Responding to floods

Disaster relief infrastructure in Piura, Peru

Located on the periphery of the city of Piura in Peru, a series of villages face increasing flooding related to El Niño phenomenon (FEN) and climate change. This causes separation of families, the loss of their homes, crops, livelihoods, and worsens already poor living conditions and access to public services.

The project considers the victim's displacements, main actions and needs related to the catastrophe to propose a series of relief infrastructures that aim to ease the post-disaster processes and improve their regular living conditions during and after the emergency.

The proposed interventions include an emergency shelter for families and their livestock, a resting cabin in the agricultural fields and a series of guidelines for house improvements at the individual scale.

Current emergency management

Emergency	Transition	Recovery- Mitigation
Day 0-3	Day 3 – 1 year	1 – 5 years
Evacuation Isolation Community, host population and local people support	Authorities support Displacement to higher areas Emergency Kits (limited) Individual and common shelters arrangements	Food and tents support from government (1 year) Government housing modules National program Reconstruction with changes
A u t o - c o n s t r u c t i o n		

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CC BY 2.0 Ministerio de Defensa del Peru. Piura, Chato Grande 2017

Seasonal calendar

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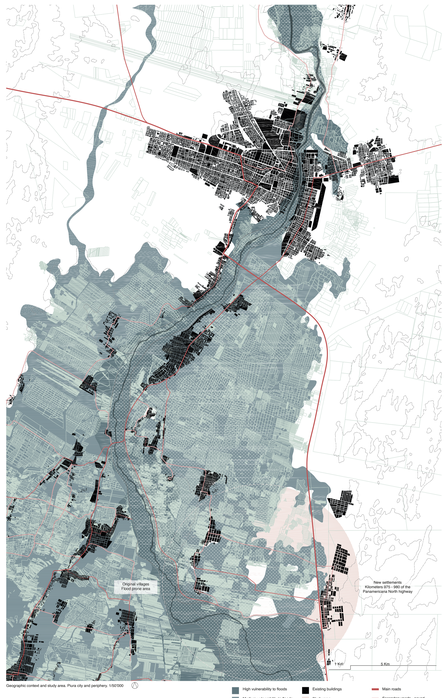
Flood prone area, Chato Grande village, 2022

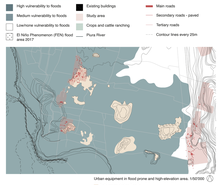
Flood prone area, Chato Chico village, 2022

Auto-construction after the floods, new settlement San Pablo, Piura 2022

High-elevation area, new settlement San Pablo, Piura 2022



Geographic context and study area. Piura city and periphery. 1/10/7500



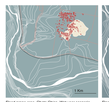
Urban equipment in flood prone and high-elevation area. 1/90/1800

What they do

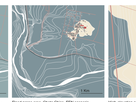
Emergency		Transition
Wet year	FEN year	2 weeks – 1 /10 months later
Most families stay in their homes Valuable belongings are moved to high places Water is partially removed manually	70% of people prepare in advance and go with their animals to the high area 30% of people stay until the critical moment	Most people come back to the flood prone area Some people stay for good in the high area

What they want

Stay in family		Return to their homes and livelihoods
Safe their animals, crops, objects of value (medicines) Avoid mosquitoes and diseases	Water, food and personal hygiene items	Support for reconstruction



Flood prone area, Chato Chico. Wet year scenario. Esc: 1/20/500



Flood prone area, Chato Chico. FEN scenario. Esc: 1/20/500

High-elevation area, Km 980 Panamericana North highway. FEN scenario. Esc: 1/20/500

Vernacular house in Piura, redrawing based on Jorge Burga's drawings

Construction methods

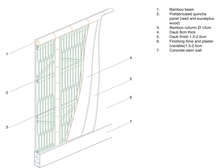
The project is inspired by traditional construction techniques from the region in order to respond to its environment and facilitate access to resources by the population, promoting their implementation in individual houses.

Reinterpreting construction systems and integrating local knowledge and materials, the project allows the intervention of people both in the construction of the building and in its maintenance, creating jobs and generating responsibility and appropriation of the building by the community.

