelihoods. Surveys, transect observations, focus groups and workshops with residents were conducted. To understand the institutional dimension interviews were conducted

Map 1.1. Location of Pachacamac District in Lima



Recommendations

- Strengthen and harmonise governance efforts towards environmental protection and improvement at local level by creating an environmental committee, linked to the metropolitan level and constituting a strategic environmental alliance.
- Encourage ecotourism for livelihoods, as a protective economic 'occupation' of the *lomas* against industrial enclosure and misuse.
- Support and resource ecologically coherent sanitation programmes and use grey water to irrigate public spaces, improving local wellbeing and dissuading further encroachment in public or fragile spaces.
- Legislate at the highest level to recognise, protect and assign responsibilities for the conservation of ecological resources.

(between April and May 2016) with informants from service providers (SEDAPAL), civil servants from the district, metropolitan (MML) and national governments and local agricultural associations. While there were obstacles (discussed below) this research provides a broad insight into complex, multi-scale risk production cycles.

Problems

Residents lack adequate basic services including water, sewerage and transport. It has been a persistent problem for decades. CPRs have developed water infrastructure

Map 1.2. Location of the Study Area



that taps into the local aquifer, making the area habitable, but provision is limited in time and quantity. Water quality is poor as the supply is contaminated both at source (mainly due to infiltration from toilets) and via ageing infrastructures. SEDAPAL has repeatedly delayed service provision to the CPRs and its current plans do not contemplate doing so before 2020.

On a larger scale the lower Lurín River basin has undergone rapid and drastic land use changes, particularly over the last 15 years. This traditionally agricultural area has lost large swathes of farmland to urban development (residential and commercial), altering the basin's hydrology. The remaining farmland is often switched from vegetable to livestock production causing additional pollution.

Climate change is already impacting agriculture and extreme events cause damage to constructions, something identified by residents and farmers.

Causes

Land use is changed without any long-term planning or zoning. CPRs developed territorial land use zoning maps years ago and the district municipality creates 'concerted development plans' regularly, to be approved by the Municipality of Metropolitan Lima (MML). However, according to our local partner CPR residents (possibly including the leaders) are unaware of the zoning maps and thus, ignored. The maps' potential function to enhance local empowerment (as evidenced by QV's successful prevention of cement company UNACEM's wall) is lost. Similarly, interviews with district municipality officials reveal they too are unaware of the

zoning maps, as these were made under the previous administration, exemplifying inadequate institutional continuity.

Meanwhile, recent changes in legislation allow private actors to apply directly to MML for zoning changes for construction or conversion (interview, Hernán Núñez). This weakens ecological infrastructures at a wider scale. The deterioration is left unchecked due to institutional overlap of competencies and responsibilities, both spatial and sectorial (interview, Andrés Alencastre). This creates a vacuum in responsibility for the realisation of socio-ecologically coherent land use, which could prevent risk cycles.

Local health and livelihood risks are strongly linked to the lack of infrastructural connections. While residents use water efficiently, health risks are produced through the contamination of the water source. This is tied to a historical trend in Lima whereby an increasingly liberalised utility has produced unequal service provision, mirroring socio-economic spatial segregation (Fernandez-Maldonado, 2008). Moves towards increased privatisation of SEDAPAL (currently under debate) are likely to exacerbate this situation. SEDAPAL's 2020 scheme anticipates high connection and unit costs relative to residents' current fees, and for economic reasons it will not invest in local waste water reuse (interview, SEDAPAL).

