UNIVERSITÀ DEGLI STUDI FIRENZE

Fog collection as a strategy to sequester carbon in drylands

The experiment of Lomas de Mejia (Peru) 1996-2010

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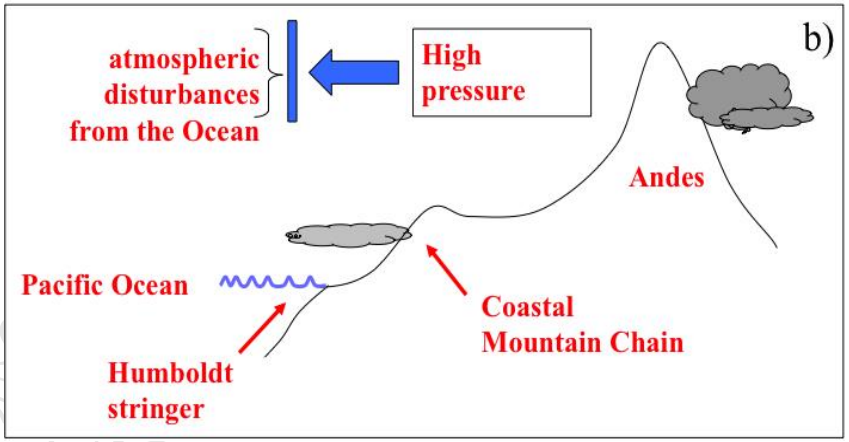
Atacama Desert

- **Hyper Arid region**, where relic forest and resilient ecosystems can be sustained by advection fog.
- In mid-16th century, following the Spanish conquest, an **unprecedented exploitation of natural resources began** (Belknap and Sandweiss, 2014).
- The trees of the low-density woodlands and savannah-like arid ecosystems of the coastal lomas, i.e. the fogscapes were cut for timber and fuelwood production

The pilot project “Fog as a new water resource for a sustainable development of the Peruvian and Chilean Coastal Desert”

- **Experimental reforestation** by using 5 native and exotic tree species
- Some of them **were irrigated with artificially fog-collected water**.
- Later, all the trees were **left to grow relying on fog water** collected by their canopy.
- **Survivorship, height, and collar diameter** were monitored **until 2010**, while final soil carbon and nitrogen stocks were measured in 2010**.**

The pilot project “Fog as a new water resource for a sustainable development of the Peruvian and Chilean Coastal Desert”



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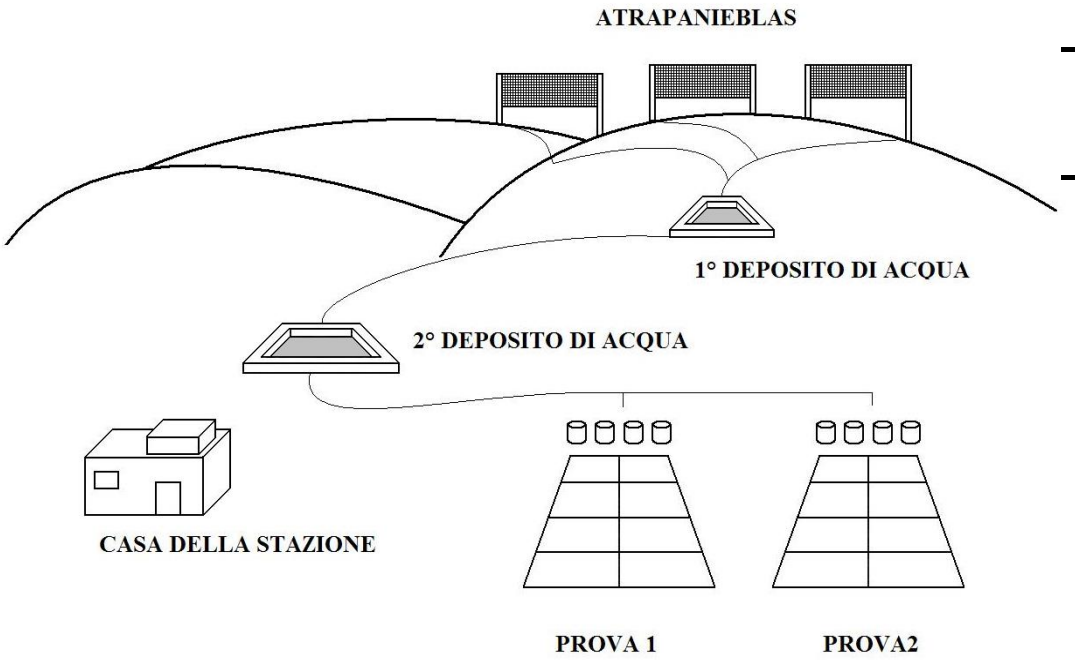

