

# SYNTROPIC SETTLEMENTS VS ENTROPIC LANDSCAPES

Experimenting The Multipolar Paradigm  
for the Regeneration of the Fragmented Metropolitan Margin  
[The Bogotá Sabana Case Study]



Politecnico di Milano | Dipartimento di Architettura e Studi Urbani | DASTU  
Dottorato di Ricerca in Progettazione Architettonica e Urbana XXVII Cycle

Doctoral Dissertation of: Felipe Barrera Castellani  
Supervisor: Professor Sergio Crotti | Tutor: Professor Guya Bertelli  
Chair of the Doctoral Program: Pierfranco Galliani



## SYNTROPIC SETTLEMENTS VS ENTROPIC LANDSCAPES

*Experimenting The Multipolar Paradigm  
for the Regeneration of the Fragmented Metropolitan Margin  
[The Bogotá Sabana Case Study]*

Felipe Barrera Castellani

**Politecnico di Milano | Scuola di Architettura e Società**  
**Dipartimento di Architettura e Studi Urbani | DASTU**  
**Dottorato di Ricerca in Progettazione Architettonica e Urbana, PAU**  
XXVII Ciclo

**Felipe Barrera Castellani**

**Thesis coordination**

Sergio Crotti, mentor  
Guya Bertelli, tutor

**POLIMI DASTU**

Pierfranco Galiani, PhD coordinator PAU





**SYNTROPIC SETTLEMENTS VS ENTROPIC LANDSCAPES** 13

Premise (15), Introduction (21).

**INTERRELATIONS AND STABILITY [FORMATION]** 29

Interrelation: Conceptualization and Relation to the Discipline (31), Interrelation and Human Settlements (35), *Formation of Settlements* (35), *Geomorphology and Settlements* (37), *Stability of Significant Places in Settlements* (43), Limits of Interrelation (47), *Colonization* (49), *Macrocephaly* (55), Conclusions (59).

**SYNTROPIC VS ENTROPIC [DEFORMATION]** 63

Entropy: Conceptualization and Relation to the Discipline (65), *Entropic processes in Settlements* (73), *Fragmented Edges and Margins* (79), *Entropic processes in Landscapes* (83), Global Intentions / Local Contradictions (85), *Modern Strategy: Limits and Potential of the Plan Piloto* (87), *Infrastructure from Relation to Connection* (90), Local Intentions / Global Contradictions (99), *Disorganization of Void* (99), *the Rise of Walls: Gated Communities / Gated Slums* (105), *Can Less generate More?* (109), *Open Composition* (119), Conclusions (129).

**NET PHENOMENON AND  
NODE STRATEGY [TRANSFORMATION]** 131

Net Phenomenon: Conceptualization and Relation to the Discipline (133), Nodal entities in Historicized Models of the 20<sup>th</sup> Century (145), Conclusions and Definition of a Node Strategy (158).

**CONCLUSIONS AND POSSIBLE APPLICATIONS** 161

---

**APPLICATION OF THE MULTIPOLAR PARADIGM  
THROUGH THE NODE STRATEGY**

**167**

Design Experimentation (169), Sabana Systems (183),  
Intersections between Systems (191), North System: the Salt  
Route (195), *Territorial Interpretation: the North System* (196), Territorial  
Context (200), Multiple Ambit Identification (214), *Node\_1* (246),  
*Node\_2* (254), *Node\_3* (260), *Node\_4* (266), *Node\_5* (272).

**BIBLIOGRAPHY**

**287**

**ANNEXES**

**299**

Bogota Historical Urban Development, 1772-2011 (301), Plan  
Piloto for Bogota by Le Corbusier, 1951 (347), Plan de  
Ordenamiento Territorial, Secretaria de Planeacion (397), Key  
Words (413), *Interrelational Space* (414), *Form* (415), *Syntropy* (416),  
*Disorder* (417), *Quality* (418), *Entropy* (419).

**KEY WORDS INDEX**

**421**

*Index\_1* (422), *Index\_2* (424).





## ANNEXES

Bogota Historical Urban Development, 1772-2011 (301), Plan Piloto for Bogota by Le Corbusier, 1951 (347), Plan de Ordenamiento Territorial, Secretaria de Planeacion (397), Key Words (413), *Interrelational Space* (414), *Form* (415), *Syntropy* (416), *Disorder* (417), *Quality* (418), *Entropy* (419).

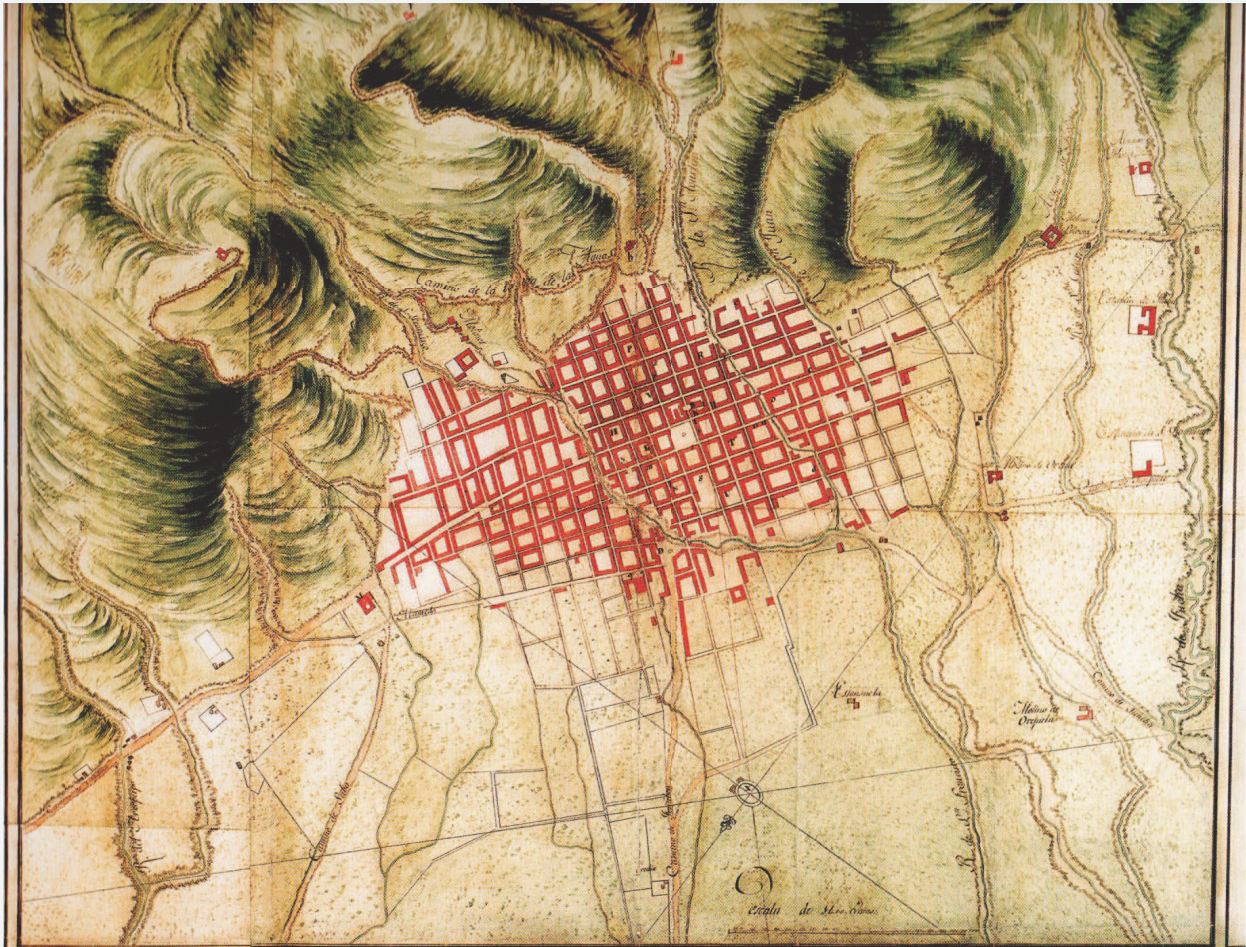


**Bogota Historical Urban Development, 1772-2011)**

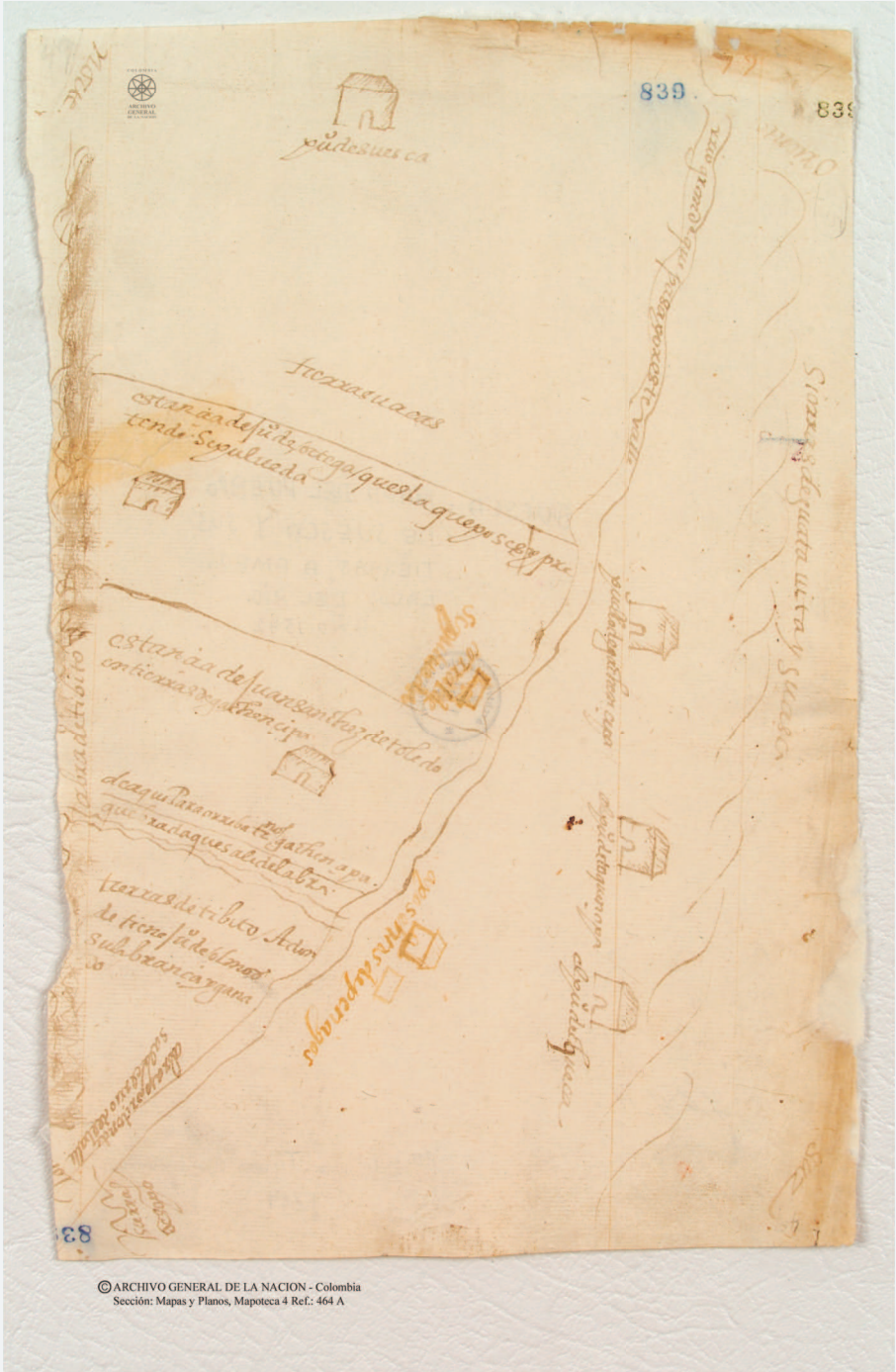


Panoramic view of Santa Fe de Bogota by Joseph Aparicio Morata, 1772

Source: Archivo General de la Nacion, Colombia



Plan of Santa Fe de Bogota by Domingo Esquiaqui, 1791  
Source: private collection



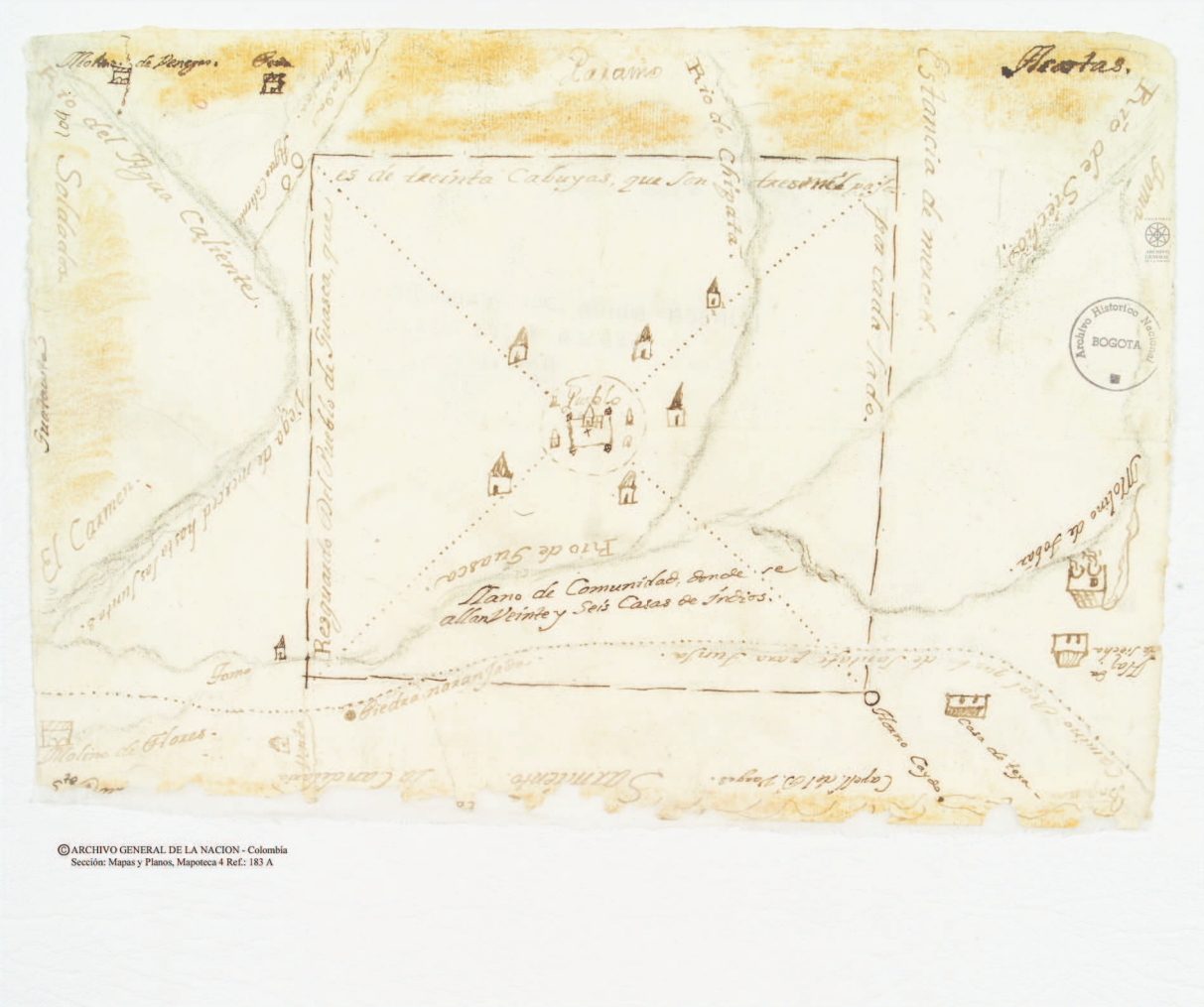
© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 4 Ref: 464 A

Map of Guatavita and Suesca, Sabana de Bogota, 1592  
Source: Archivo General de la Nacion, Colombia



© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 4 Ref.: 34 A

Map of Pueblo de Bogota and surrounding villages  
Source: Archivo General de la Nacion, Colombia



© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 4 Ref: 183 A

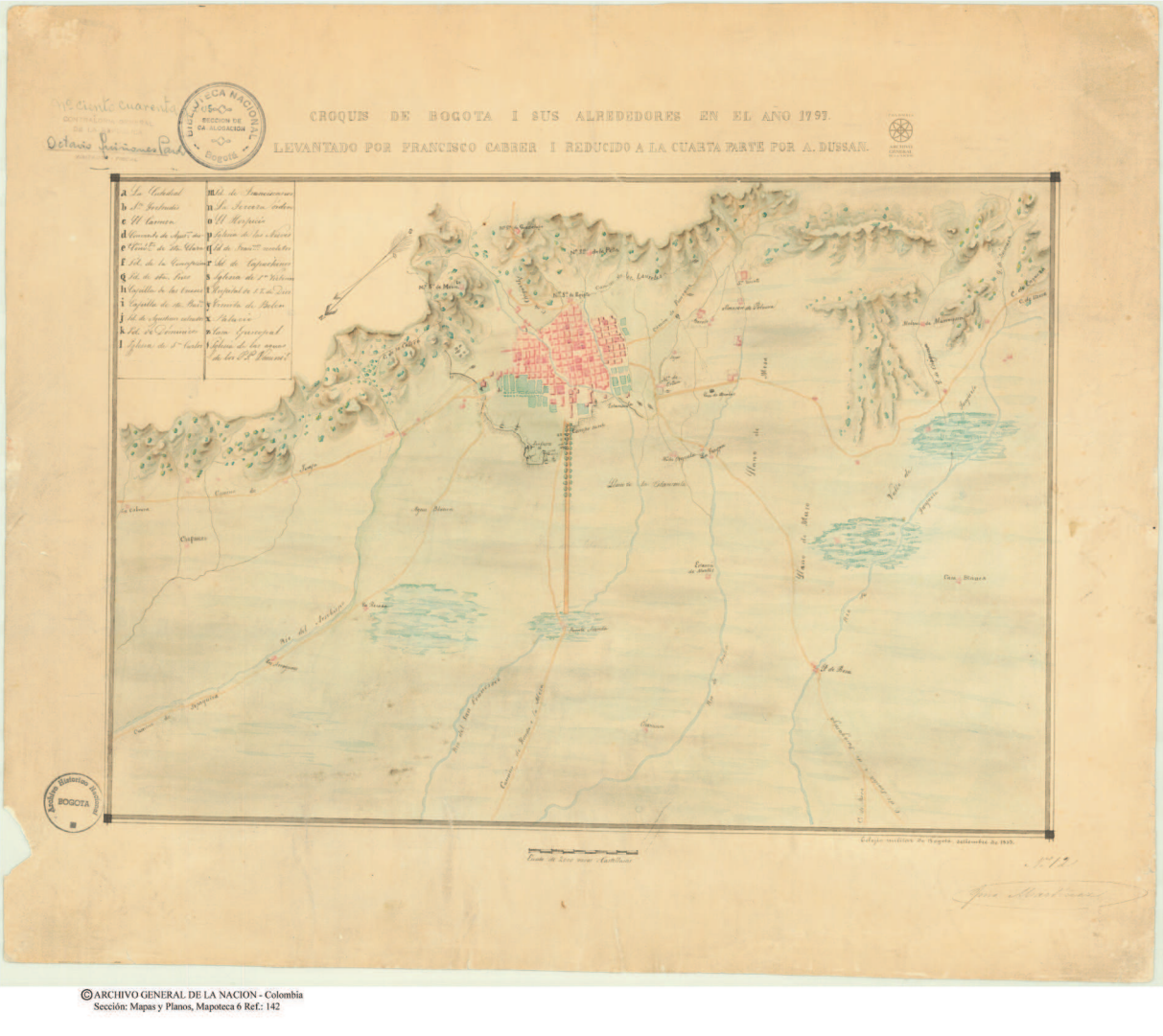
Map of the center of Guasca, Sabana de Bogota, XVIII century  
Source: Archivo General de la Nacion, Colombia





© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 4 Ref.: 138 A

Map of Choconta, Sabana de Bogota, XVIII century  
Source: Archivo General de la Nacion, Colombia