Prefabricated quincha panel: wood frame
© Centro Tierra PUCP

Prefabricated quincha panel: cane (reed) knitting
© Centro Tierra PUCP

Prefabricated quincha panel: Panel joints with nails
© Centro Tierra PUCP

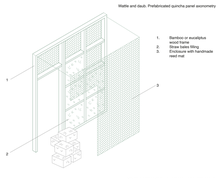


Wattle and daub. Prefabricated quincha panel axonometry

Adobe mix preparation: clay soil, sand, water and vegetable fibers © Centro Tierra PUCP

Adobe mix: clay soil, sand, water and vegetable fibers
© Centro Tierra PUCP

Prefabricated quincha panel: filling with adobe
© Fundación Altiplano

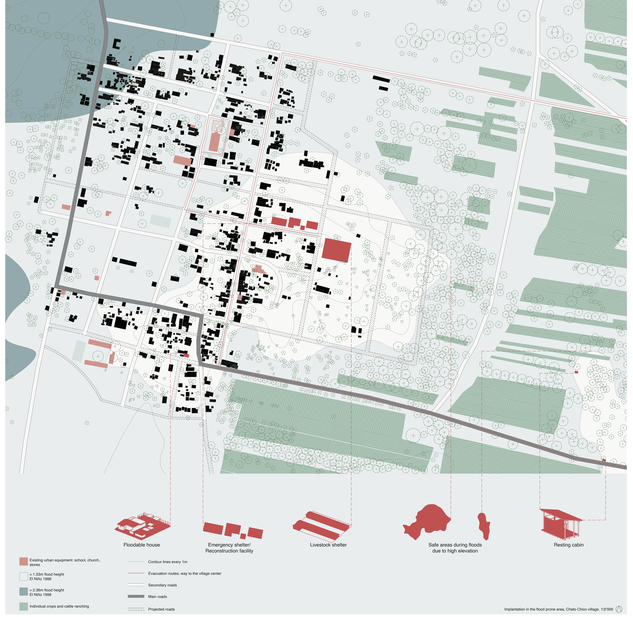


Reinterpretation of dry quincha for removable panels

Quincha panel in gables
© Fundación Altiplano

Adobe roof covering
© Fundación Altiplano

Adobe plastering with long thatch in traditional housing
© Centro Tierra PUCP



Implantation in the flood prone area, Chato Chico village. 1/2/1800

Location, periphery of the city of Piura. 1/20/1500

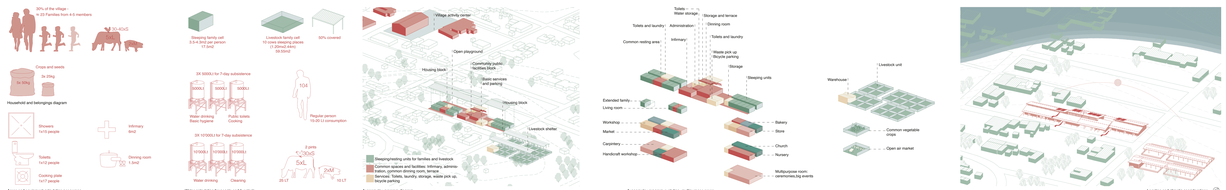
Main Tasks

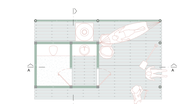
Pre-Emergency	Transition	Post-Emergency
1 /10 months later		1 year
Reinforcement of dike and houses Moving personal belongings to higher zones Packing Moving to high-elevation areas	Water pumping Mud and invasive weeds cleaning Fumigation House reconstruction	Auto-construction

Relief Infrastructure

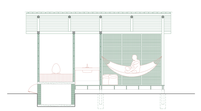
Pre-Emergency	Transition	Post-Emergency
1 /10 months later		1 year
Emergency shelter for 30% of the people and their livestock	Accommodation during reconstruction Feeding cattle in agricultural fields	Community facilities: commerce, culture, sports, education, health Guidance and assistance for auto-construction in individual homes

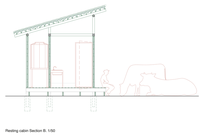
Shelter Floor plan. 1/200




Resting cabin Floor plan. 1/50

Resting cabin axonometry. 1/50


Resting cabin Section A. 1/50


Resting cabin Section B. 1/50

Resting cabin front elevation. 1/50

Resting cabin

Small-scale infrastructure involves a resting module located in the agricultural zone. It is intended to provide rest and basic services, improving the quality of travel between the high-elevation and low-elevation areas, both during an emergency and under normal circumstances.