- 20 Large Fog Collectors used for fog collection for irrigation
- 6 cohorts of plant
  - Acacia saligna (AS)
  - Causarina equisetifolia (CE),
  - Parkinsonia aculeata (PA),
  - Prosopis pallida (PP),
  - 2 cohorts of Caesalpinia spinosa (CS). (6 and 12 months old).

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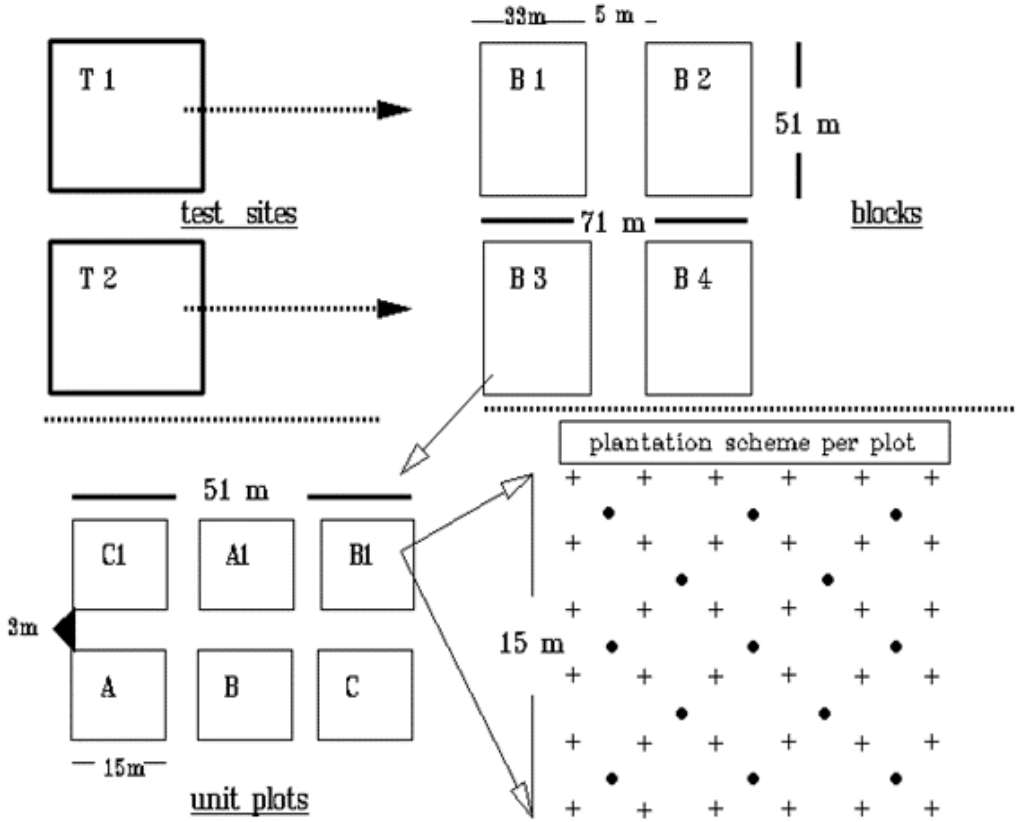

- Two different test sites (here in over T1 and T2) with an altitude difference of about 50 m.
- Four blocks were created and then divided into 6 plots.
- In each plot, 36 trees were planted, at a relative distance of 3 m, in each one of the plots
- 864 Plants (144 x species)