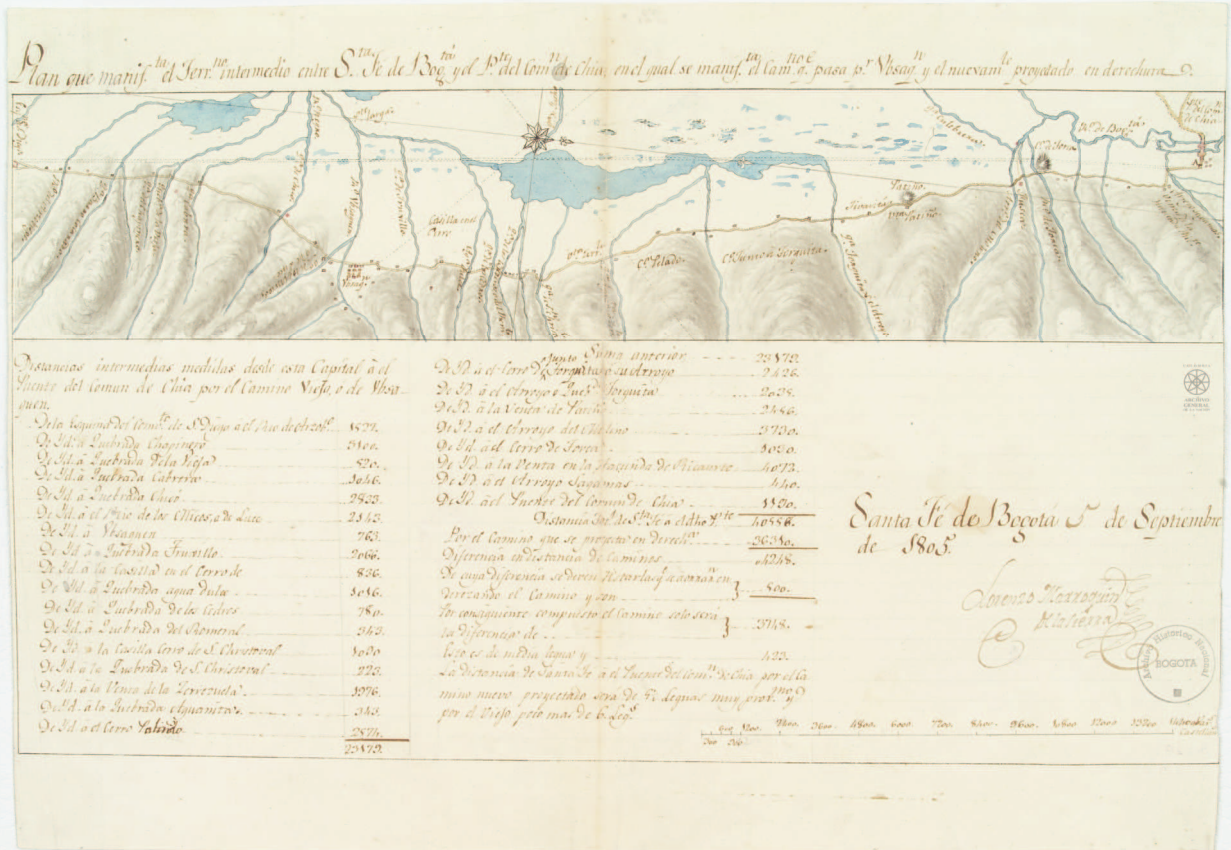


Map of Santafe de Bogota and surrounding by Carlos Francisco Cabrer, copy by A. Dussan, 1797  
Source: Archivo General de la Nacion, Colombia

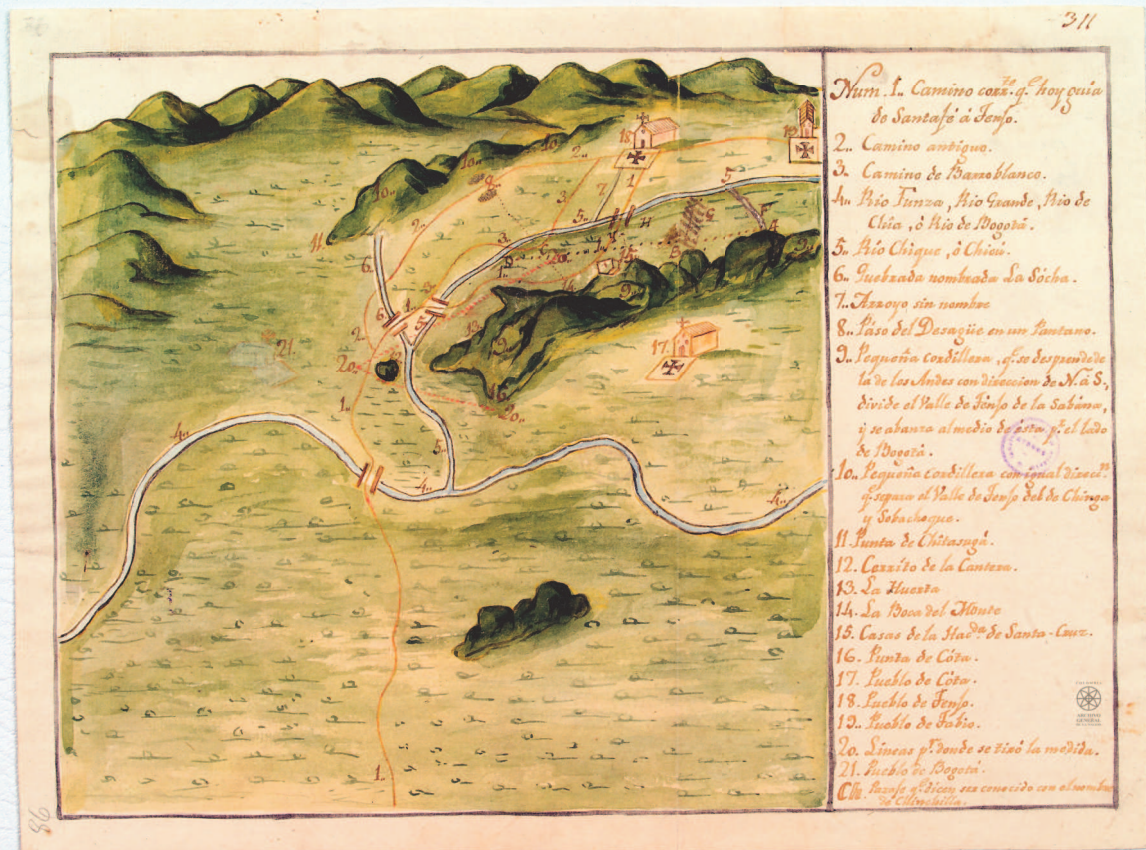


© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 1 Ref: 85

General map of Sabana de Bogota, XIX century  
Source: Archivo General de la Nación, Colombia

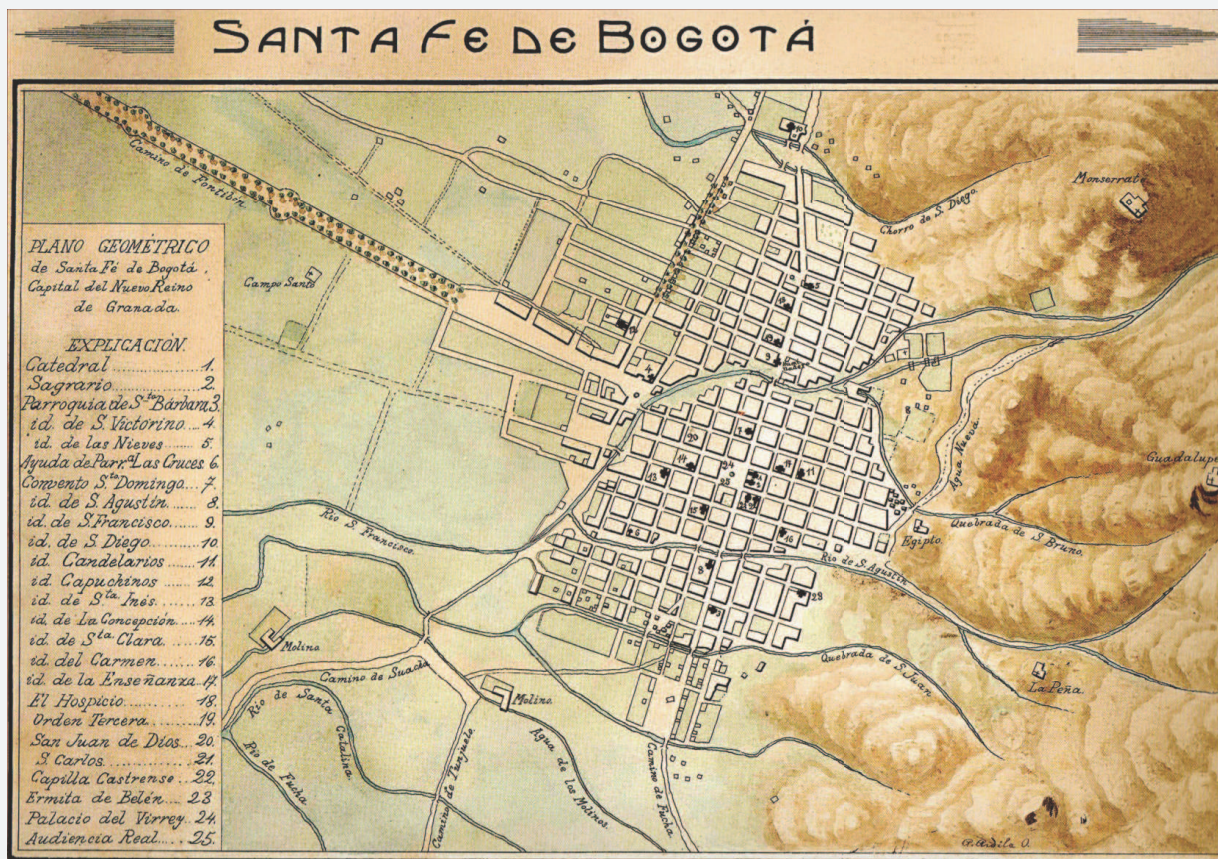


Map of Santafe de Bogota and surrounding areas, 1805  
Source: Archivo General de la Nacion, Colombia

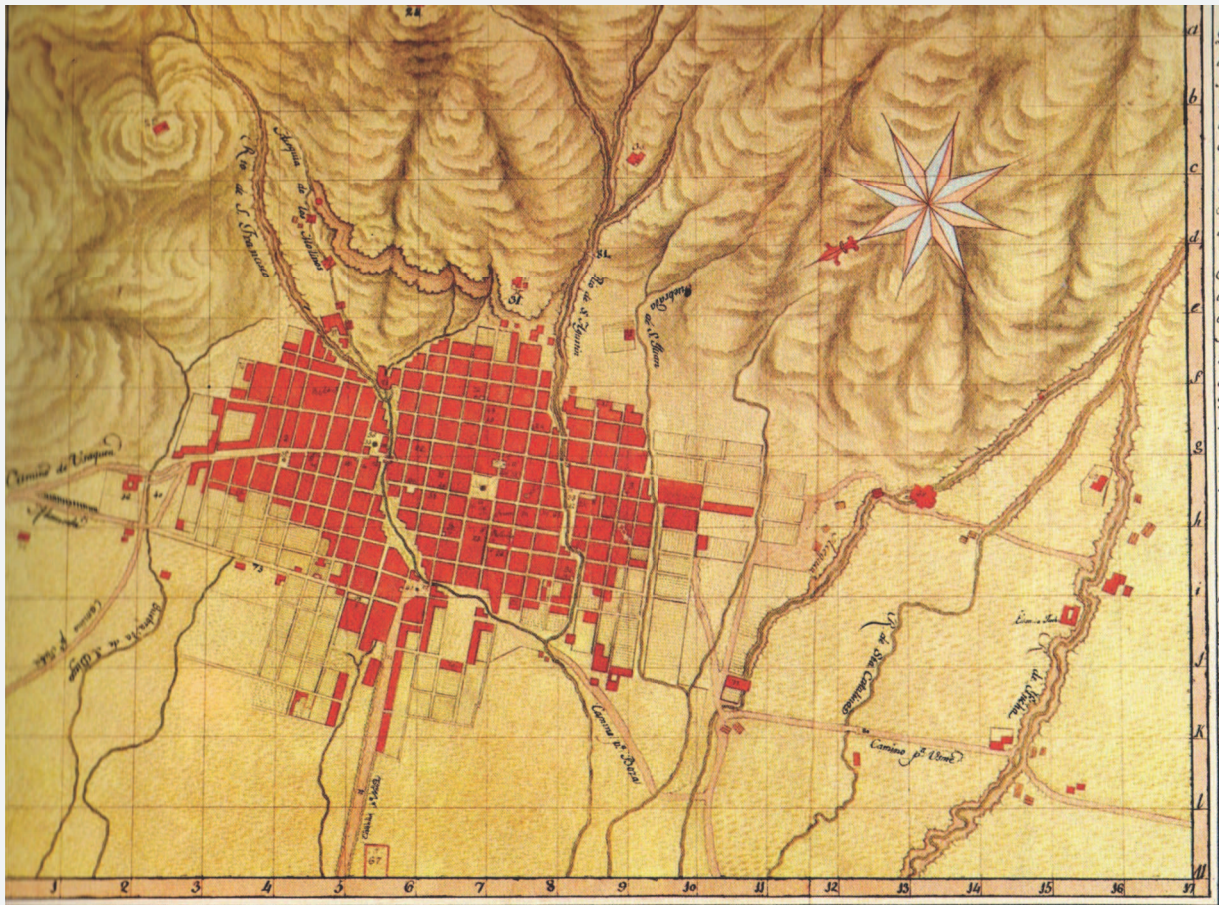


© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección: Mapas y Planos, Mapoteca 4 Ref: 473 A

Map of Tenjo, Cota and Tabio, Sabana de Bogota, 1807  
Source: Archivo General de la Nacion, Colombia



Map of Santafe de Bogota by Vicente Talledo y Rivera, 1810 (copy of 1921)  
Source: Museo de la Independencia



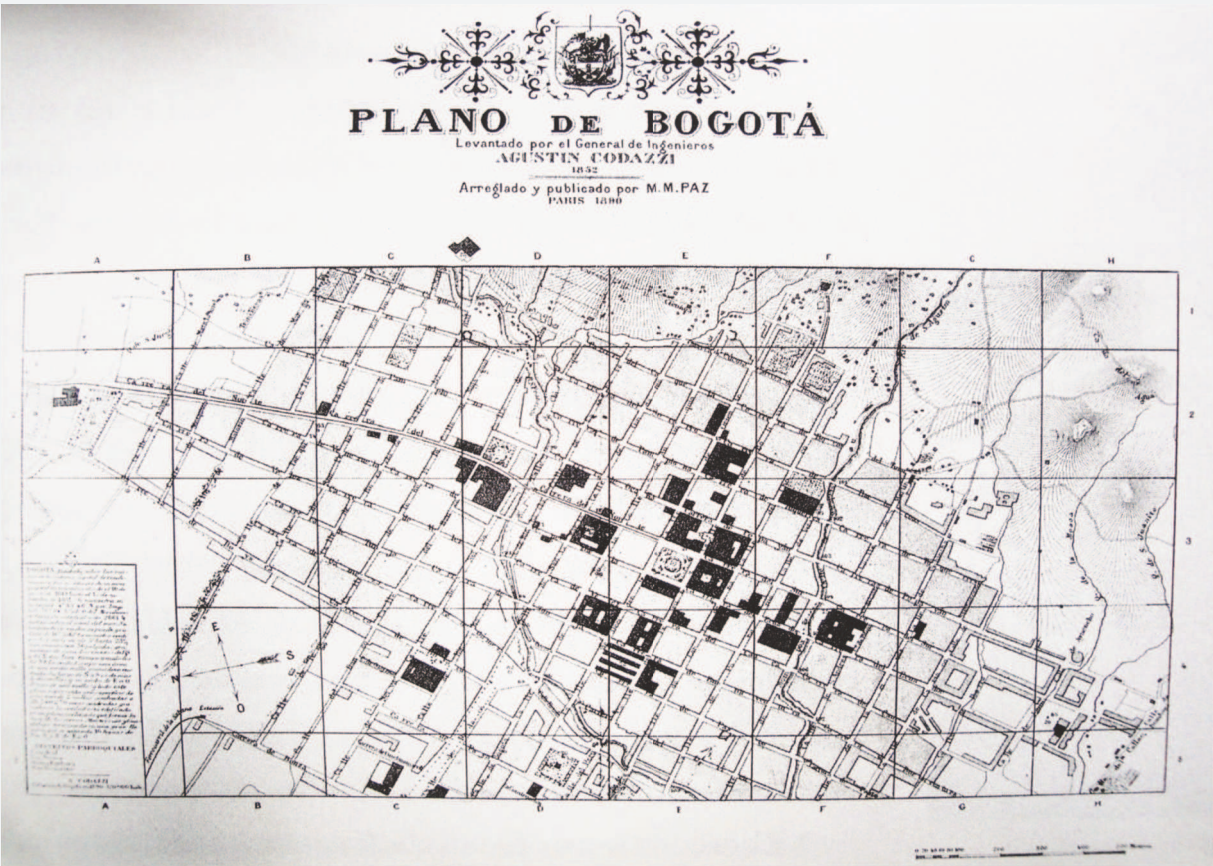
Map of Santa Fe de Bogota by Domingo Esquiaqui, 1816  
Source: Servicio Geografico del Ejercito