Effects

Human level. As identified by residents, inadequate water and sanitation provision causes health risks. Parasites and diarrhoea are common; consequently, anaemia is high - 80% of children in El Guayabo, far exceeding Peru's average (interview, Dr Strobbe). Most

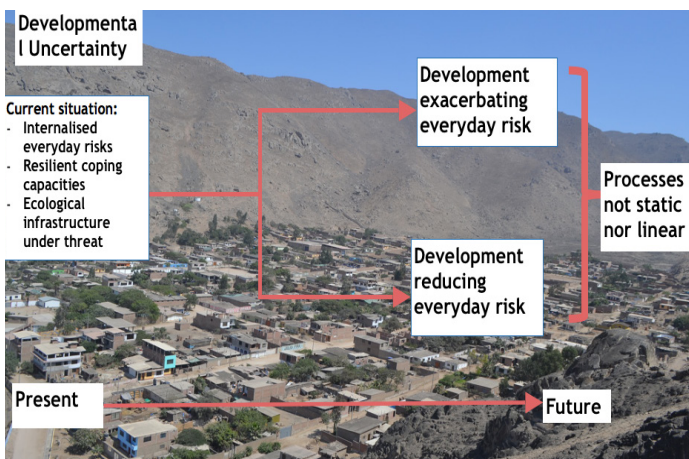
inhabitants get to internalise these health risks as normal, inhibiting action towards the fulfilment of their human right to water and sanitation. Furthermore, district municipality officials identify that inadequate water and sewerage is a major impediment to tourism development, which could otherwise bring significant economic benefits.

Ecological infrastructures. Ecological infrastructures that support wellbeing, including *lomas* and agricultural river valley land, are undermined through significant land use changes. The *lomas*, which provide seasonal green space and grazing as well as better air quality, are inaccessible to CPR residents due to enclosure by cement company UNACEM, which owns the subsoil resource rights of all land up to the river, including the CPRs. Even if UNACEM does not own the land itself, according to residents the company built walls in the mid 1990s to prevent towns from expanding and thus impeding its mining rights.

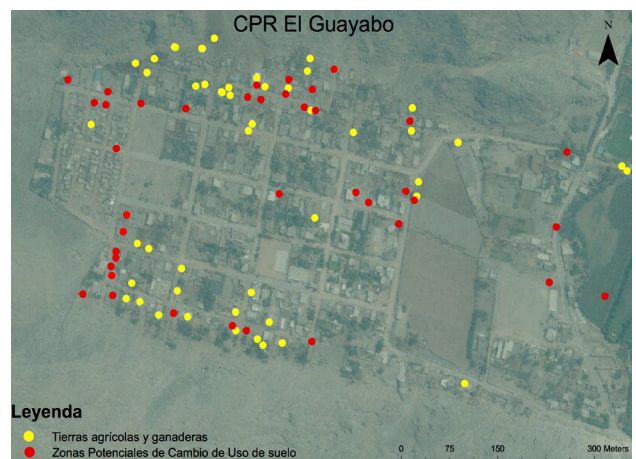
Historically, UNACEM's unregulated industrial activities emitted dust that seriously damaged *lomas* vegetation. Although residents say this is not currently happening, they are concerned it could reoccur if the company expands its activities.

Climate and agriculture. The viability of growing certain crops is decreasing due to climate change (interview, Pedro Arias, Small Farmers Association San Juan de El Guayabo) and extreme events cause widespread damage. Along with rapid, large-scale conversion of agricultural land to urban/commercial, this exacerbates a trend whereby agricultural traditions (and therefore urban food security and the sustainable habitability of the valley) are being lost.

Figure 1. Possible Trajectories



Map 2. Potential Land Use Conflict Areas in CPR El Guayabo



Strategic risk reduction

The proposed strategy encompasses three main areas: environmental accreditation, water and sanitation, and governance; these areas work in tandem towards protecting the ecological infrastructure of the CPR's and of wider Lima: it builds upon funding from the municipality and United Nations Development Programme (UNDP) to develop sanitation systems; on the role of *Red de Lomeros* and on efforts in Congress to raise awareness for the protection of the *lomas* ecosystem, and together act as a basis for a strategic alliance.