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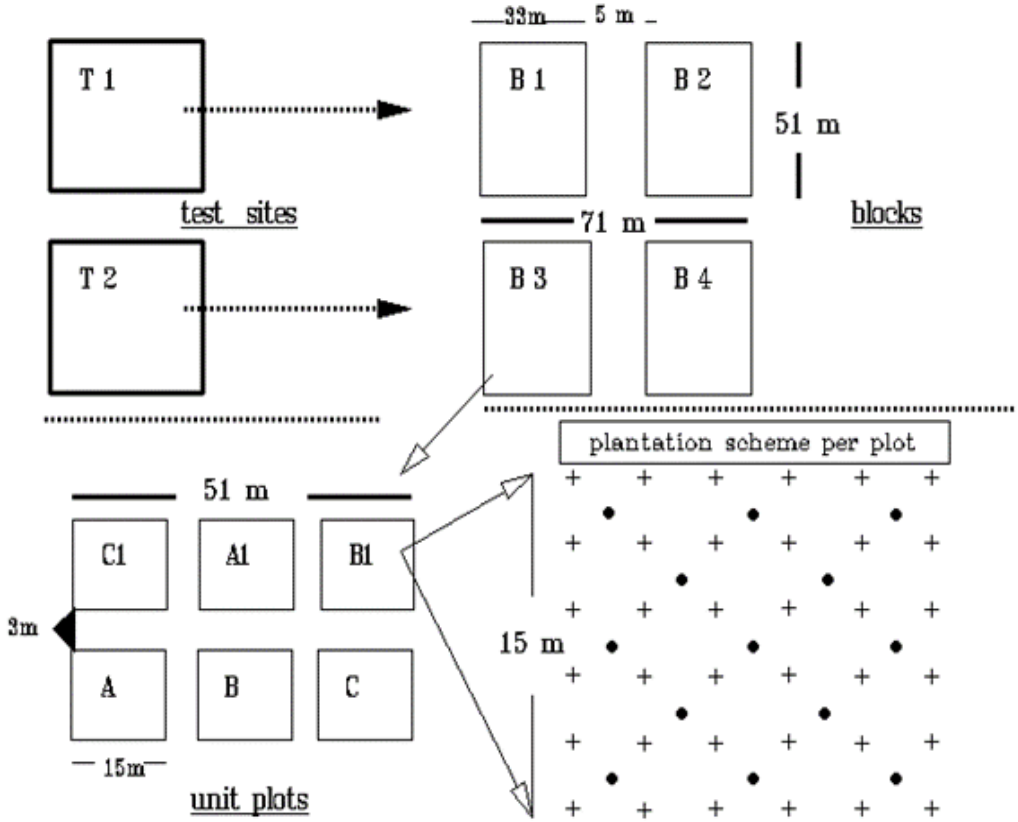
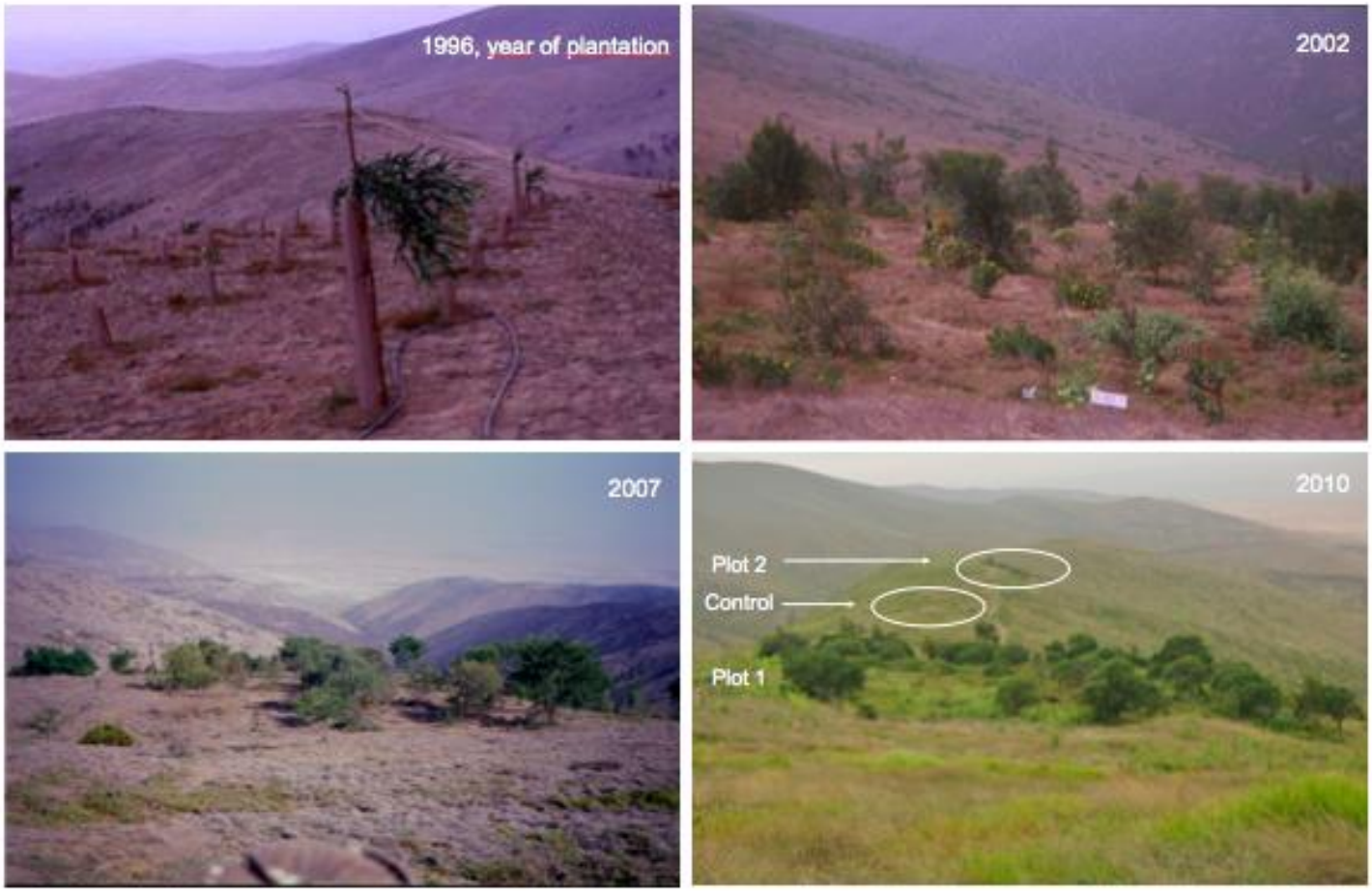