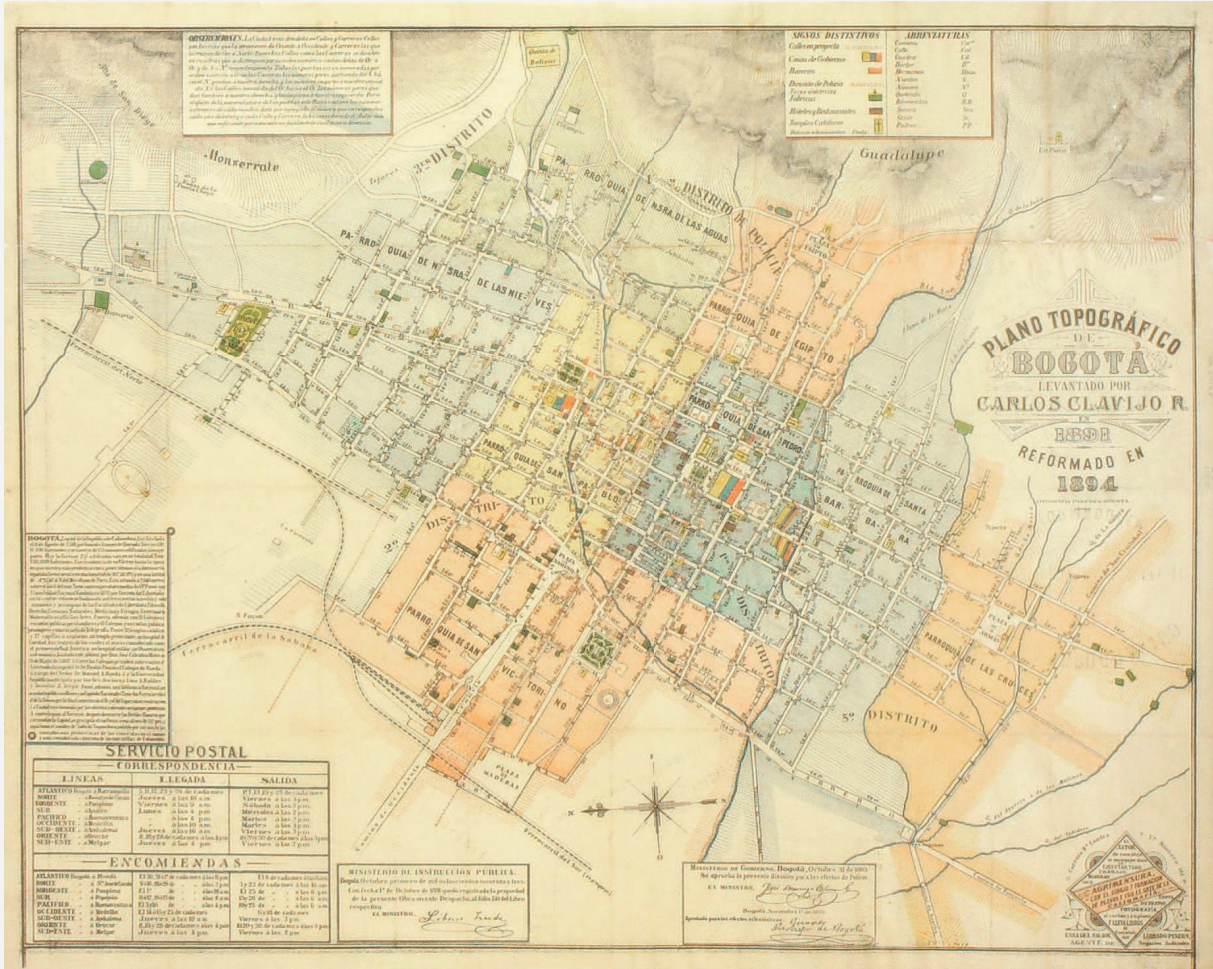




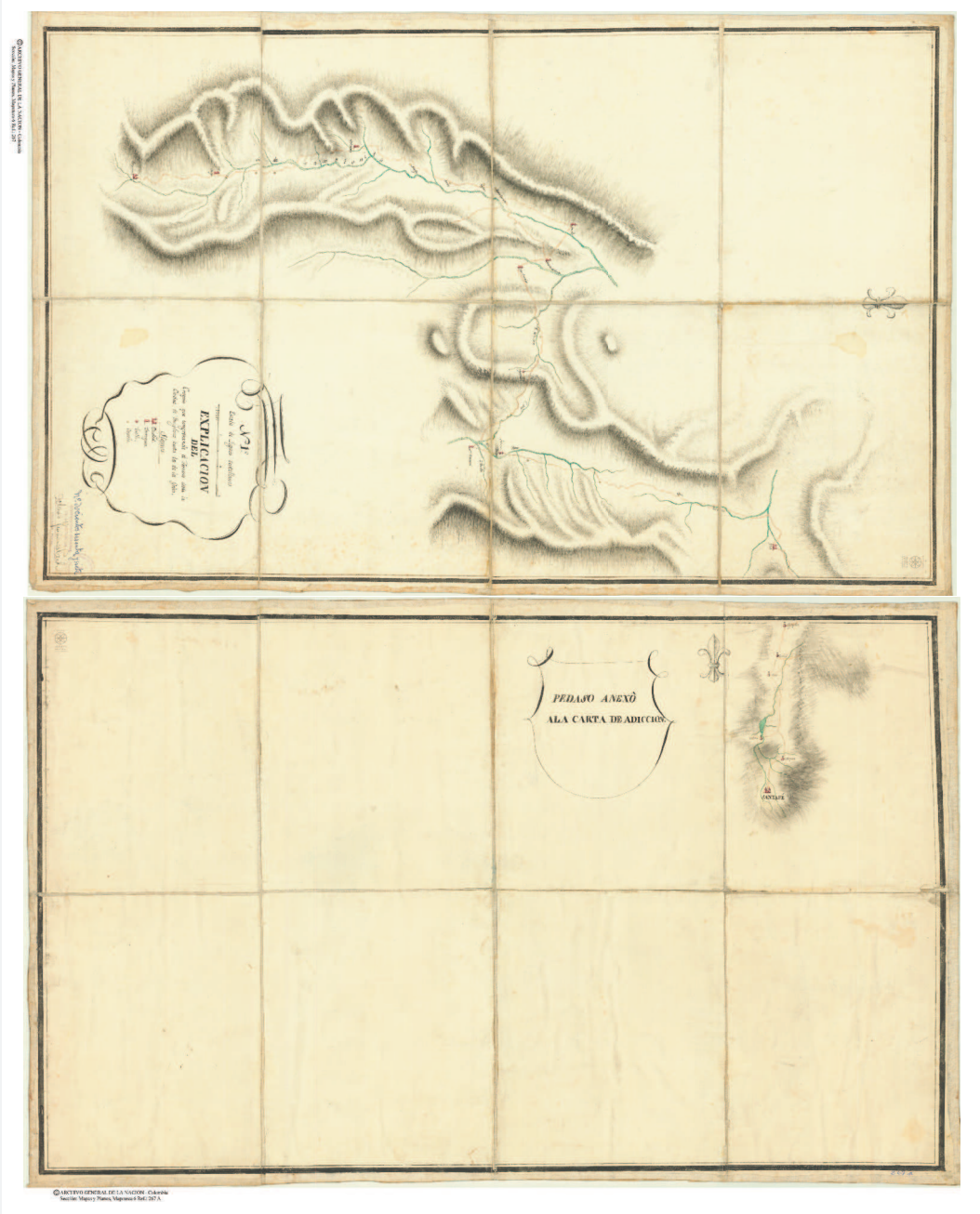
Topographic map of Bogotá, 1848  
Source: Museo de Bogotá



Map of Bogota by Manuel Maria Paz, 1890  
Source: Museo de la Independencia



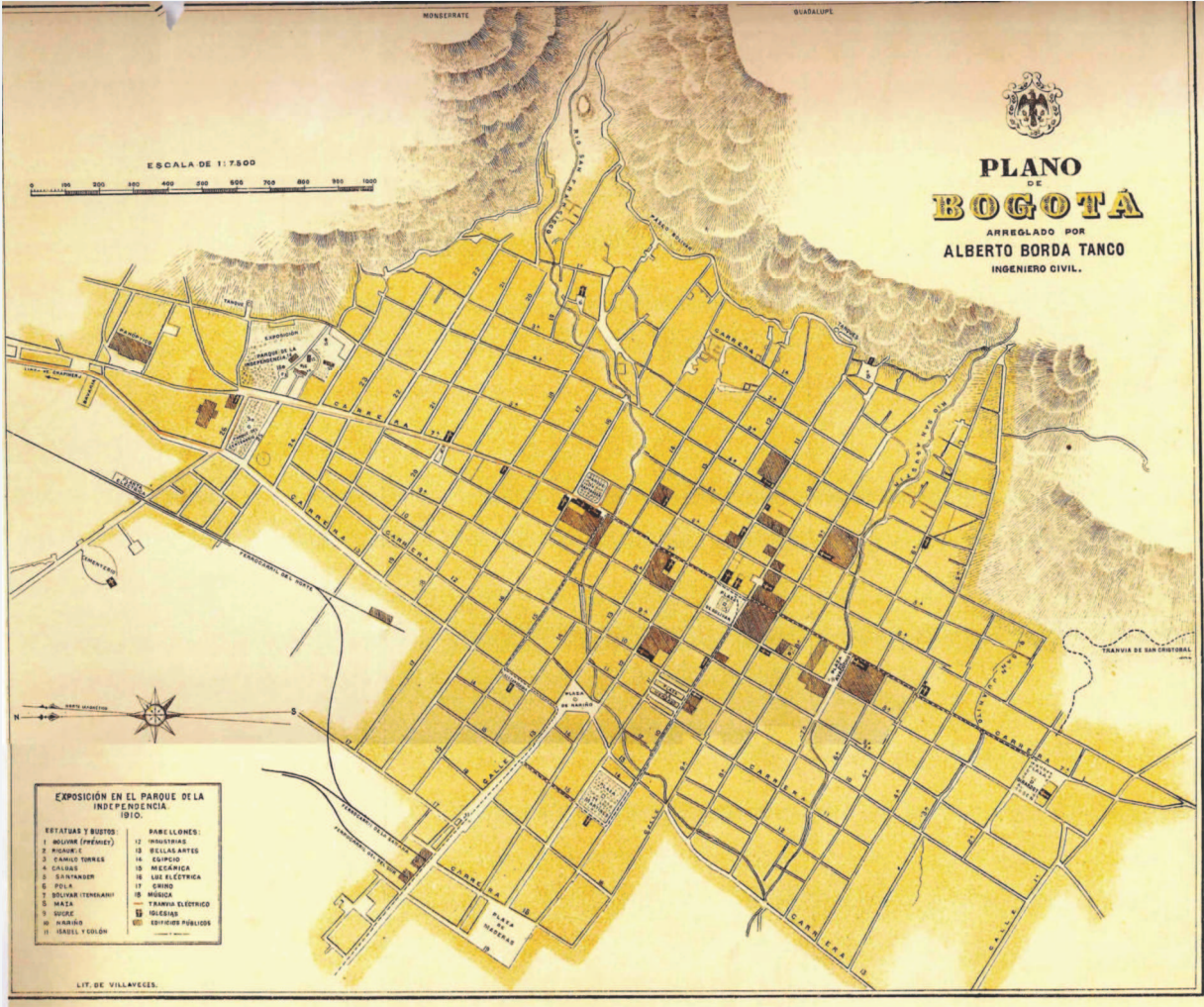
Topographic map of Bogotá, 1894  
Source: Archivo General de la Nación, Colombia



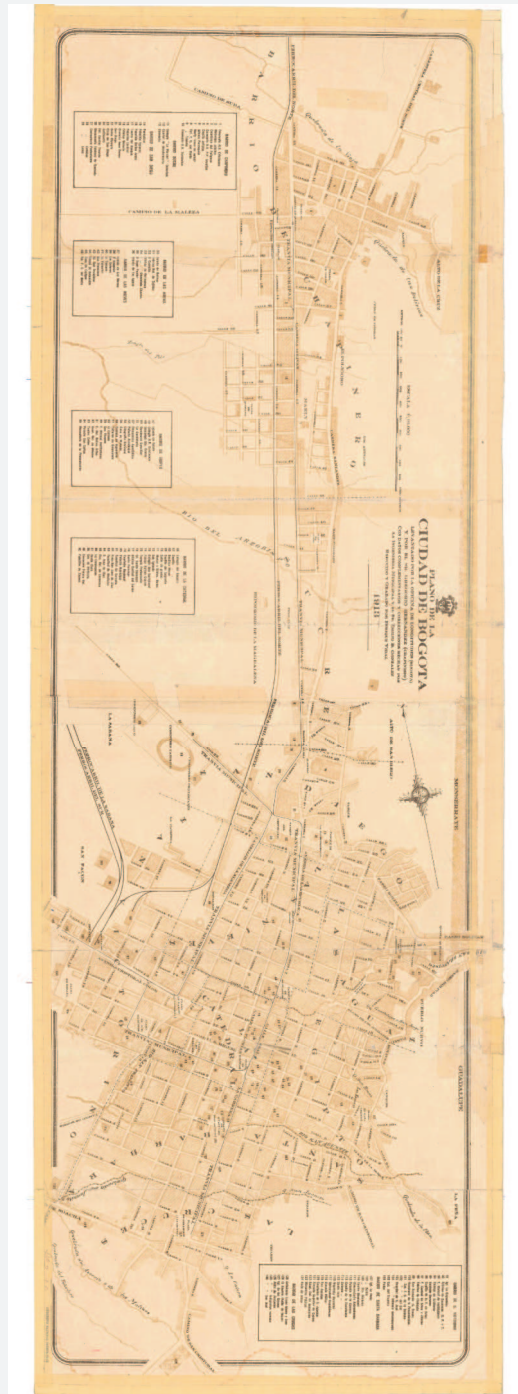
Map of the Cundiboyacense Plateau  
Source: Archivo General de la Nacion, Colombia



Topographic map of Bogota by Manuel Jose Pena, 1908  
Source: Museo de Bogota



Map of Bogota by Alberto Borda Tanco, 1911  
Source: Museo de Bogota



Plan of Bogota , Oficina de Longitudes - Gregorio Hernandez, 1913  
Source: particular collection



Map of Bogota by Manuel Rincon, 1923  
Source: Museo de Bogota







© ARCHIVO GENERAL DE LA NACION - Colombia  
Sección Mapas y Planos, Manuscrito Ref. 146

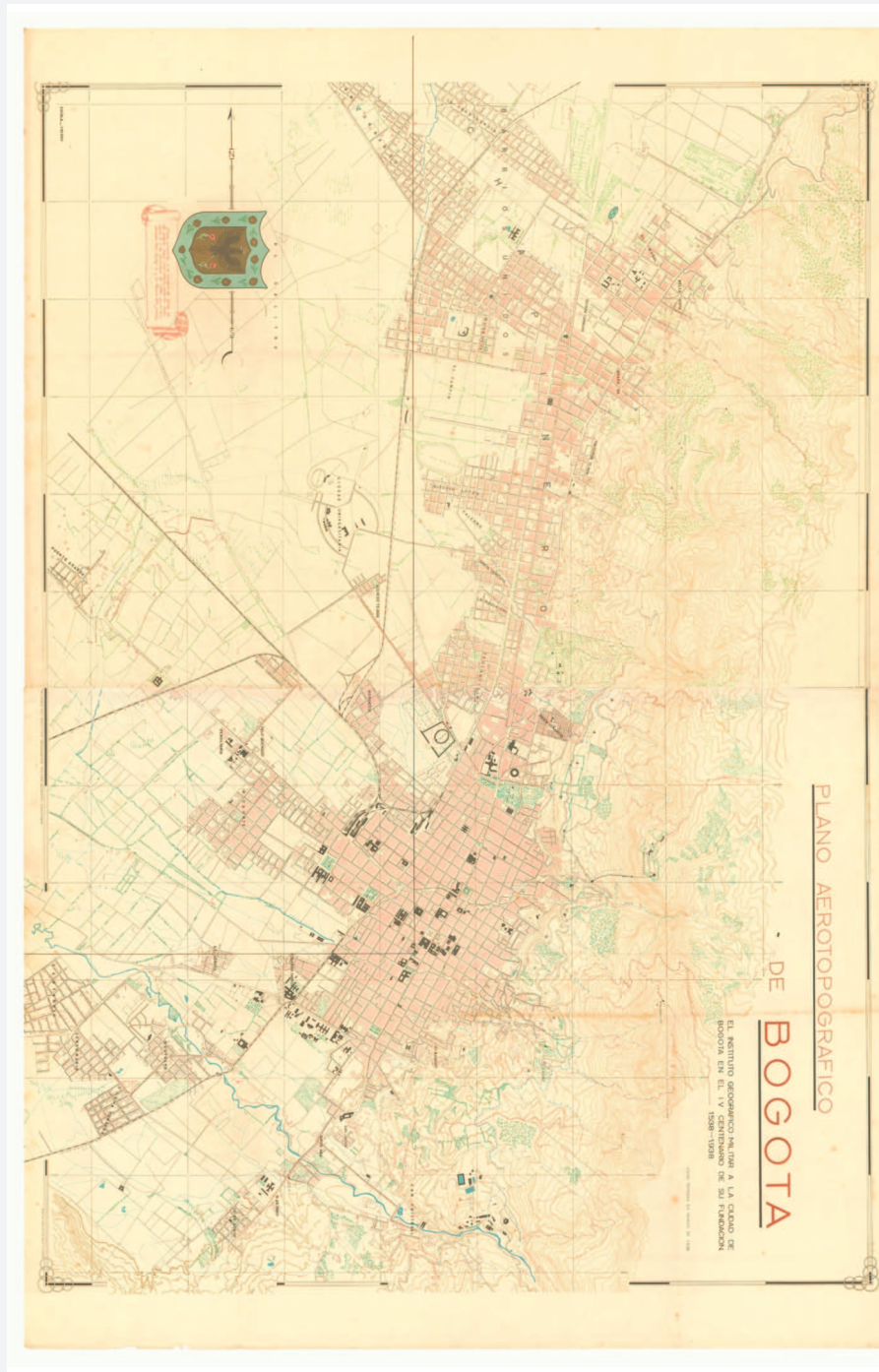
View of Santafé de Bogotá and surrounding areas, 1930  
Source: Archivo General de la Nación, Colombia



Plan of Bogotá, Secretaria de Obras Publicas Municipales, 1932  
Source: Archivo de Bogota



Plan of Bogota by Julio C. Vergara y Vergara, 1936  
Source: Archivo de Bogota



Aerial plan of Bogota, 1938  
Source: Instituto Geografico Agustin Codazzi

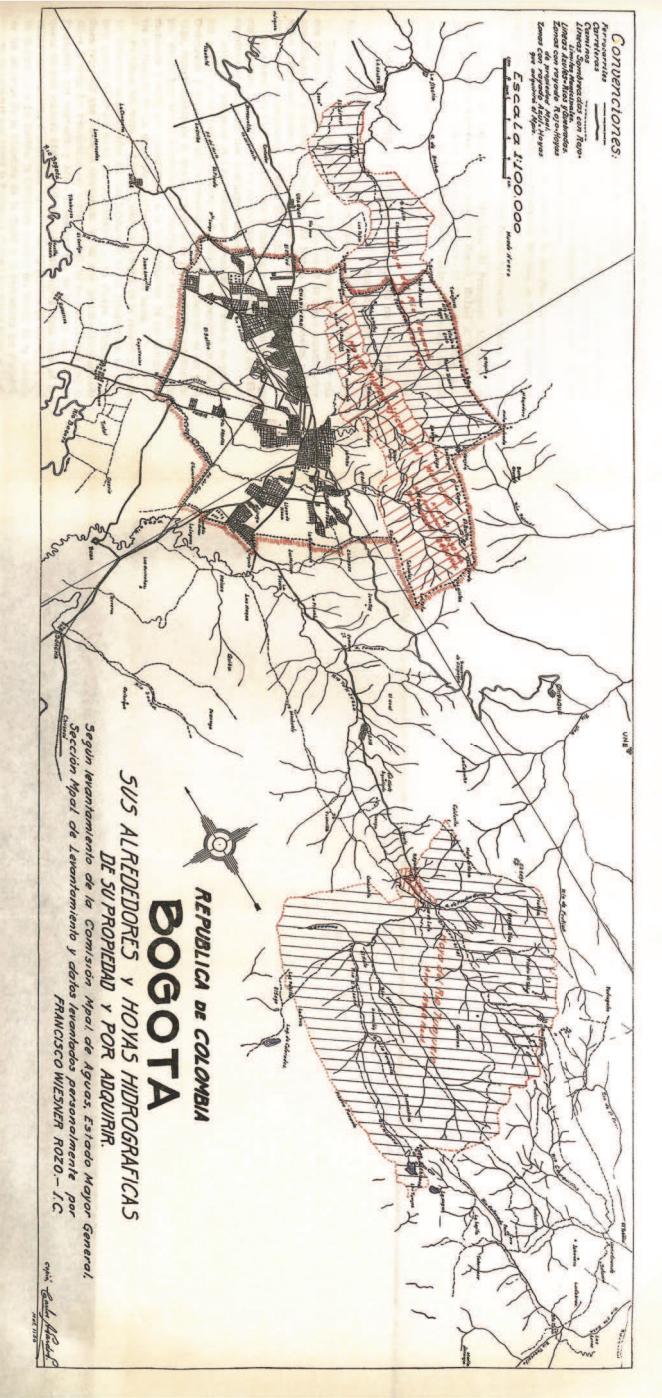


Plan of Bogota, Secretaria de Obras Publicas Municipales, 1940

Source: Archivo de Bogota



Plan of Bogota, Secretaria de Obras Publicas Municipales, 1944  
Source: Archivo de Bogota



Map of Bogota with surrounding areas and water propriety, by Francisco Wiesner Rozo, 1945