A) It is recommended to implement an environmental accreditation as a way to protect settlements from inappropriate industrial exploitation and to clarify institutional responsibilities. This protection status should help to facilitate eco-tourism, which could in turn attract investments in infrastructure provision through increased demand. This strategy builds on the existing legal infrastructure of the *lomas* and on the proposed Law 27308 and Article 313 in particular. The former would include the *lomas* as a 'protected fragile ecosystem' by MINAM and the latter stipulates penal and financial penalties for modifying 'natural' environments.

B) The water strategy involves local workshops on water reuse and recycling, led by UNALM and the municipality, using local expertise on plant-based wastewater treatment, and its setup could be financed by SEDAPAL's water source protection fund (detailed by Miranda, 2016).

Newly available grey water can provide irrigation for parks and farming in the CPRs, reducing vulnerability to climate change. The strategy recommends using this grey water to 'occupy' empty spaces with xerophytes and dry forestry. An important benefit of this strategy is its low cost and minimal maintenance. The re-greening areas in question are earmarked on Map 2. With some funding already in existence for public toilets under the project "*Fomento de la identidad local a través del arte y el turismo en el Centro Poblado Rural de El Guayabo*", the strategy contemplates directing funds to dry toilets, which would reduce groundwater risks. This would help bridge SEDAPAL's provision gap in the period up to 2020.

C) The third axis of the strategy involves clearly defined responsibilities for environmental issues under a common environmental committee between the three CPRs. This would aim to build capacity for eco-tourism and conservation following the existing governance structure of Quebrada Verde. A benefit of this wider governance is a potential holistic approach, which would oversee the mutually dependent strategies around accreditation and water. The environmental committee can work along with UNALM, elaborating a strategic plan for *Lomas* restoration and biodiversity.

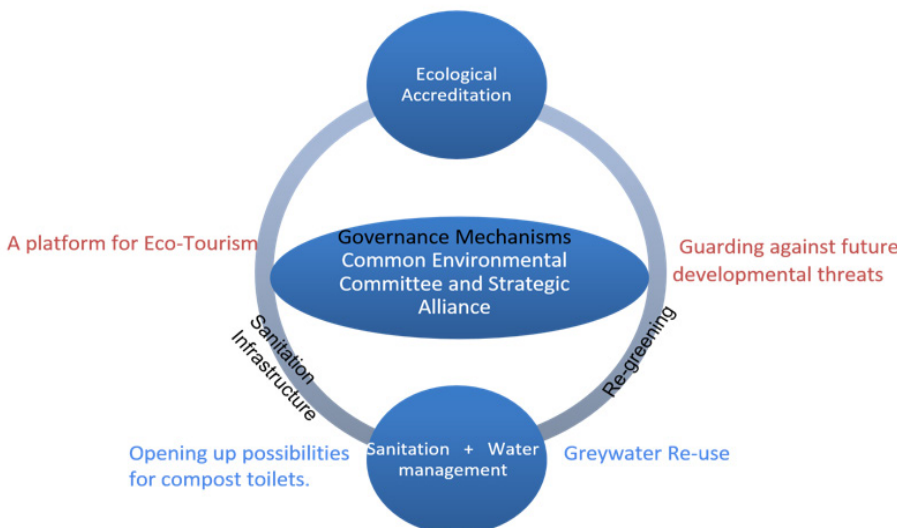
Note: To implement this three-pronged strategy, and particularly the Environmental Committee, there is considerable responsibility for the *Juntas Directivas*, for which the DPU research team couldn't

assess a sense of agency. While the above recommendations were shared with the community, only 10 people participated in the workshops. In particular, the opportunity for representatives of Picapiedra to be part of a common environmental committee is restricted at present as there are in the process of electing new members. Whilst the strategies lack a sense of co-production the research team has sought to offset this by building on existing mechanisms, and the strategies strive to capitalise on the strong will for change found in the interaction with the community.