For each cohort (144 plants)

- Treatment a – irrigation for 3 years after planting,
- Treatment a1 – irrigation for 3 years after planting and shelter
- Treatment b – irrigation for 2 years after planting,
- Treatment b1 – irrigation for 2 years after planting and shelter
- Treatment c – no irrigation
- Treatment c1 – no irrigation and with shelter

(36 plant per traeatment)

Results



Results

Table 2. Ratio and number (in parentheses) of alive individuals.

	1996	1997	1999	2002	2007	2010
AS	100% (144)	98% (141)	83% (119)	80% (115)	74% (107)	60% (87)
CE	100% (144)	97% (140)	69% (100)	67% (96)	63% (91)	41% (59)
CS6	100% (144)	99% (143)	89% (128)	82% (118)	81% (117)	75% (108)
CS12	100% (144)	100% (144)	93% (134)	90% (129)	88% (127)	81% (117)
PA	100% (144)	99% (142)	65% (94)	57% (82)	56% (80)	40% (58)
PP	100% (144)	99% (143)	89% (128)	81% (116)	79% (114)	72% (104)

Results

Table 3. Average height and standard deviation (in parentheses) of alive individuals [cm].

	1996	1997	1999	2002	2007	2010
AS	59 (19)	93 (45)	261 (100)	338 (121)	373 (120)	382 (125)
CE	63 (21)	93 (43)	275 (97)	336 (152)	387 (148)	363 (172)
CS6	20 (10)	24 (15)	73 (33)	92 (58)	107 (55)	93 (52)
CS12	35 (11)	41 (27)	87 (35)	101 (55)	120 (51)	91 (50)
PA	33 (11)	41 (23)	99 (58)	112 (70)	160 (73)	131 (66)
PP	37 (12)	47 (23)	88 (33)	70 (34)	101 (34)	84 (40)

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Results

	C in the organic horizon [kg/m^2]	C in the top 10 cm of mineral soil [kg/m^2]	N in the organic horizon [kg/m^2]	N in the top 10 cm of mineral soil [kg/m^2]
T1 1 (n=52)	**1.690 (0.435)**	2.108 (0.052)	0.100 (0.026)	0.202 (0.006)
Control plot (n=52)	**0.390 (0.223)**	1.743 (0.059)	0.021 (0.012)[b]	0.065 (0.030)
T2 (n=52)	**1.178 (0.535)**	2.240 (0.052)	0.065 (0.030)	0.193 (0.005)
Acacia-covered area in plots T1+T2 (n=21)	**6.637 (1.092)**	2.364 (0.089)	0.383 (0.062)[c]	0.213 (0.009)