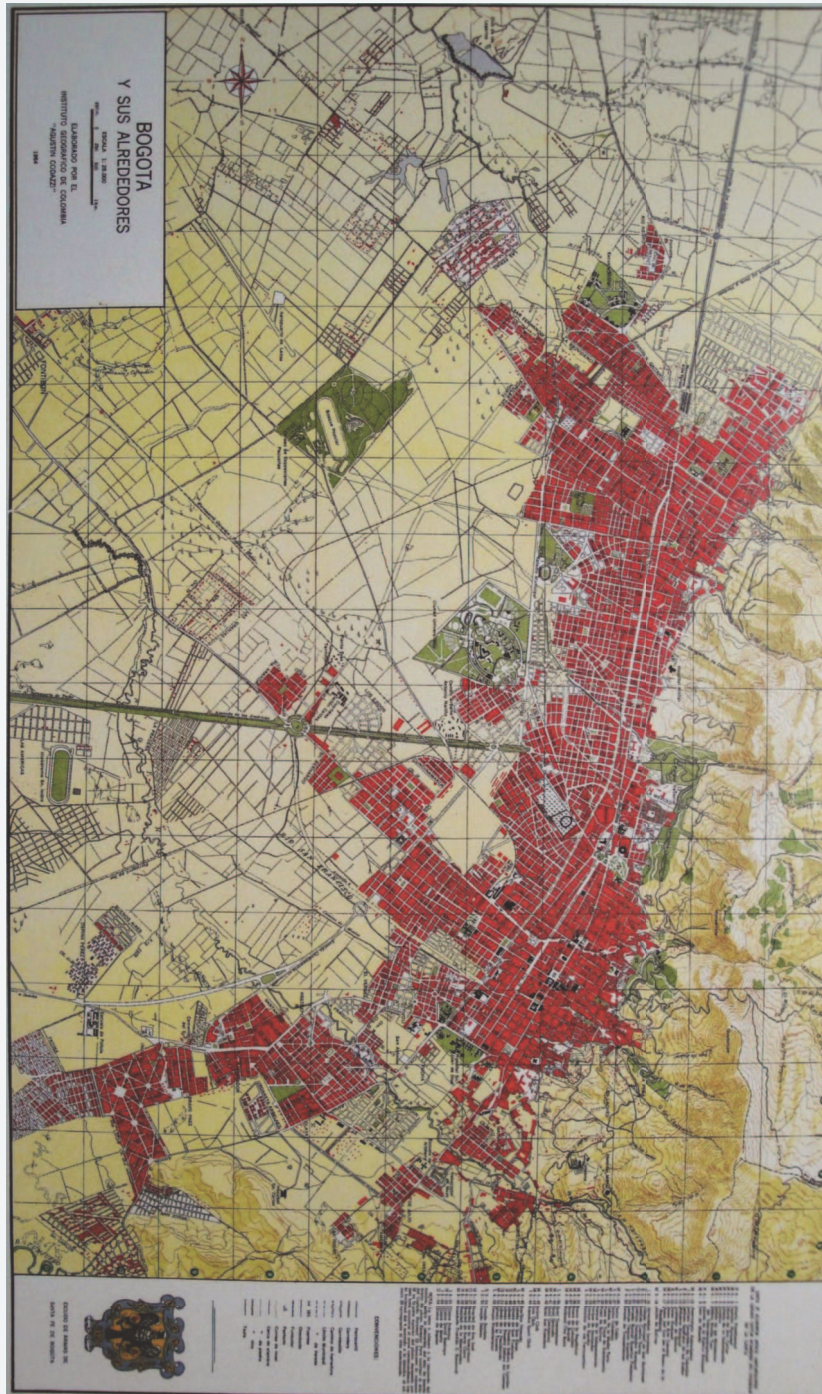
Source: Archivo de Bogota



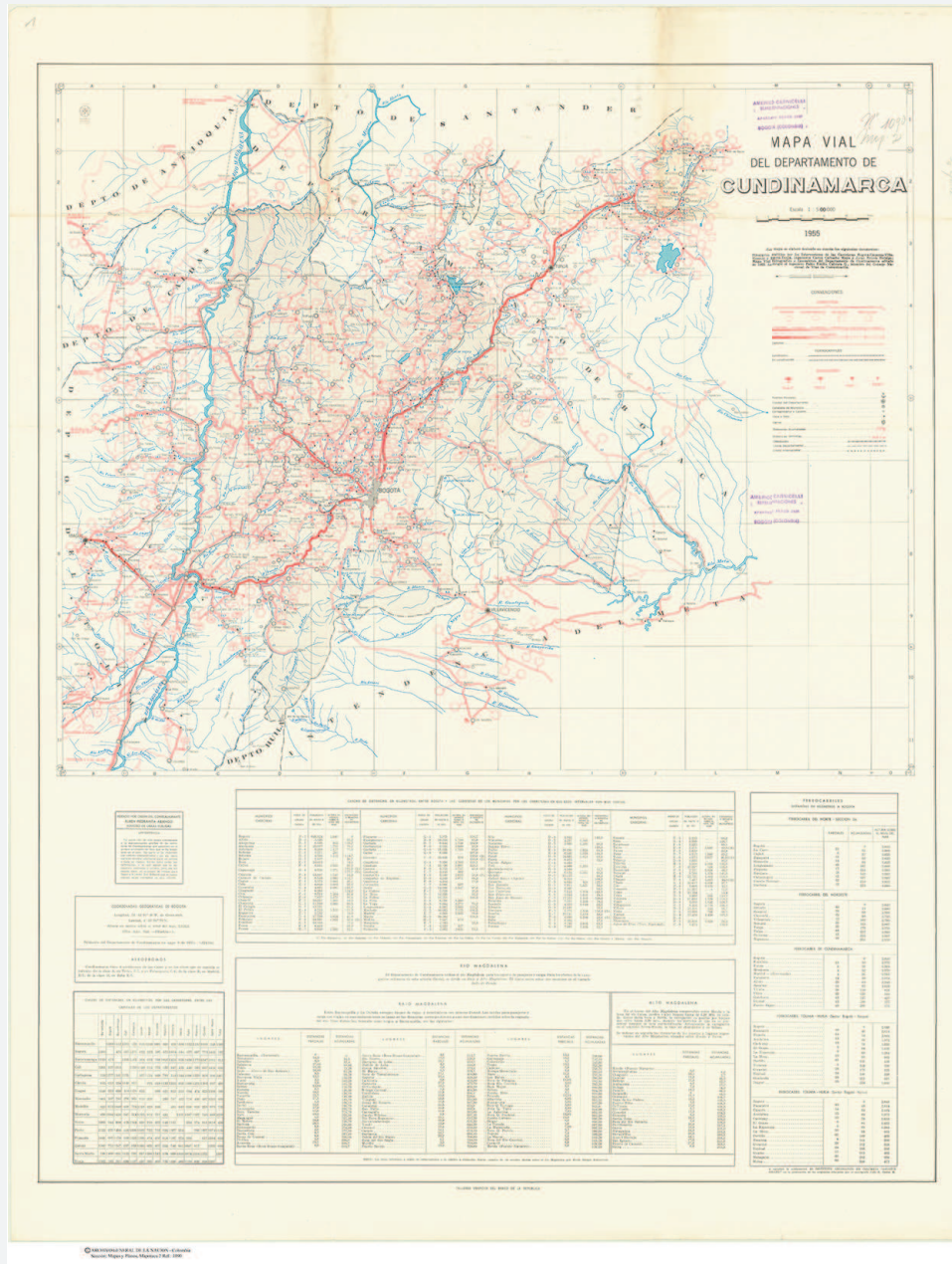




Map of Bogota and urban development, 1953  
Source: Instituto Geografico Agustin Codazzi



Map of Bogota and urban development, 1954  
Source: Instituto Geografico Agustin Codazzi



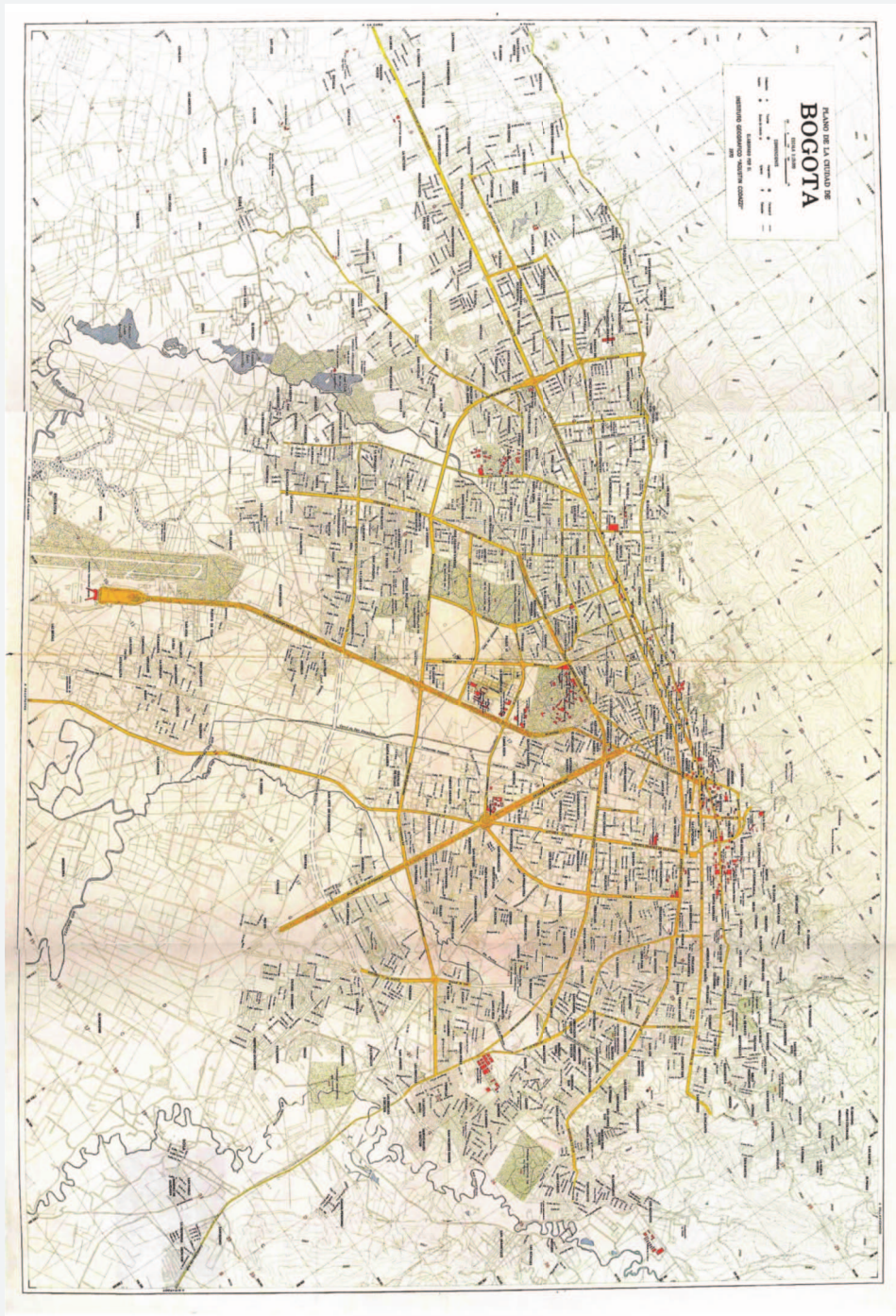
Map of Cundinamarca roads system, 1955  
Source: Archivo General de la Nacion, Colombia



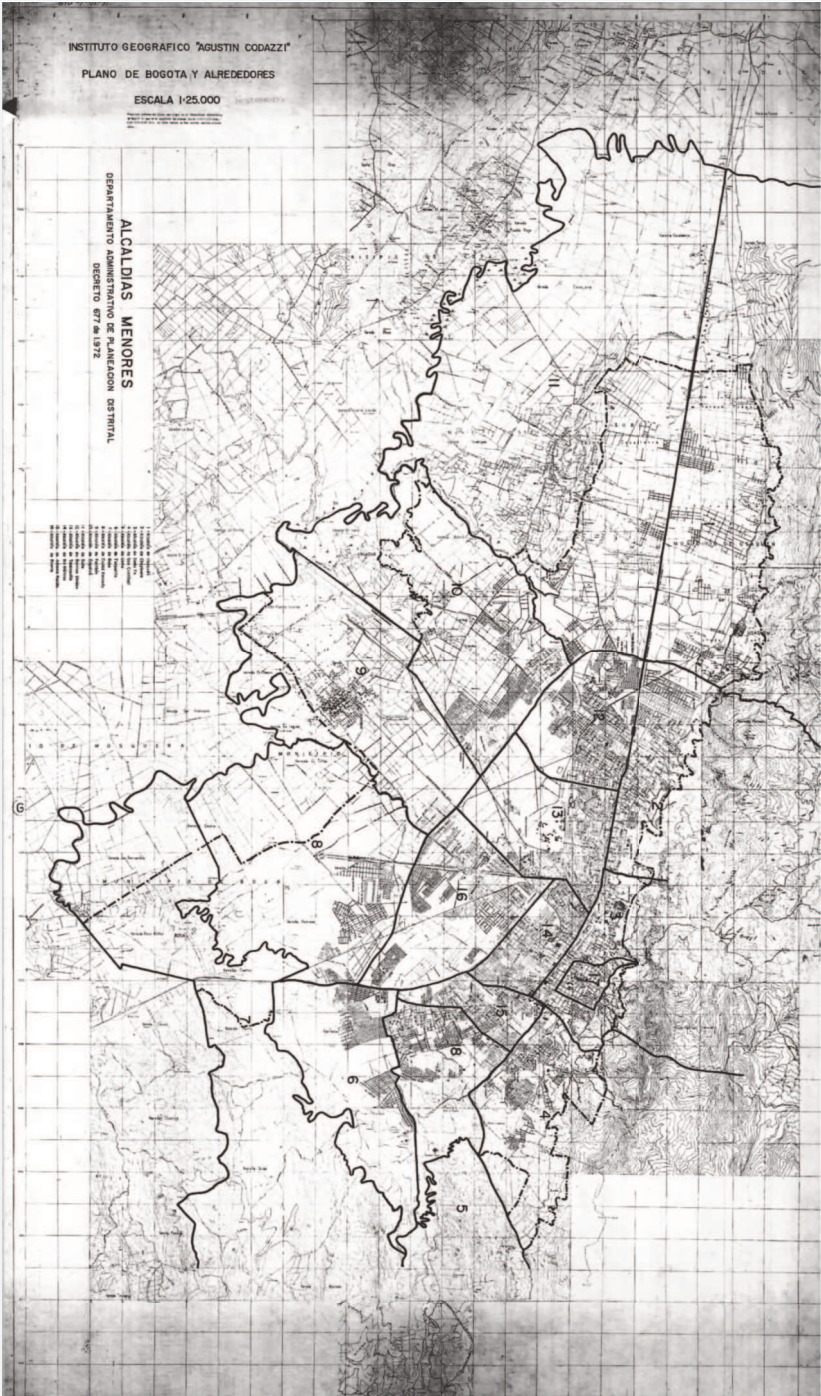
Urban development of Bogotá (1938-1957), 1957  
Source: Museo de Bogotá



Map of Bogota, 1960  
Source: Instituto Geografico Agustin Codazzi



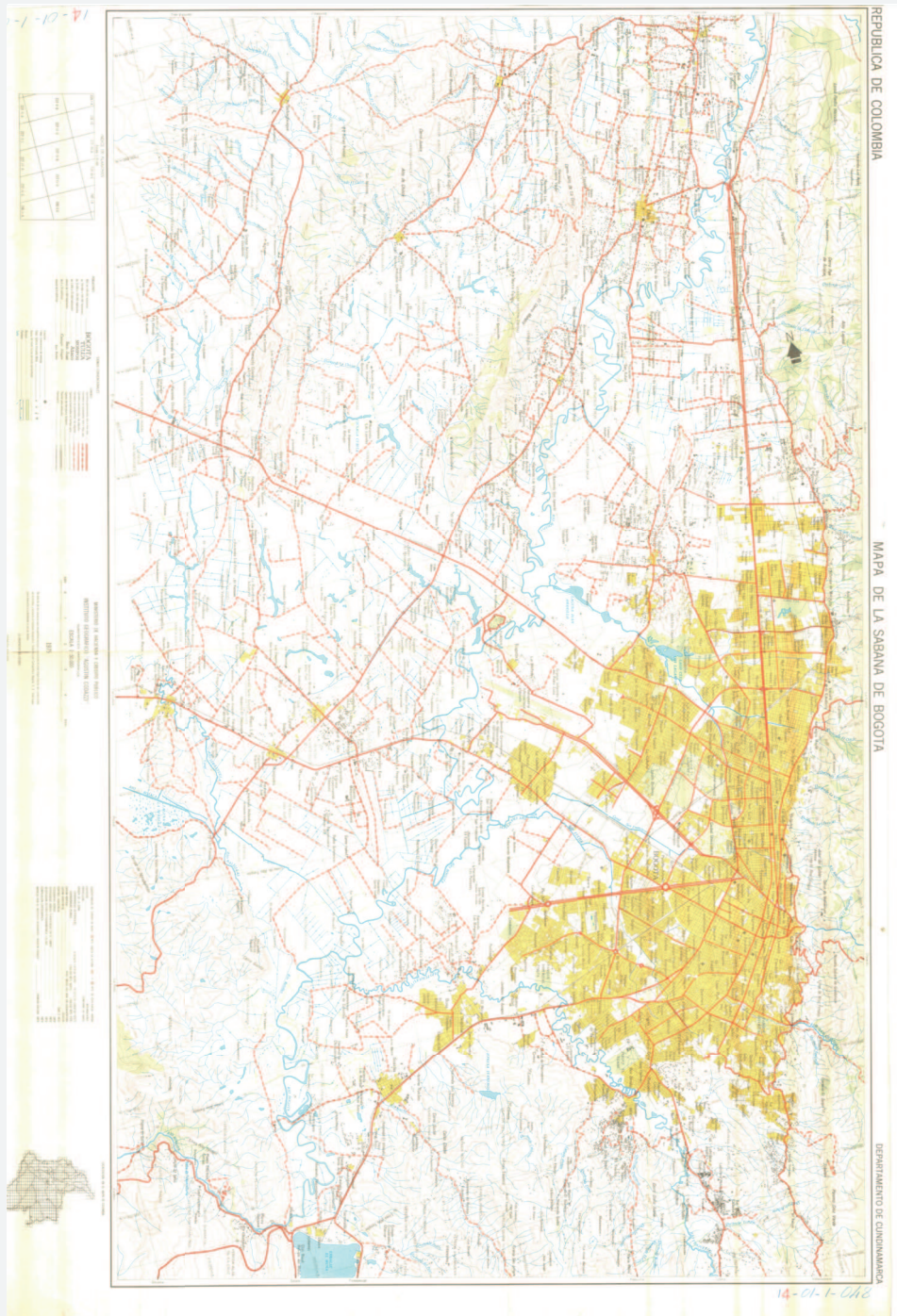
Urban plan for Bogota, 1970  
Source: Instituto Geografico Agustin Codazzi



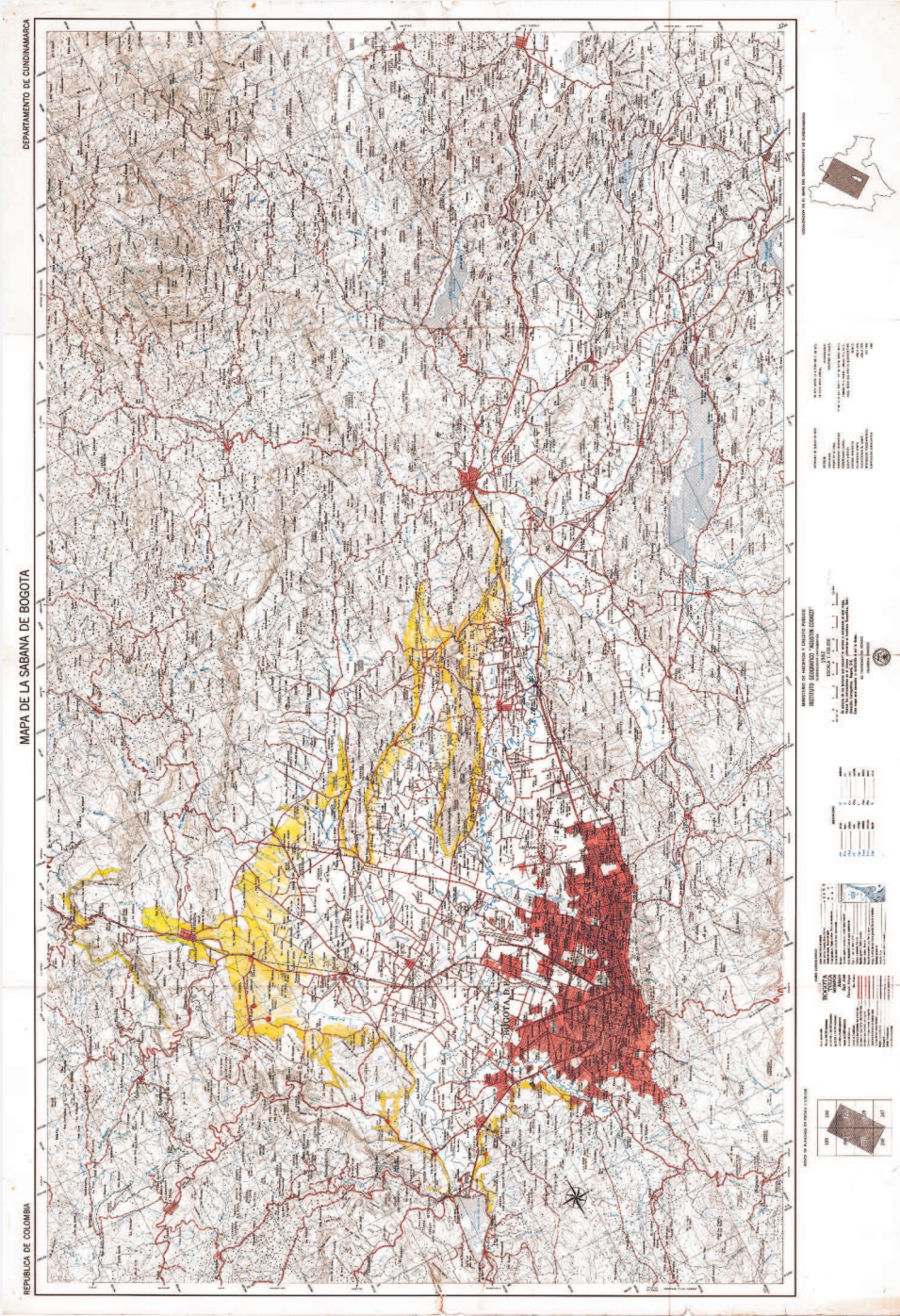
Urban Minor Centralities of Bogota, 1972