Action plan for key stakeholders

- Pachacámac Municipality: Support *Juntas Directivas* in the establishment and operation of a joint environmental committee, in order to pursue the abovementioned strategies.
- National government: Enact legislation to protect the *lomas* ecosystems at the national level, via the ministries of the environment and agriculture (MINAM and MINAGRI, respectively)
- Metropolitan Lima (MML): Support local ecotourism/eco-recreation and link existing schemes.
- Pachacámac Municipality with international donor agencies: Evaluate the funding of (public) dry toilets and small-scale grey water treatment systems.
- Pachacámac Municipality, SEDAPAL and Universidad Nacional Agraria La Molina (UNALM): Set up local workshops and explore funding towards small-scale grey water treatment, using local expertise and technical support from UNALM.
- Environmental Committee: Initiate and support a strategic alliance of committed environmentalists (e.g. *Red de Lomeros*) from different sections of society, in collaboration with MML.
- UNALM and Environmental Committee: Implementation of research projects on *lomas*' restoration and biodiversity (could be conducted by UNALM).

Figure 2. Shared Responsibility for an Environmental Regime



Potential obstacles

Potential obstacles include not having enough support for legislation at the national level and opposition from private actors interested in maintaining the status quo in the lomas. In addition, some fiscal limitations may be applicable in funding plant-based wastewater treatment, but it has taken into consideration as much as possible on the channels of funding such as the SEDAPAL water source protection fund and the UNDP GEF Small Grants Program.

Recognition of limitations

Researchers were unable to spend sufficient time co-producing the above strategies with the community. This meant that the team could not ensure local knowledge fully informed its recommendations, and there might be a weak sense of appropriation on the part of residents. Additionally, the research is predominantly based on women's experience; in transect walk surveys only 6 out of 22 people were male, and more than two thirds of the workshop participants were female, in both CPRs. Despite this 'bias' their perception is crucial, as women and children tend to be the most vulnerable to everyday risks. Finally, due in part to the ambiguity in the use of terms such as 'land invasions', the team was unable to get a full picture of the extent of urban expansion, an important task that would require a careful methodology.

Recommendations for further research

The team was unable to interview representatives from the forestry agency SERFOR (part of MINAGRI), which has been a key entity in recognising the *Lomas de Lúcumo* (and other lomas) as a 'fragile ecosystem'. Future research would benefit from this; although MINAM is now the ministry with competency for environmental protection, SERFOR has spearheaded previous efforts. Future work could aim at bringing together representatives from SERFOR (MINAGRI) and SERNANP (MINAM), perhaps with SENAMHI (MINAM) OEFA (MINAM) and ANA (MINAGRI) for a round-table approach to discuss competencies, cooperation, responsibilities, and visions for the future of the lomas and the Lurín basin as a whole. This should include discussion of the 'fragile' ecosystems concept, what it means in terms of access and productive uses, and how to move towards 'resilient' ecosystem management, which also reduces risks to human health and livelihoods.

Furthermore, the strategies would benefit from further involvement by local representatives (in the CPRs, municipality and MML) to assess their desirability and validity from the point of view of all stakeholders. Finally, future research would benefit from the involvement of UALM, considered a key actor providing technical support in the implementation of actions in the areas covered.

Acknowledgments

We extend our gratitude to all the institutional actors, civil society groups and the women, men and children from Pachacámac for their active and valuable participation in this initiative. We would also like to thank our local NGO partners (in alphabetical order), Andres Alencastre Calderon (independent consultant), Carlos Escalante Estrada from the Instituto de Estudios Urbanos- CENCA, Liliana Miranda Sara from Foro Ciudades para la Vida, Rossana Poblet Alegre (independent consultant), Silvia de los Rios from Centro de Investigación, Documentación y Asesoría Poblacional- CIDAP, Carmen Robles Aranade from Servicios Educativos el Agustino- SEA, Linda Zilbert Soto (independent consultant), the interns that joined each group as well as Fre Zeremariam as our DPU tutor, for their valuable contributions, knowledge and guidance.

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