Results

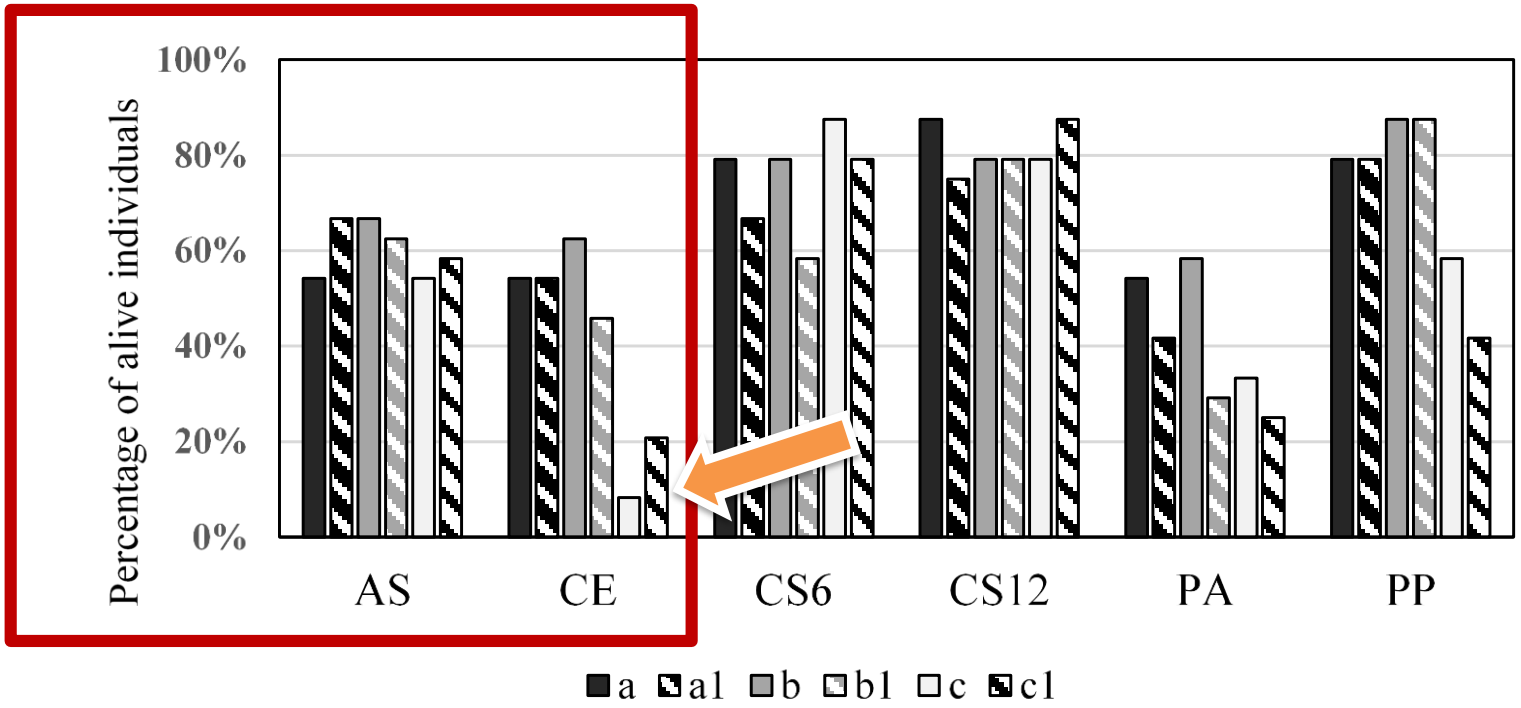

Figure 5. Percentage of alive individuals per treatment in 2010

HIGHLIGHTS

- Advection fog is the sole source of water for many near-the-sea areas worldwide.
- We presented the results of a long-term reforestation project in the Atacama Desert.
- Trees were irrigated with artificially fog-collected water for three years.
- After 15 years from planting, about 65% of trees were still alive and growing.
- Reforestation induced fast and substantial carbon sequestration.

Looking for MSc Candidates

"Spatial and Temporal Analysis of Fog Collection Time Series in Bolivia"