Source: Instituto Geografico Agustin Codazzi



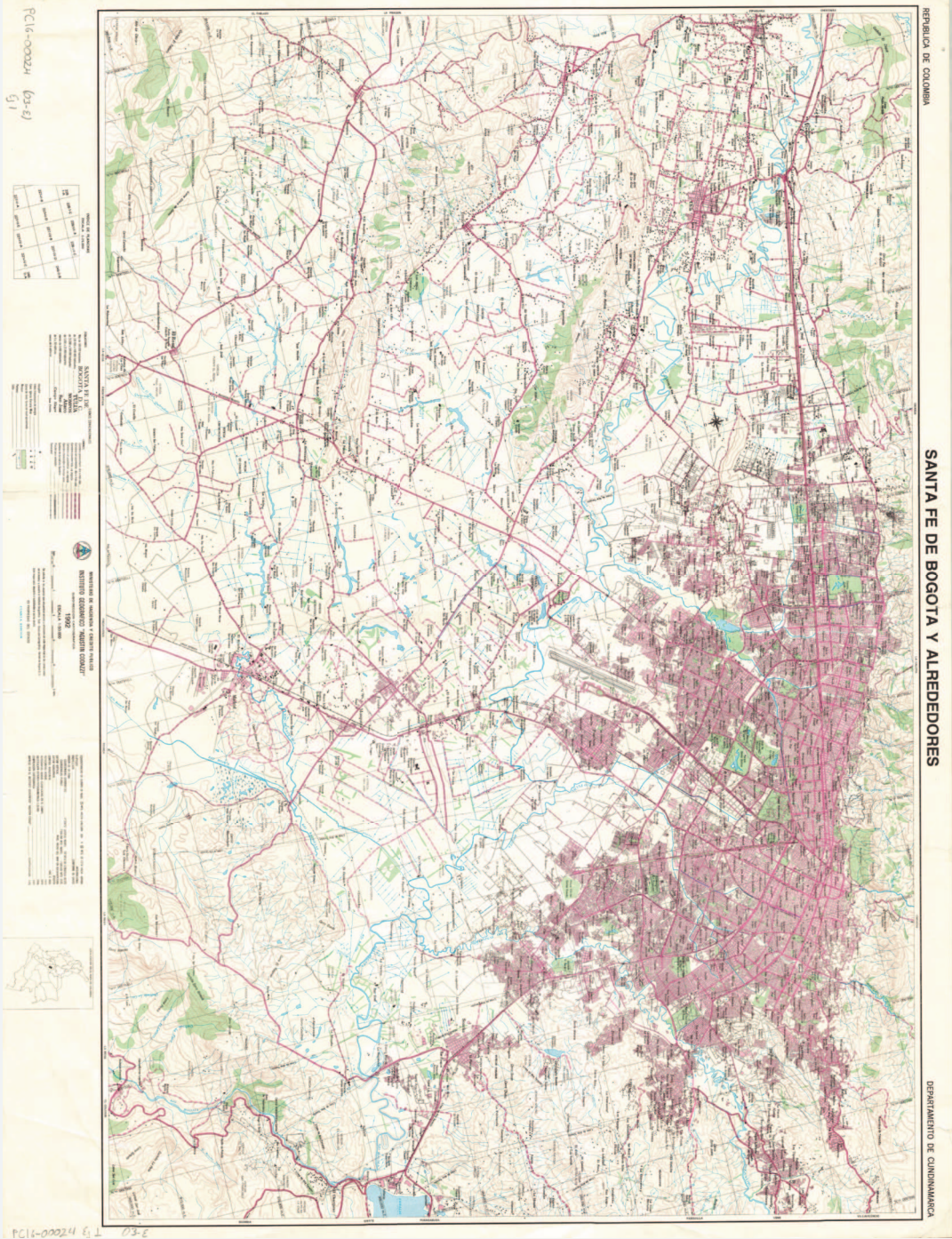


Map of Sabana de Bogota, 1975  
Source: Instituto Geografico Agustin Codazzi

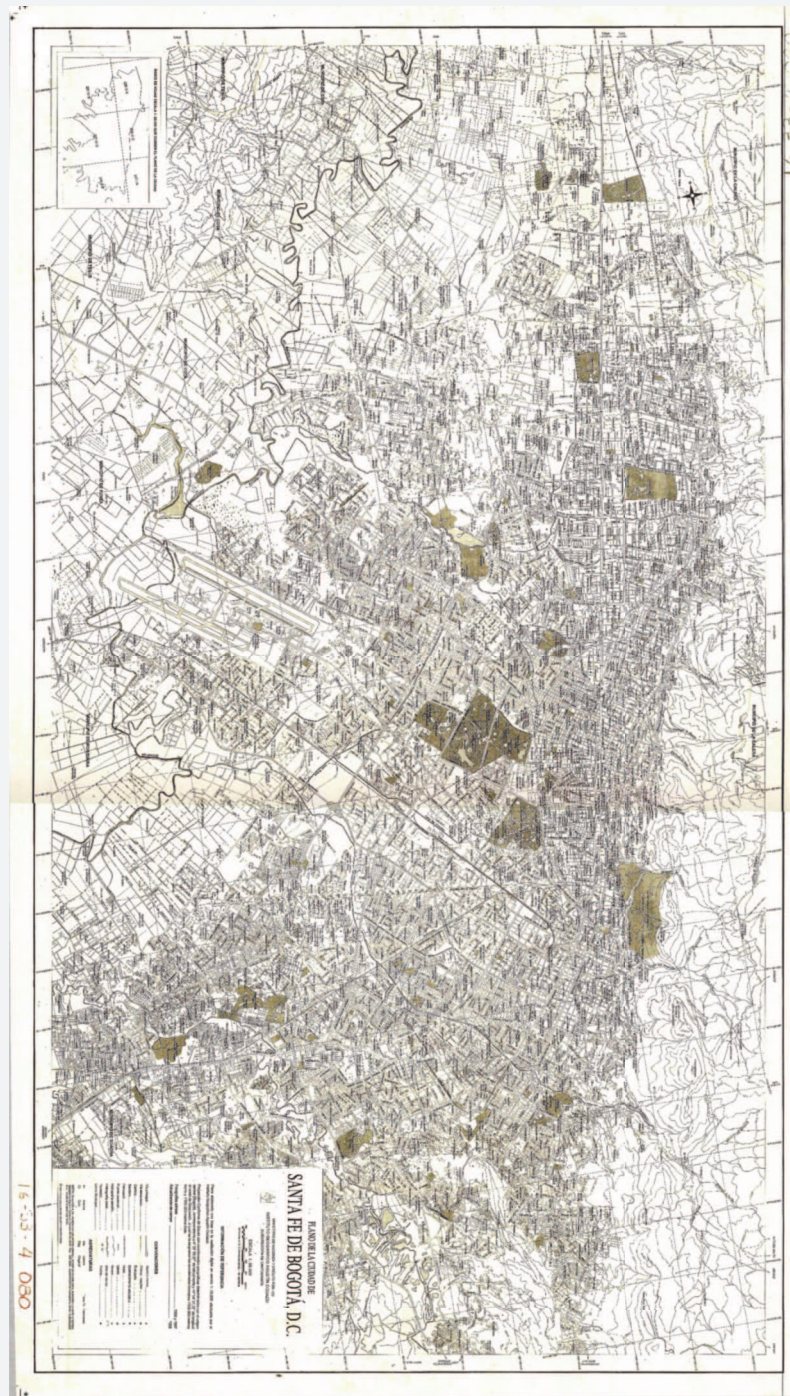


Road map fo Sabana de Bogota, 1982  
Source: Instituto Geografico Agustin Codazzi

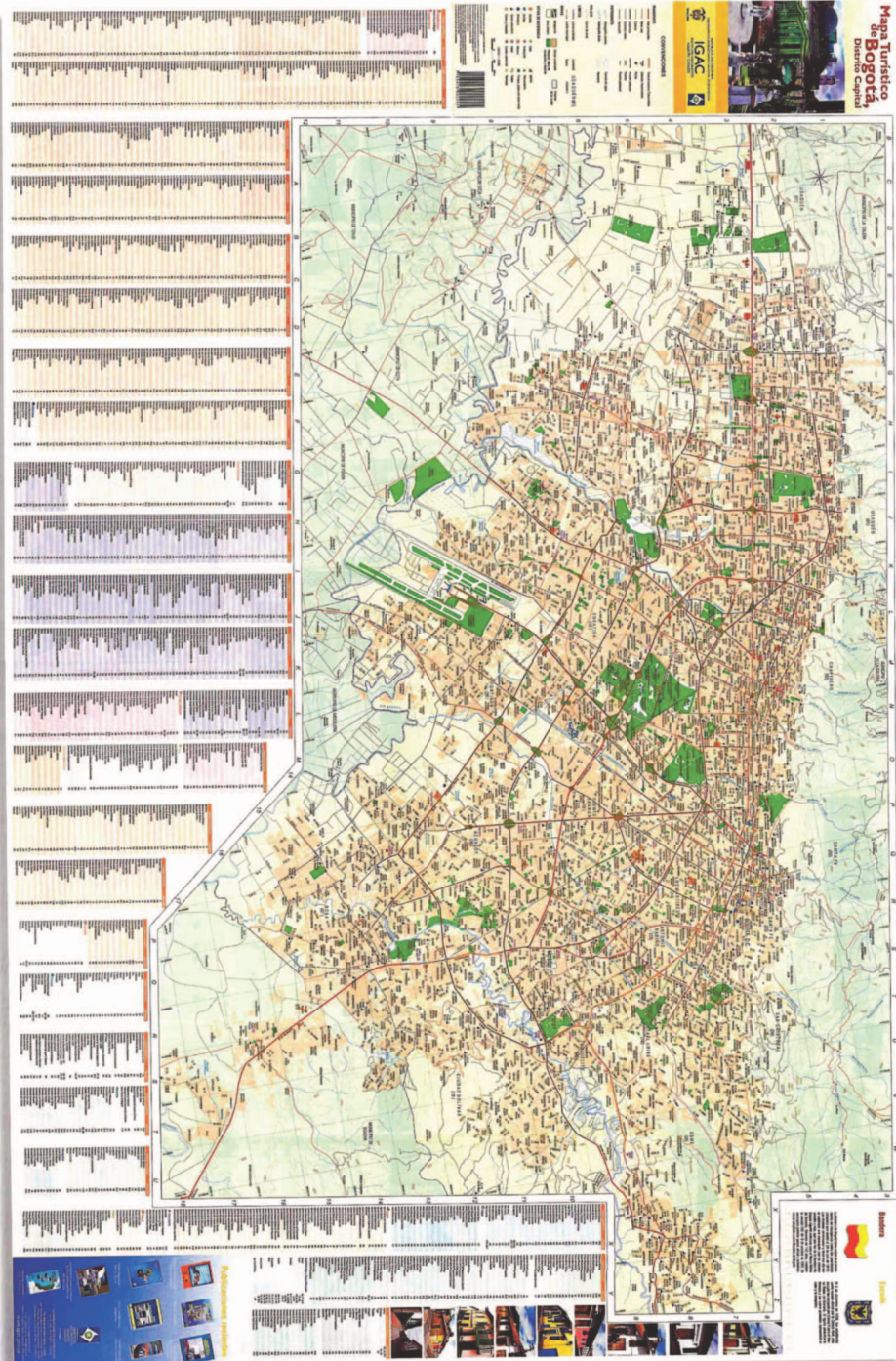




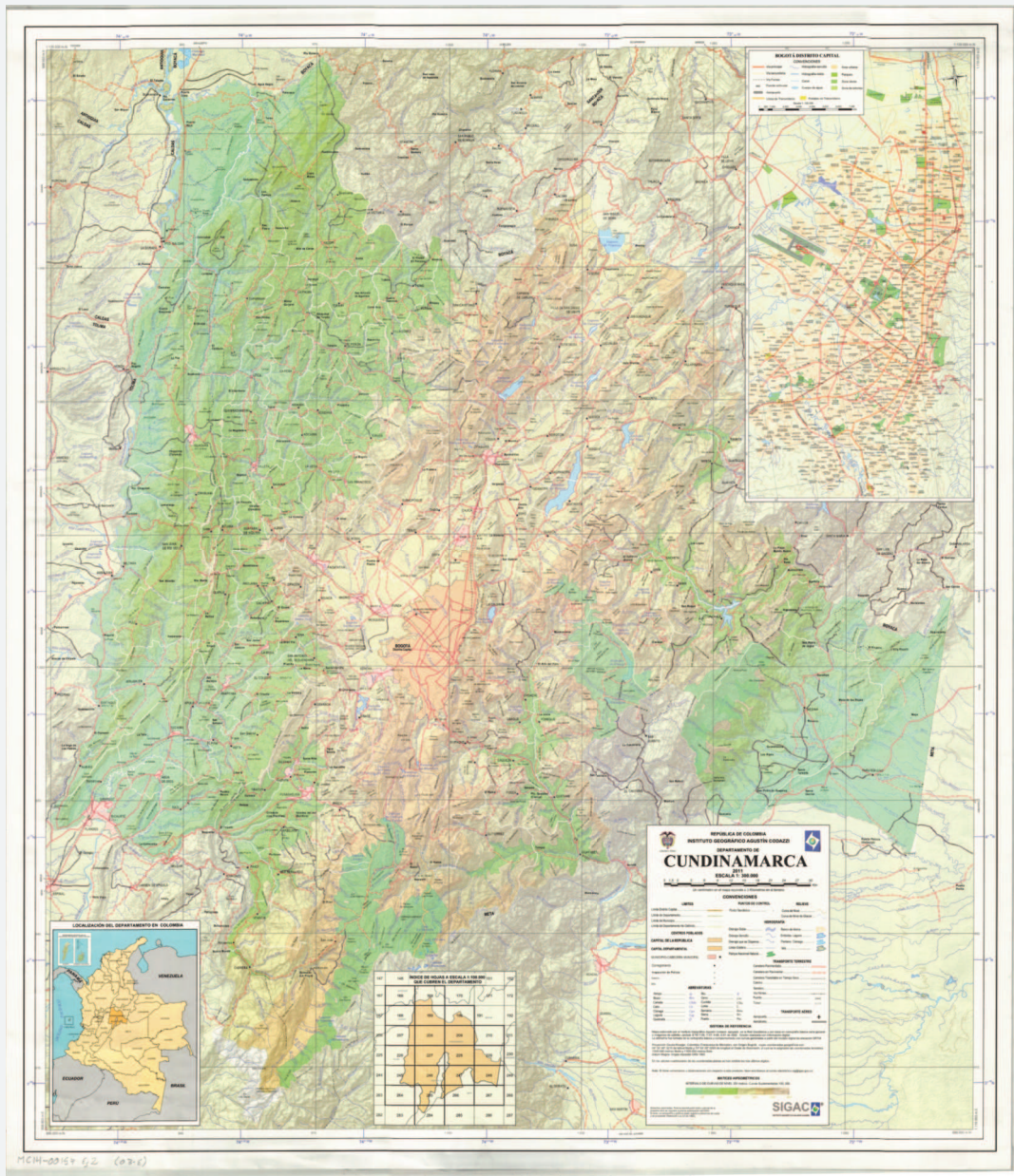
Map of Santa fe de Bogota D. C. and surrounding area, 1992  
Source: Instituto Geografico Agustín Codazzi



Urban plan of Santa fe de Bogota D. C., 2000  
Source: Instituto Geografico Agustin Codazzi



Turist map of Santafe de Bogota D. C., 2006  
Source: Instituto Geografico Agustin Codazzi



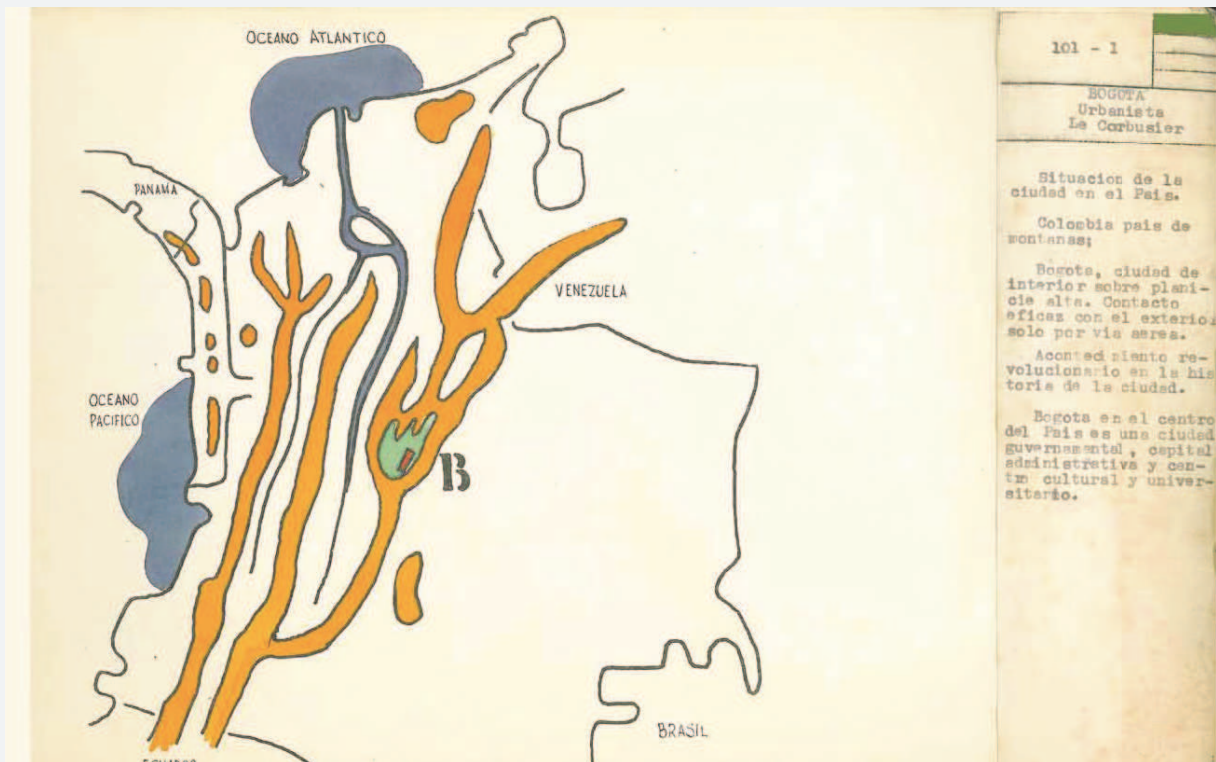
Map of Cundinamarca region, 2011  
Source: Instituto Geografico Agustín Codazzi