Individual scale

Different guidelines ranging from simple to more complex solutions were studied, in order to be implemented by families according to their means, improving the infrastructure of their homes in phases.

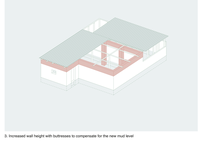
Walls of traditional quincha wall in Chato Chico

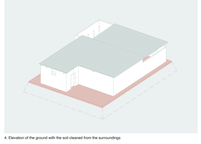
Family crops and animal area, Chato Chico

Animal area in individual house, high area, new settlement San Pablo

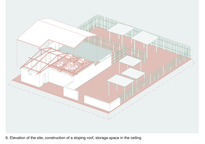
1. Original single-family house in Chato Chico village

2. Platform in the upper part of the house according to main structure

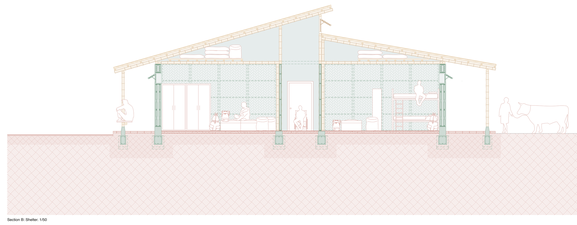

3. Increased wall height with buttresses to compensate for the new mud level


4. Elevation of the ground with the soil cleaned from the surroundings

5. Elevation of the plot area with the soil cleaned from the surroundings


6. Elevation of the site, construction of a sloping roof, storage space in the ceiling

Section A, landscape section. 1/750


Section B: Shelter. 1/50

ROOF
Cement finishing 1x2cm
Adobe layer 1x4cm
Reed mat Ø 2.5cm
Bamboo beams Ø 7cm every 60cm
Interior finishing: mud and plaster 1x1.5cm

INTERMEDIATE FLOOR
Wooden decking 1x5cm
Bamboo beams Ø 7cm every 40cm

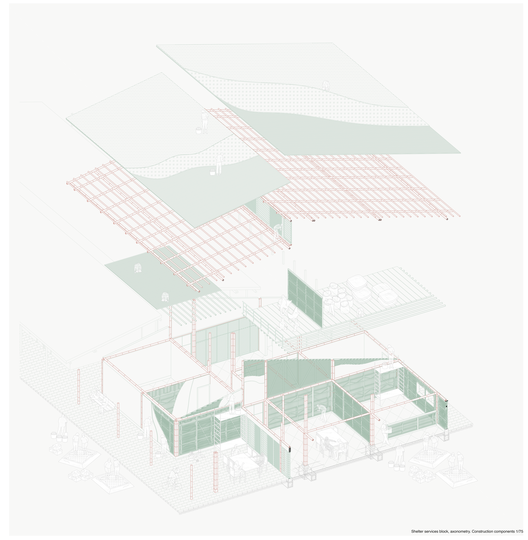
CEILING
Reed mat Ø 1.5 - 2.5cm

WALLS
Wattle and daub: Quincha
Lime/mud mortar 1x1.5cm
Adobe finish 1x2.5cm
Adobe filling (mix of clay soil, sand, water and vegetable fibers)
Reed lattices
Wood frame

STRUCTURE
Bamboo columns and beams Ø 12cm

FLOOR
Interior floor: concrete slab and ceramic floor tiles
Waterproofing membrane
Exterior floor: Natural stone
Gravel and fine sand
Compacted soil

FOUNDATIONS
Strip concrete footing


Shelter services block, axonometry: Construction components 1/75

Open market in livestock shelter: exterior view

Shelter: exterior view. Open playground

Shelter: interior view. Second floor terrace in services block

Church and common dining room, auto-construction in the high area, new settlement San Pablo

Shelter: South elevation. 1/100

Livestock shelter: South elevation. 1/100

Livestock shelter: Section C. 1/100