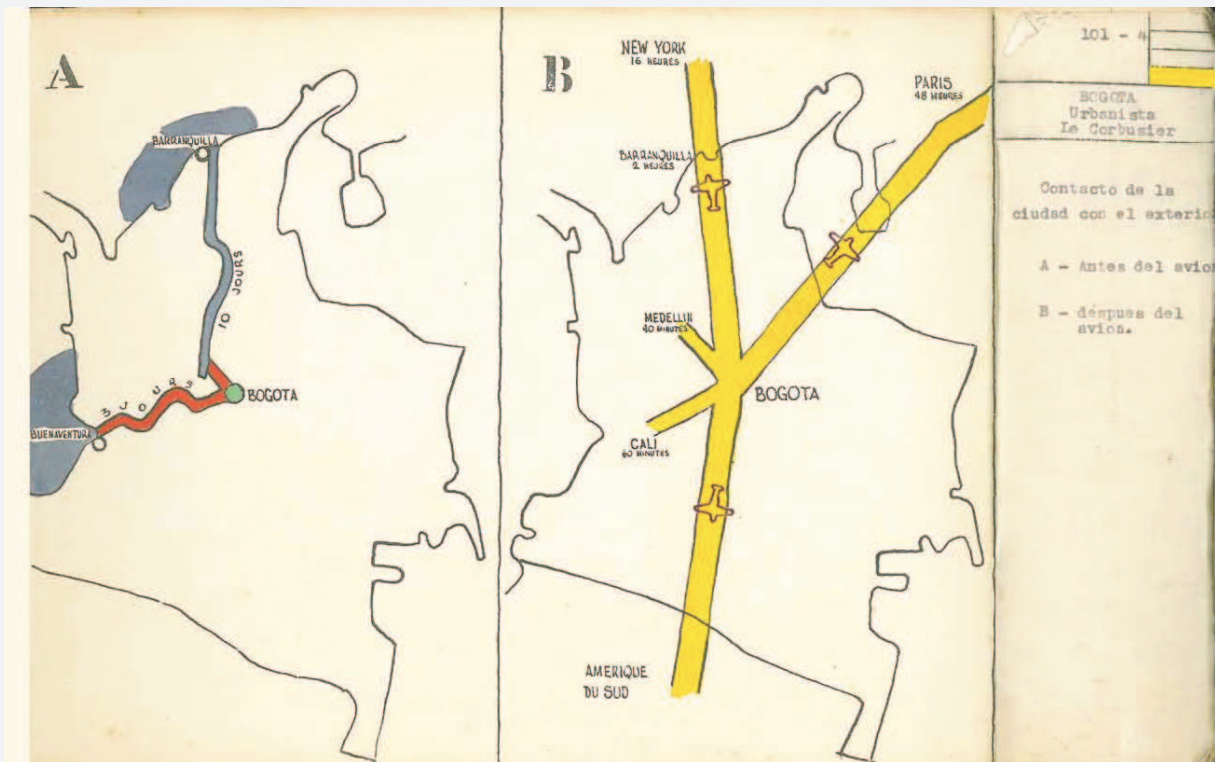


**Plan Piloto for Bogota by Le Corbusier, 1951**

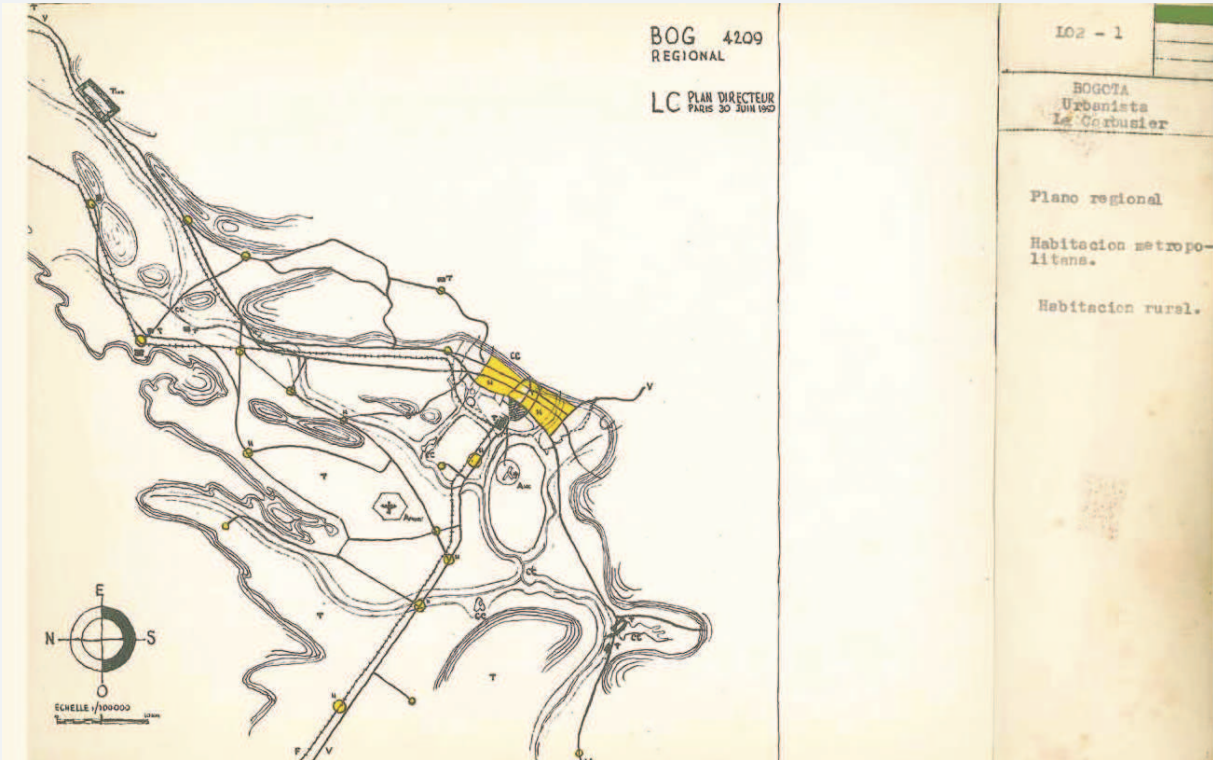




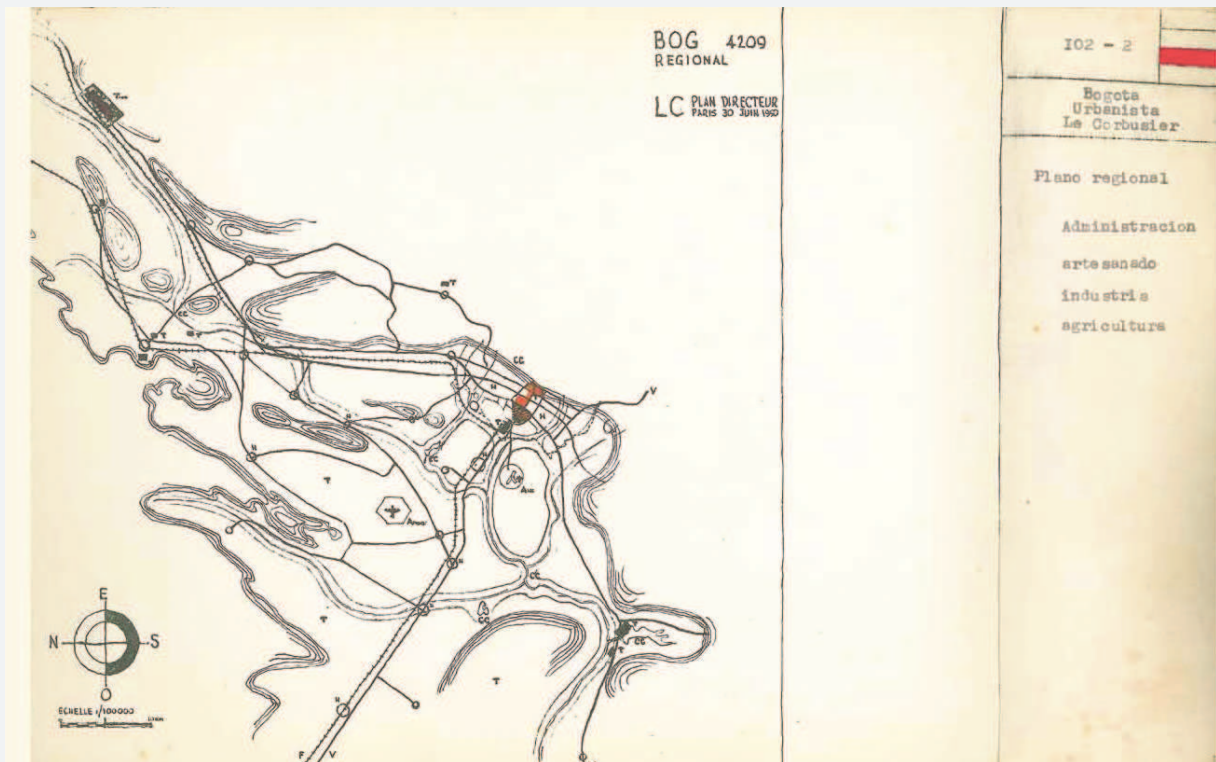
Plan Piloto for Bogotá 1951  
Source: Fondation Le Corbusier



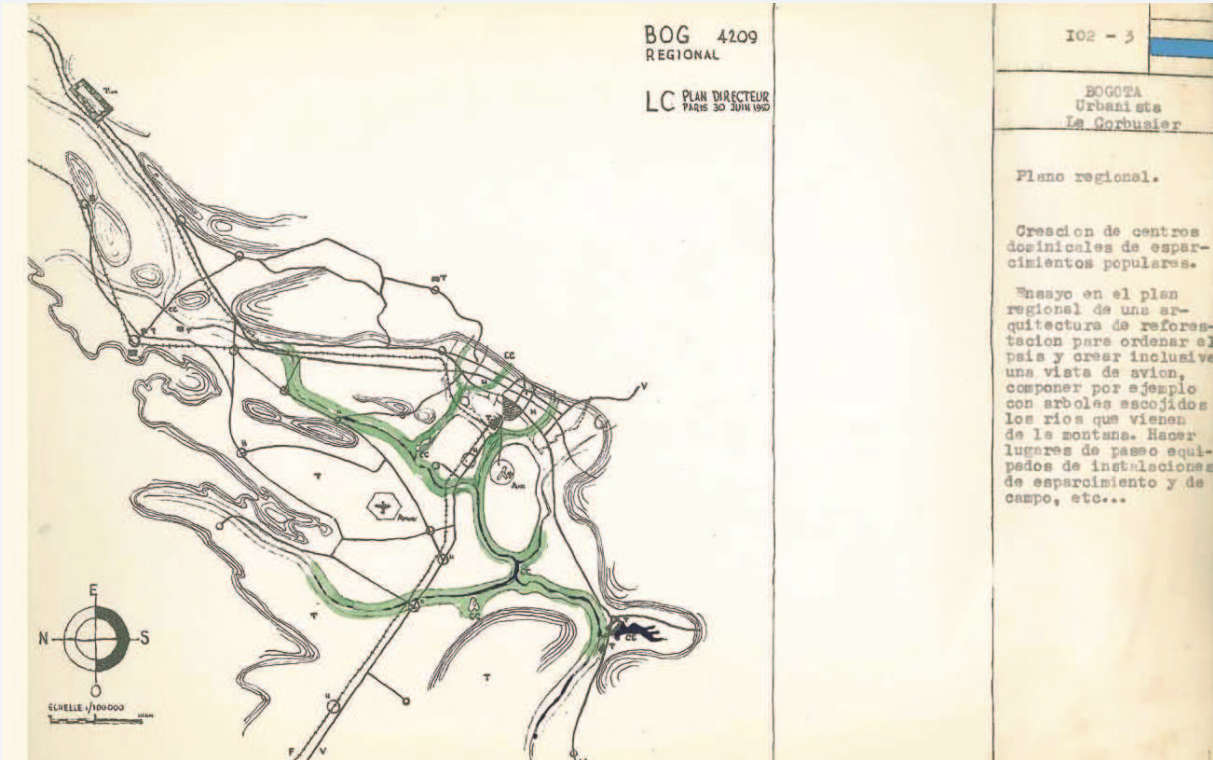
Plan Piloto for Bogotá 1951  
Source: Fondation Le Corbusier



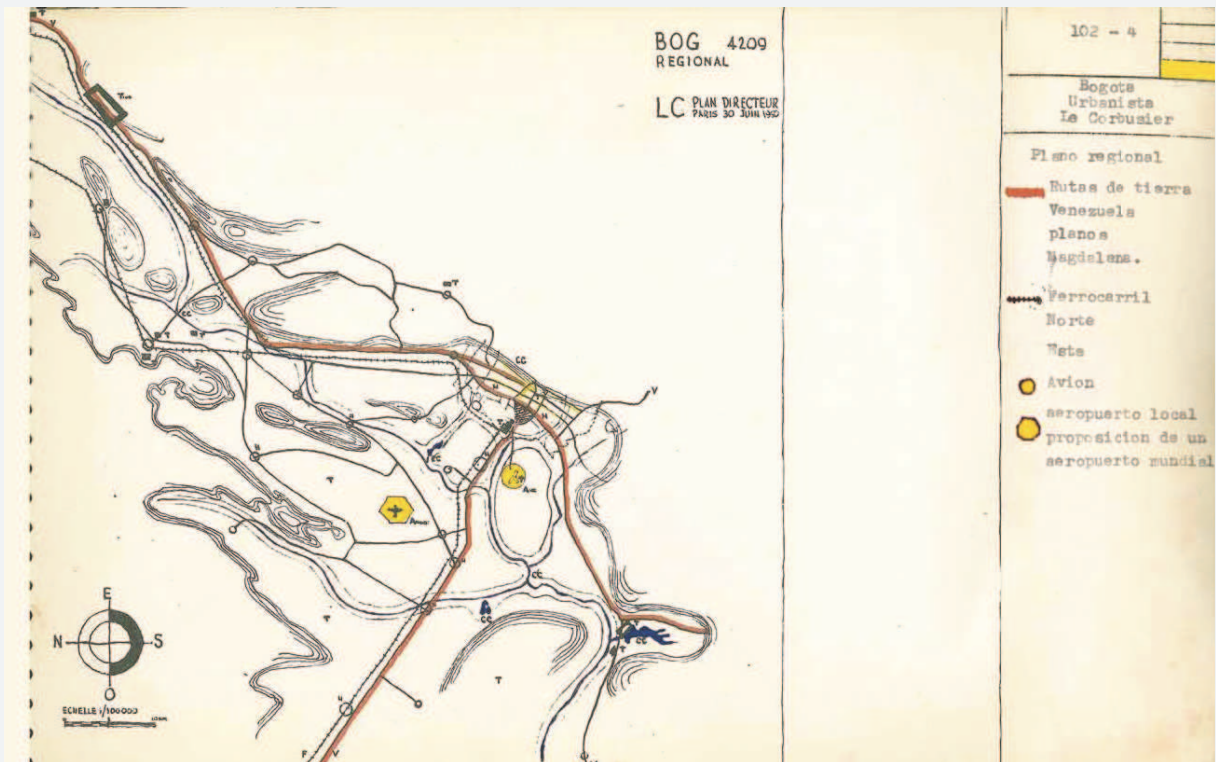
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



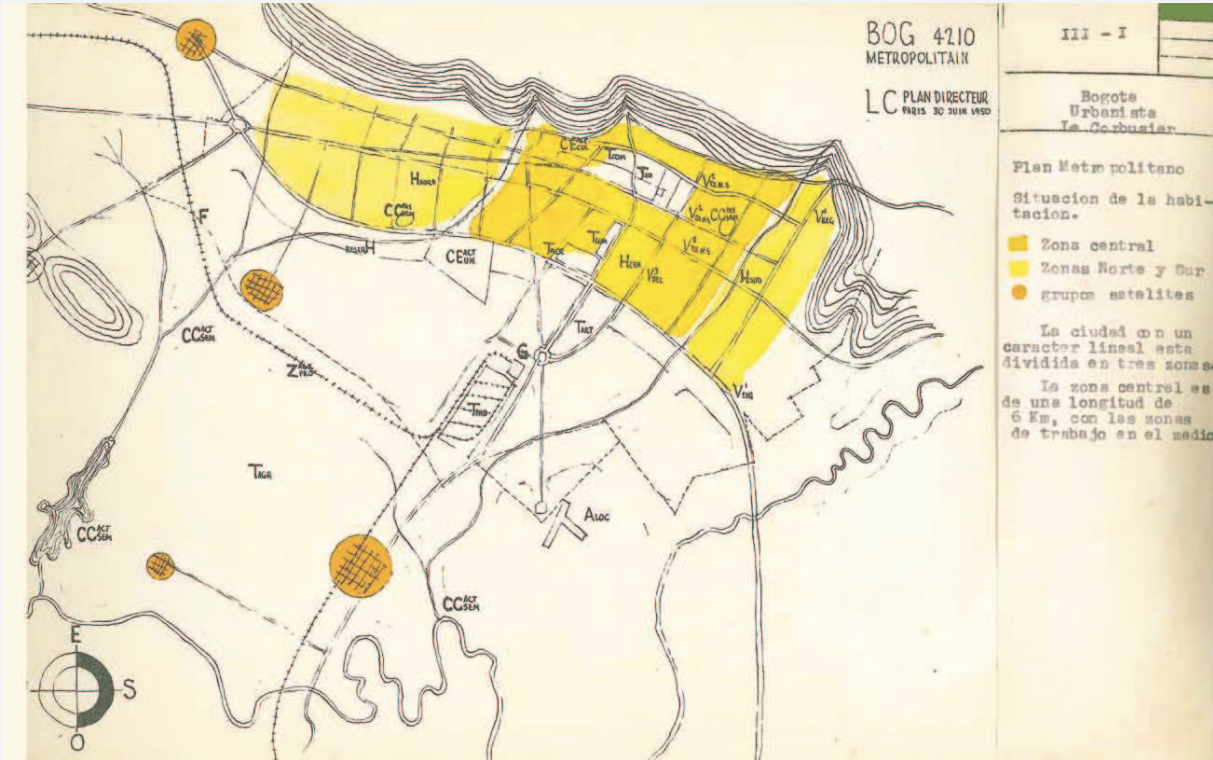
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

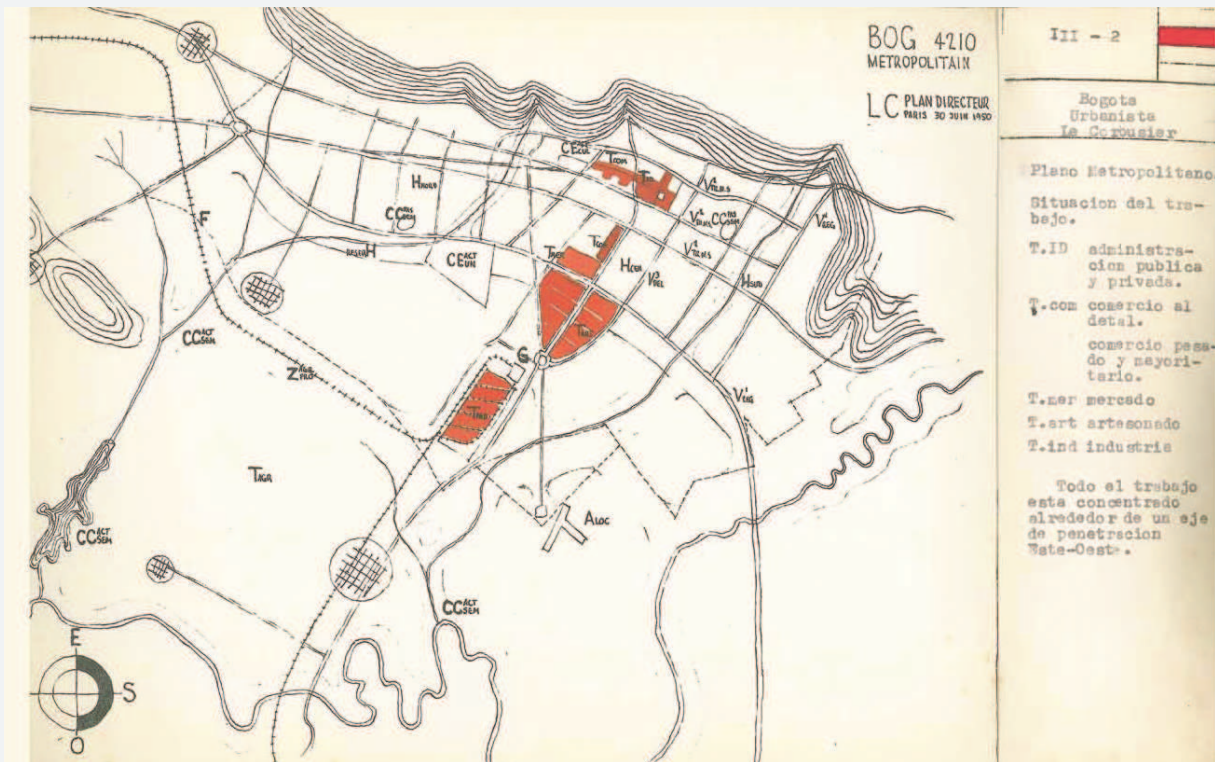


Plan Piloto for Bogotá 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

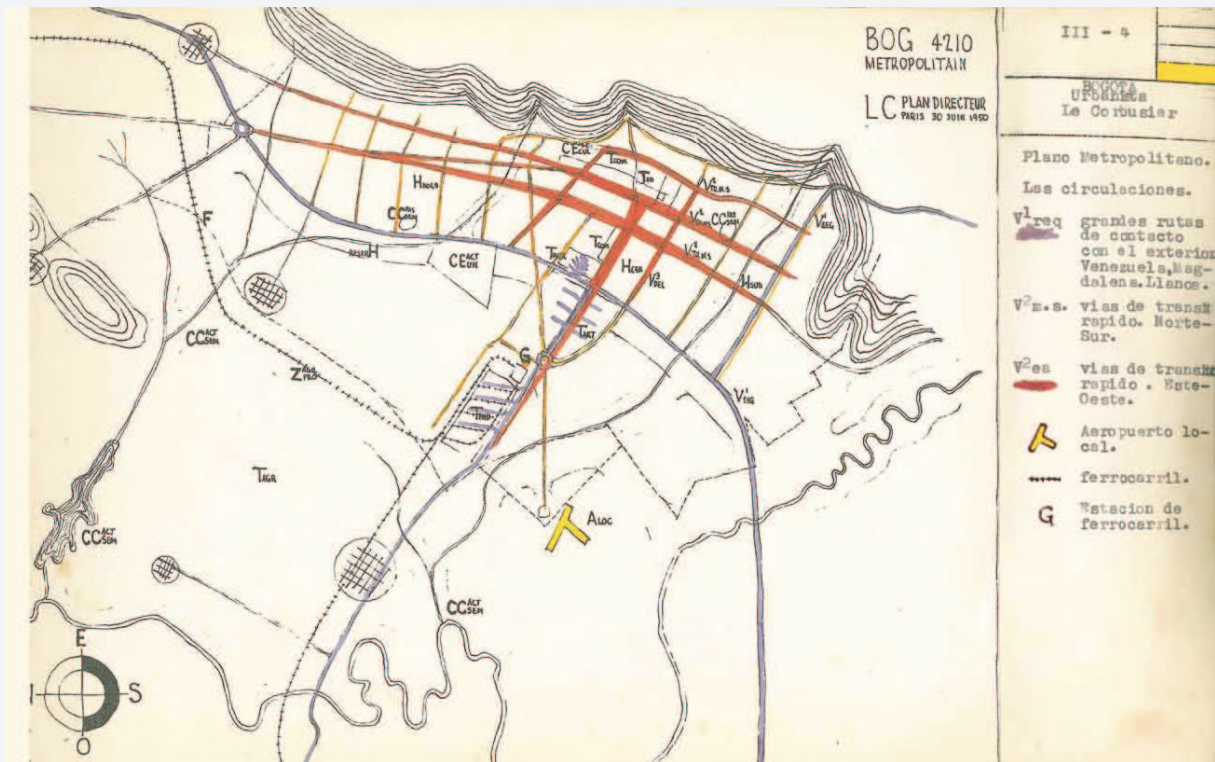




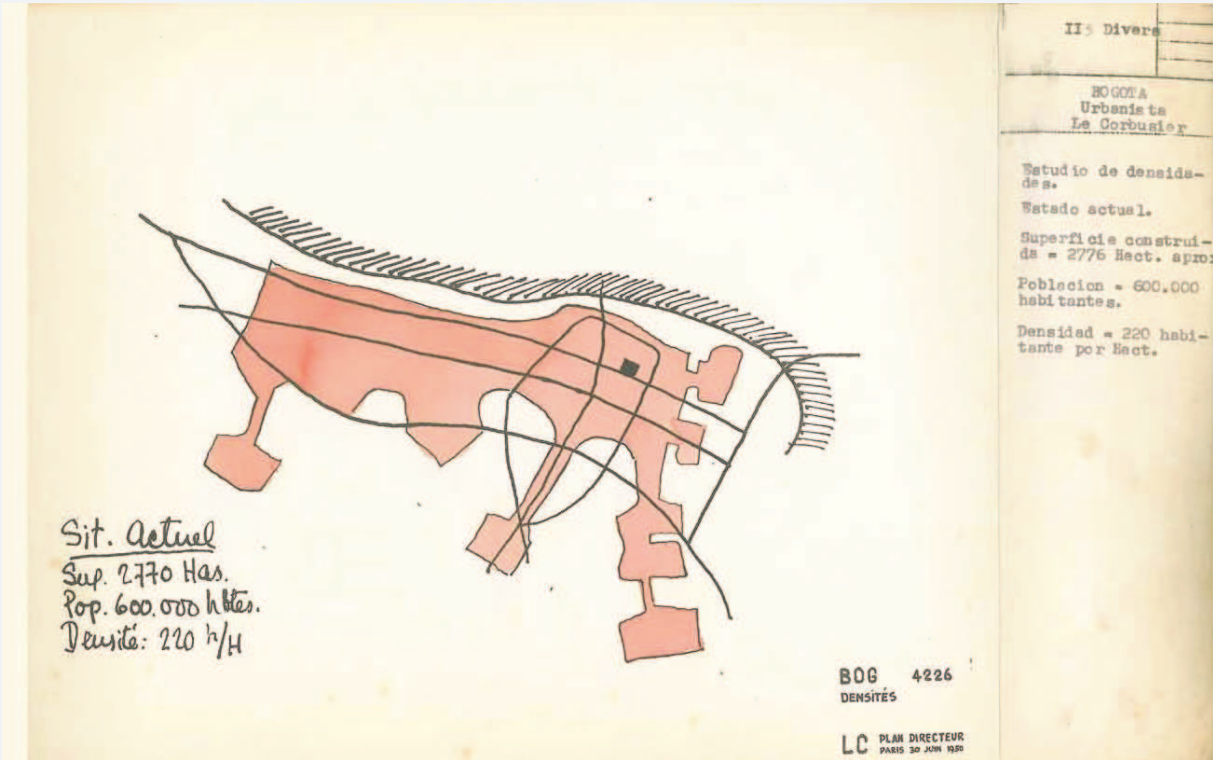
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



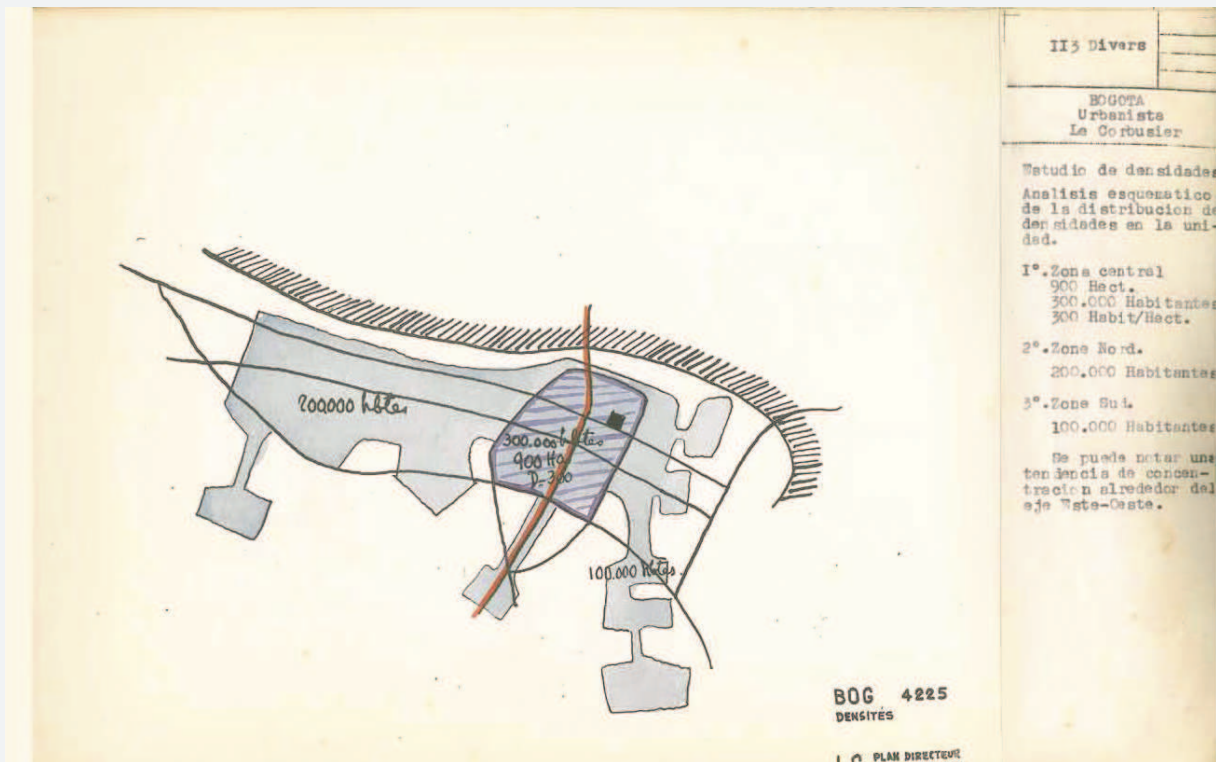
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



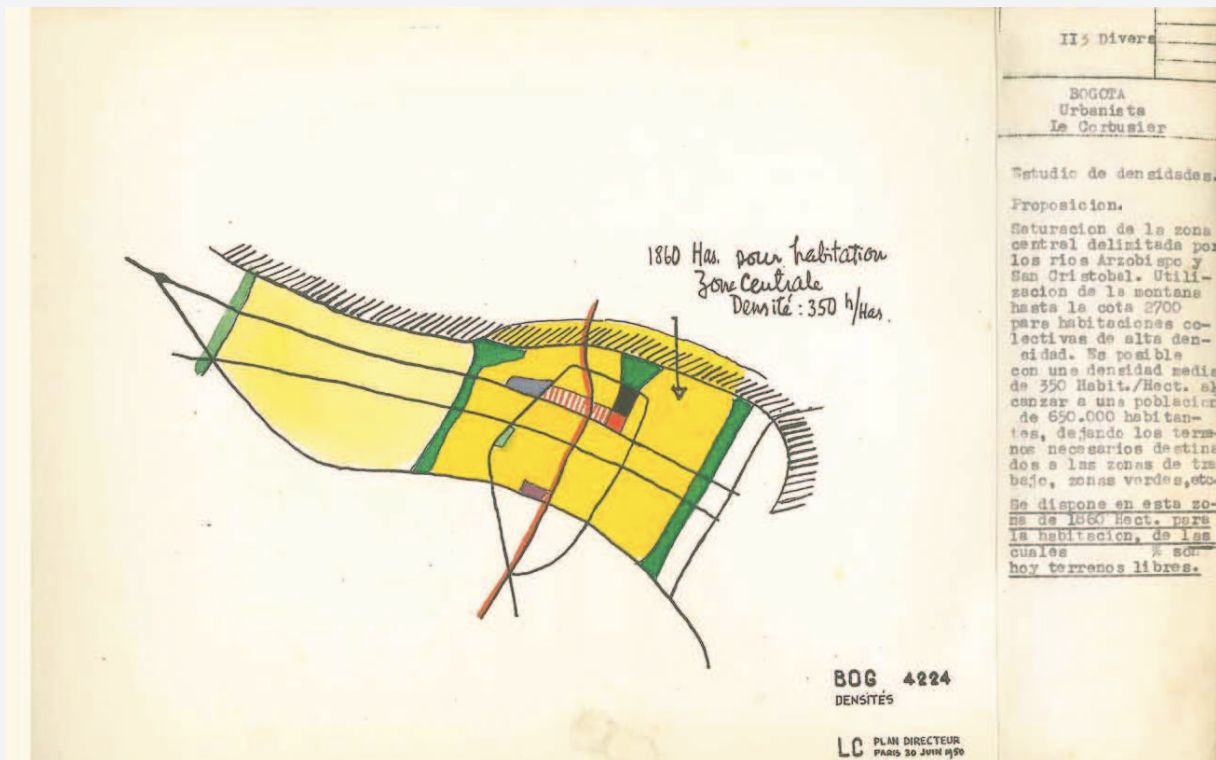
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



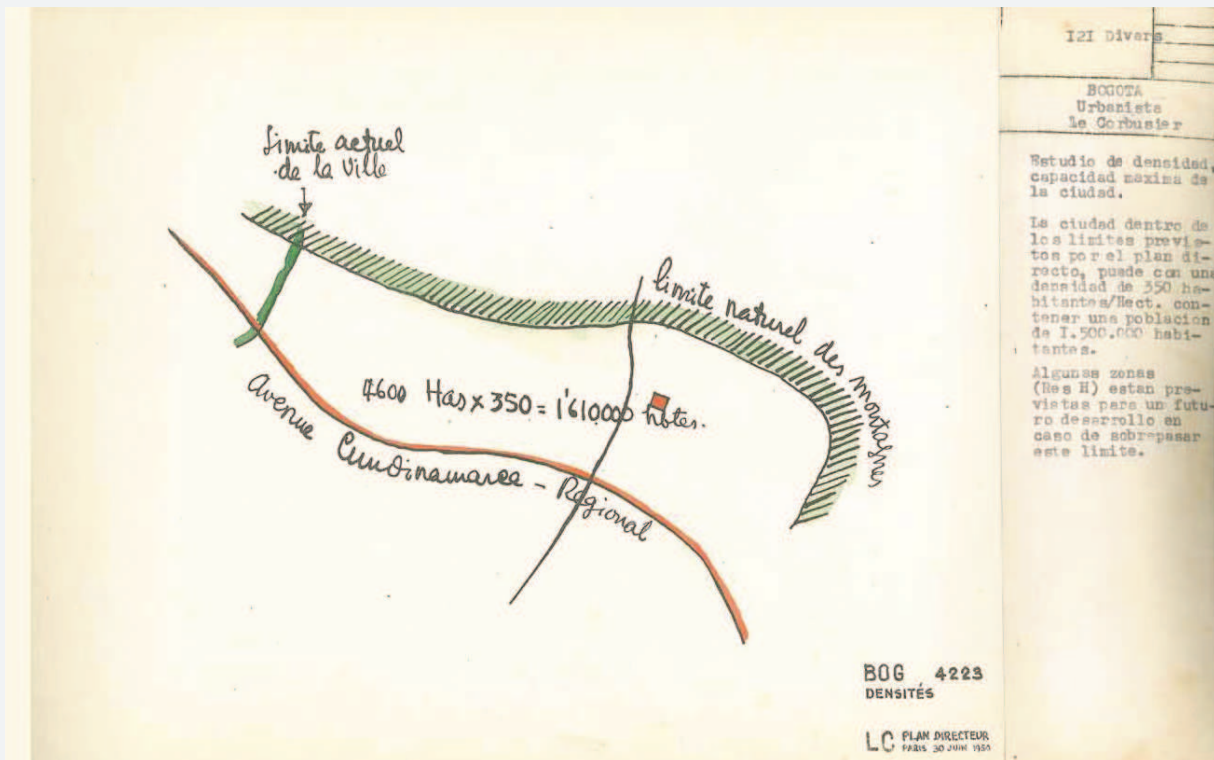
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



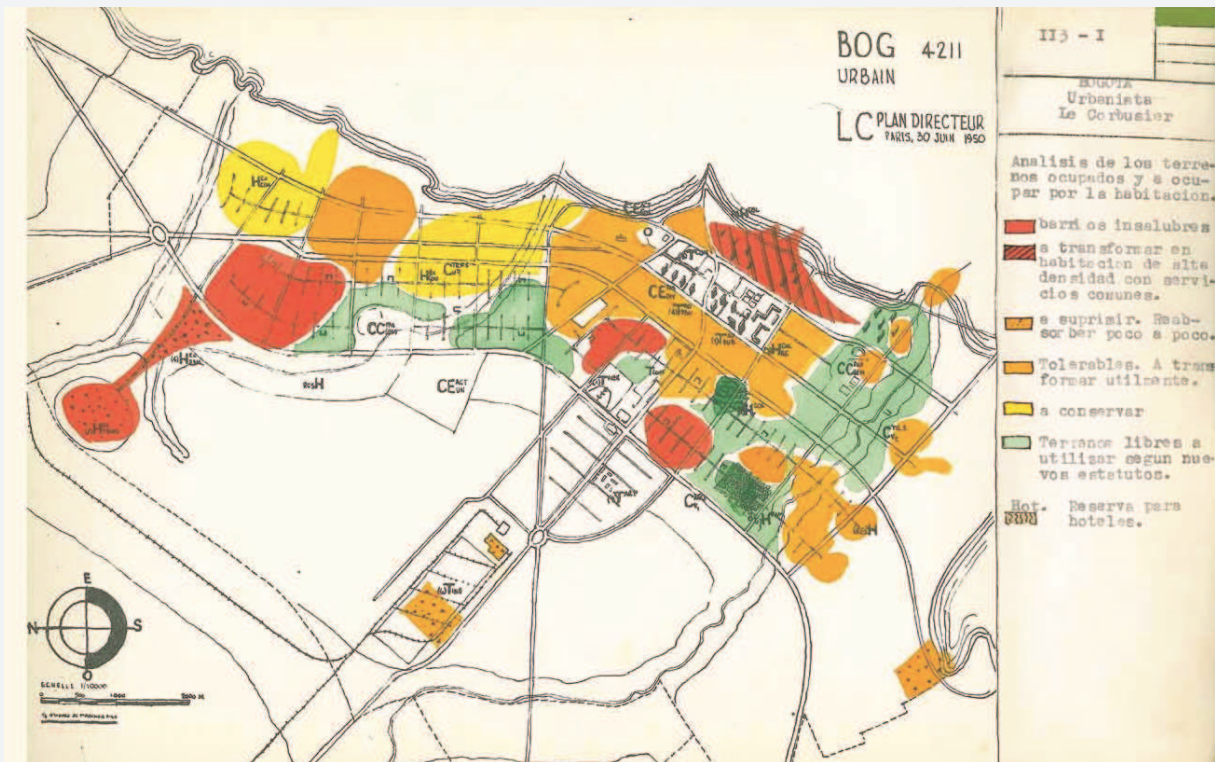
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



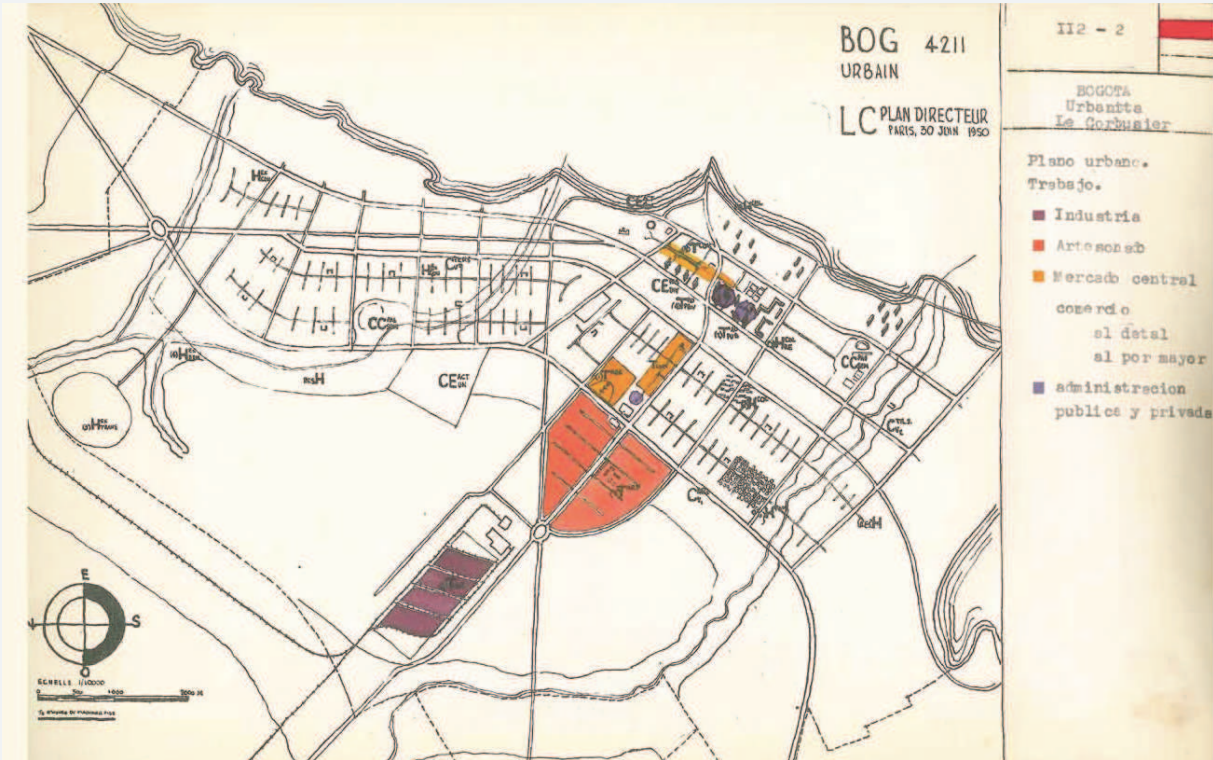
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



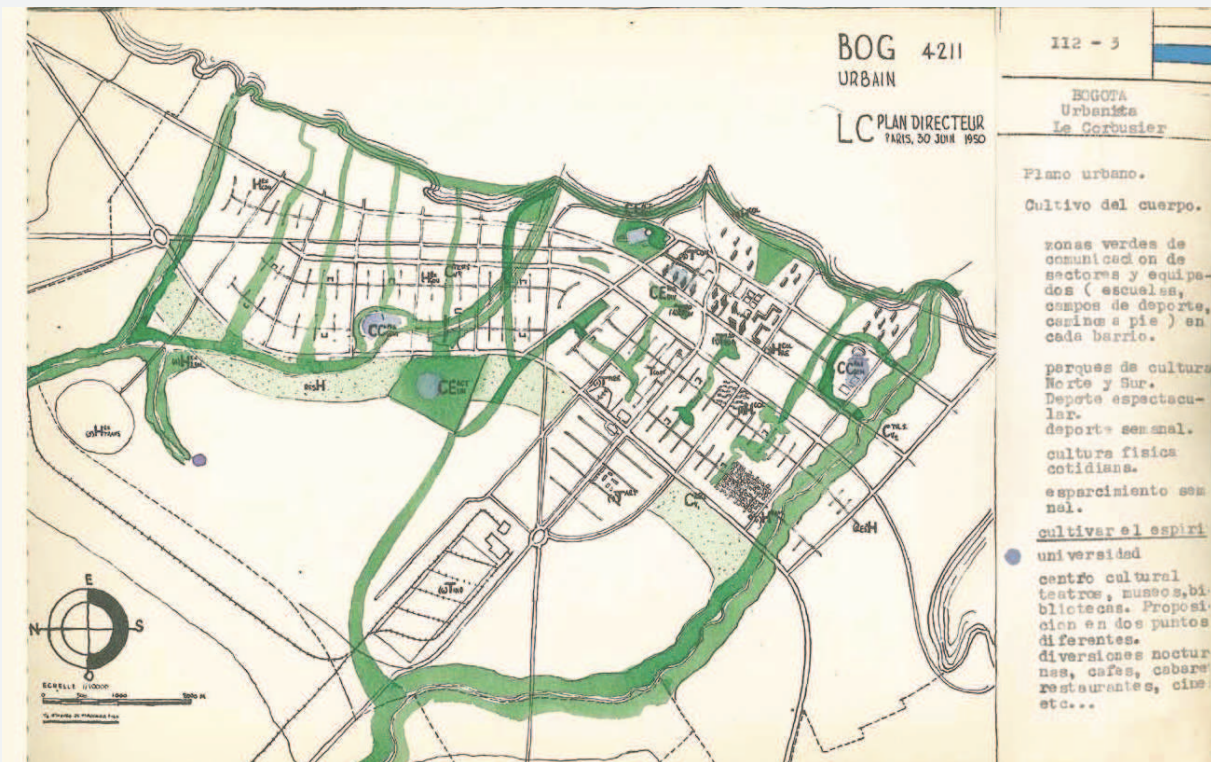




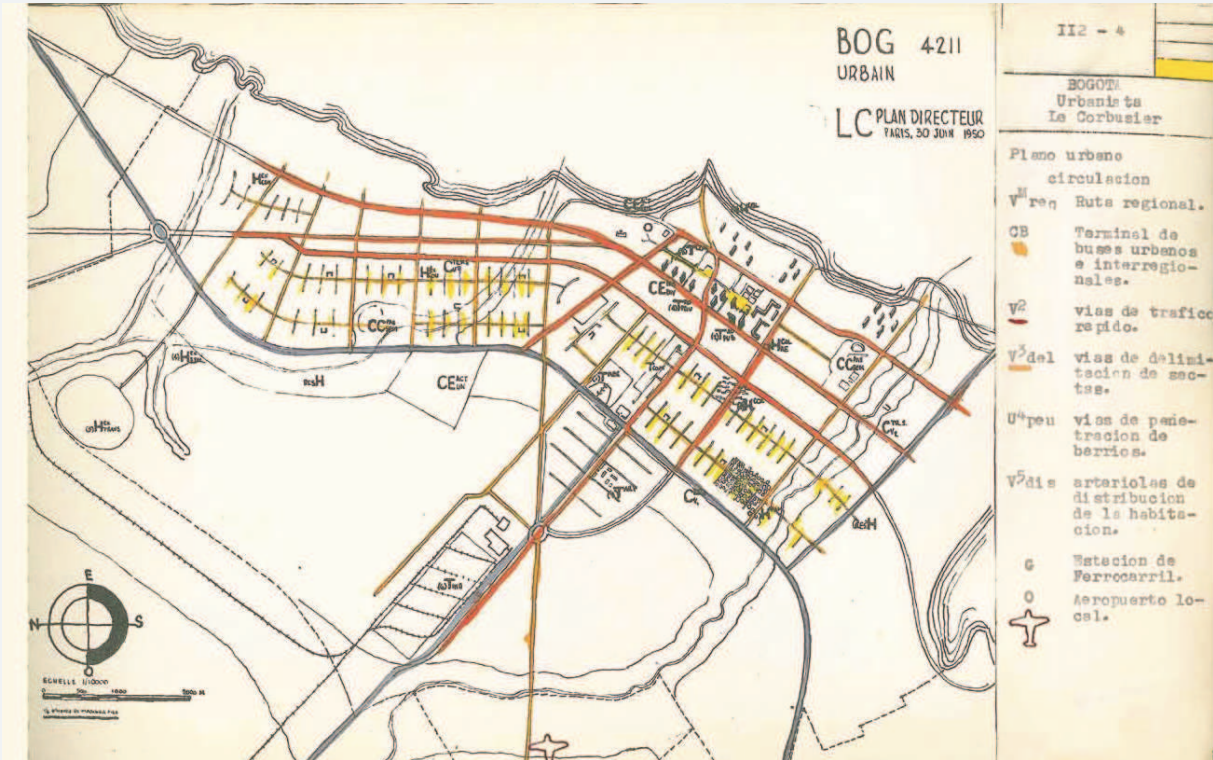
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



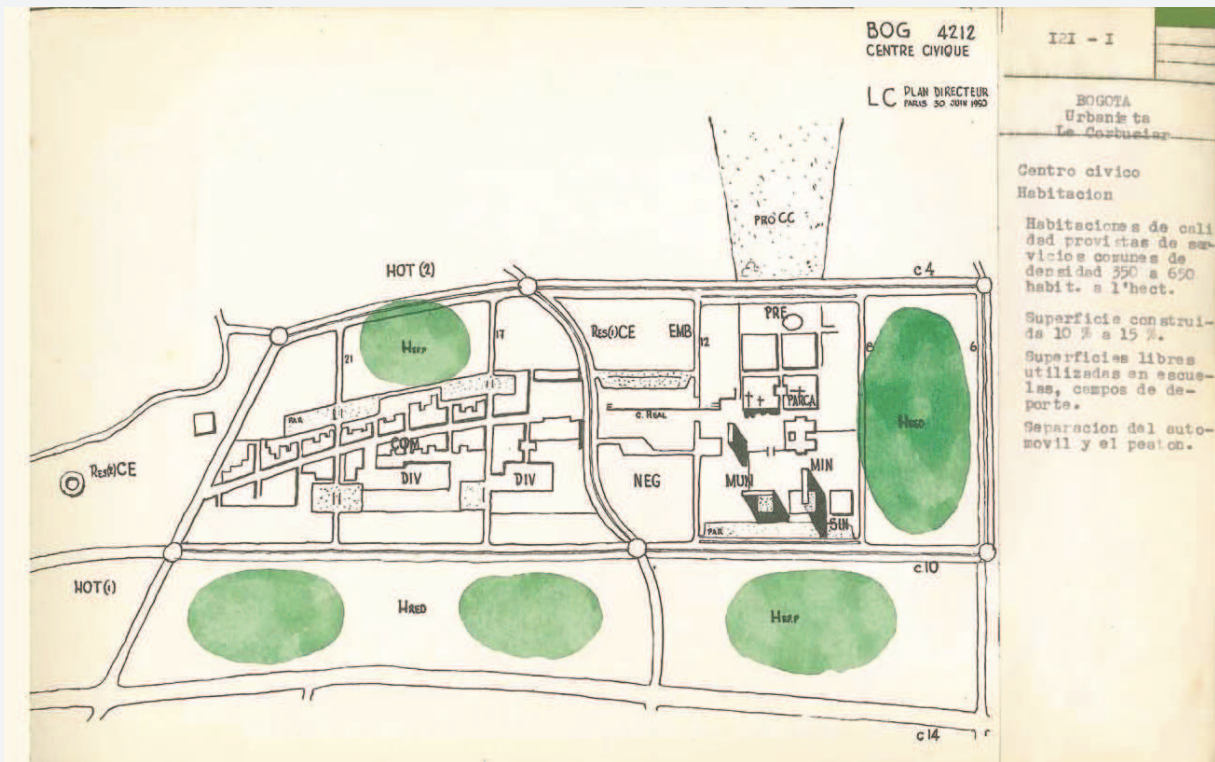
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



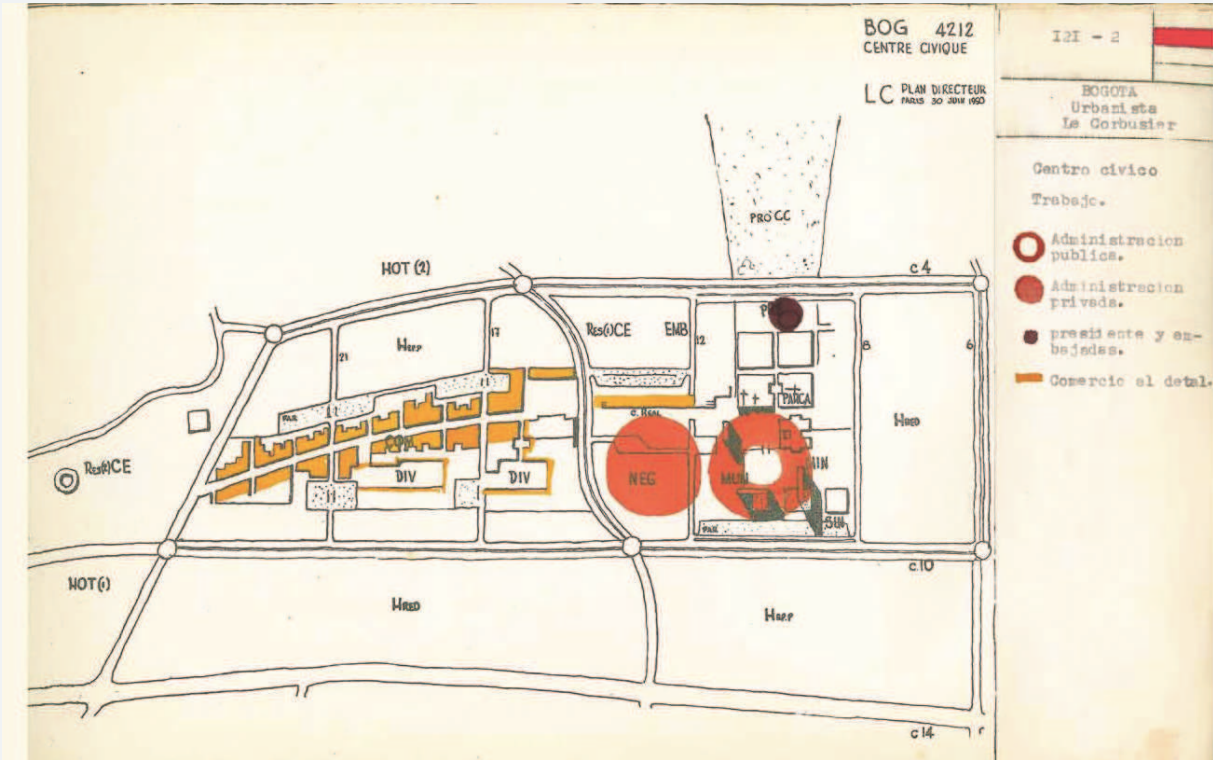
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



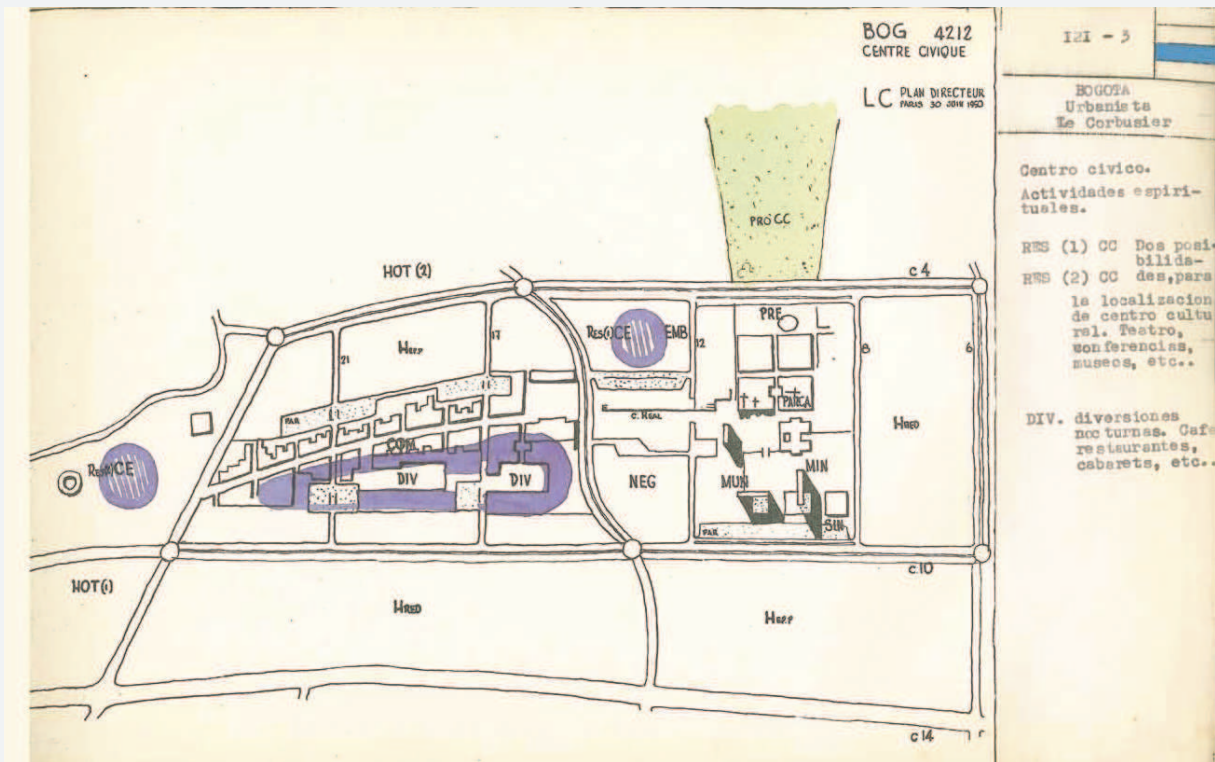
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



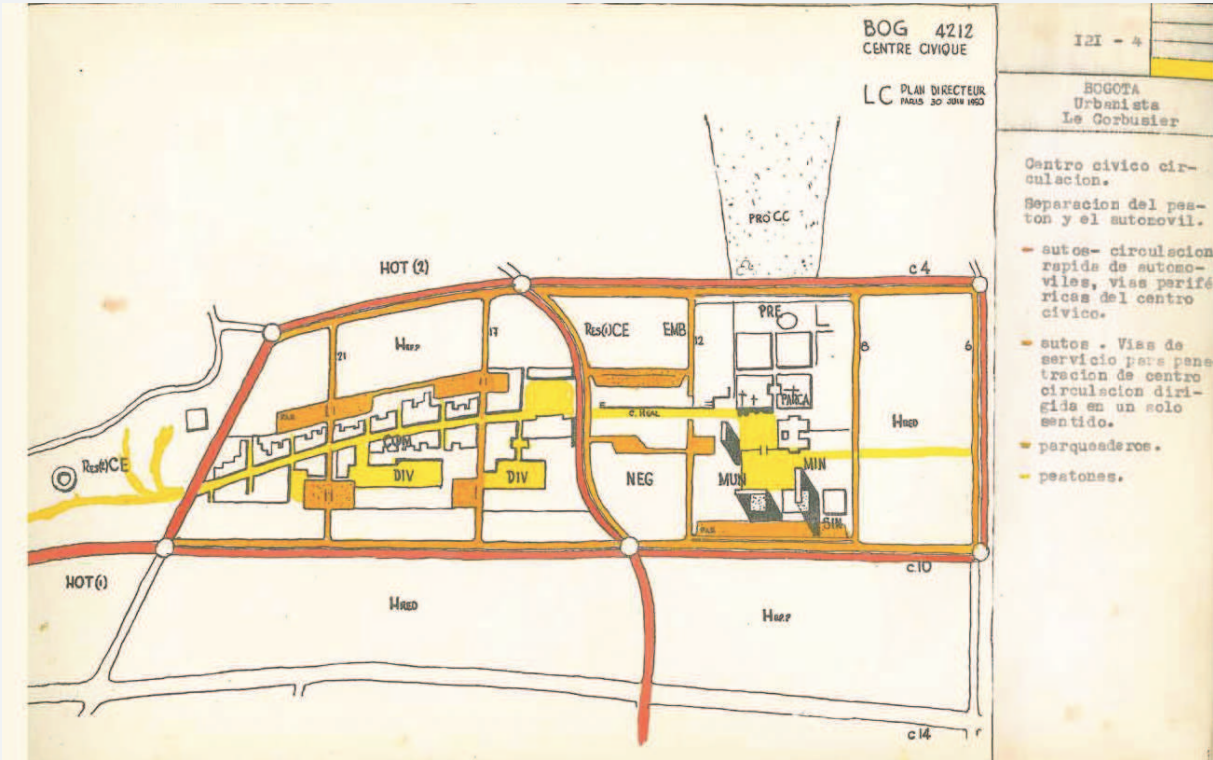
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

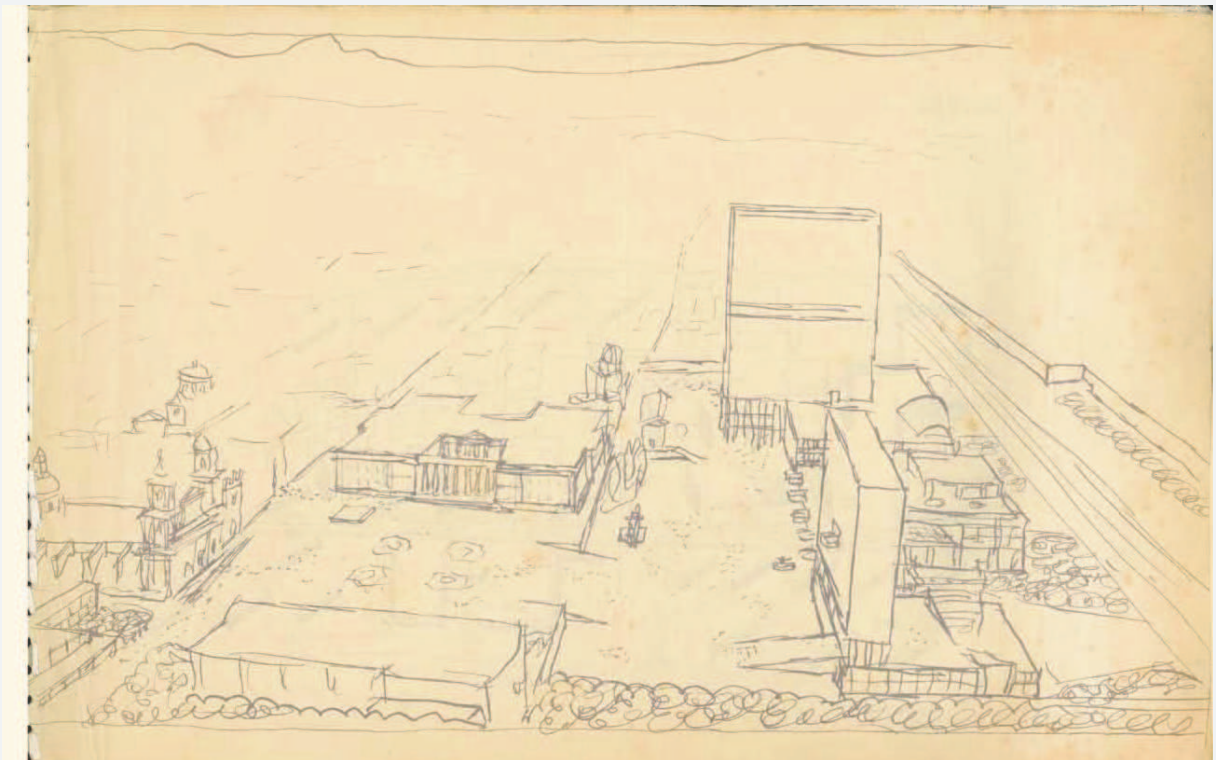


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

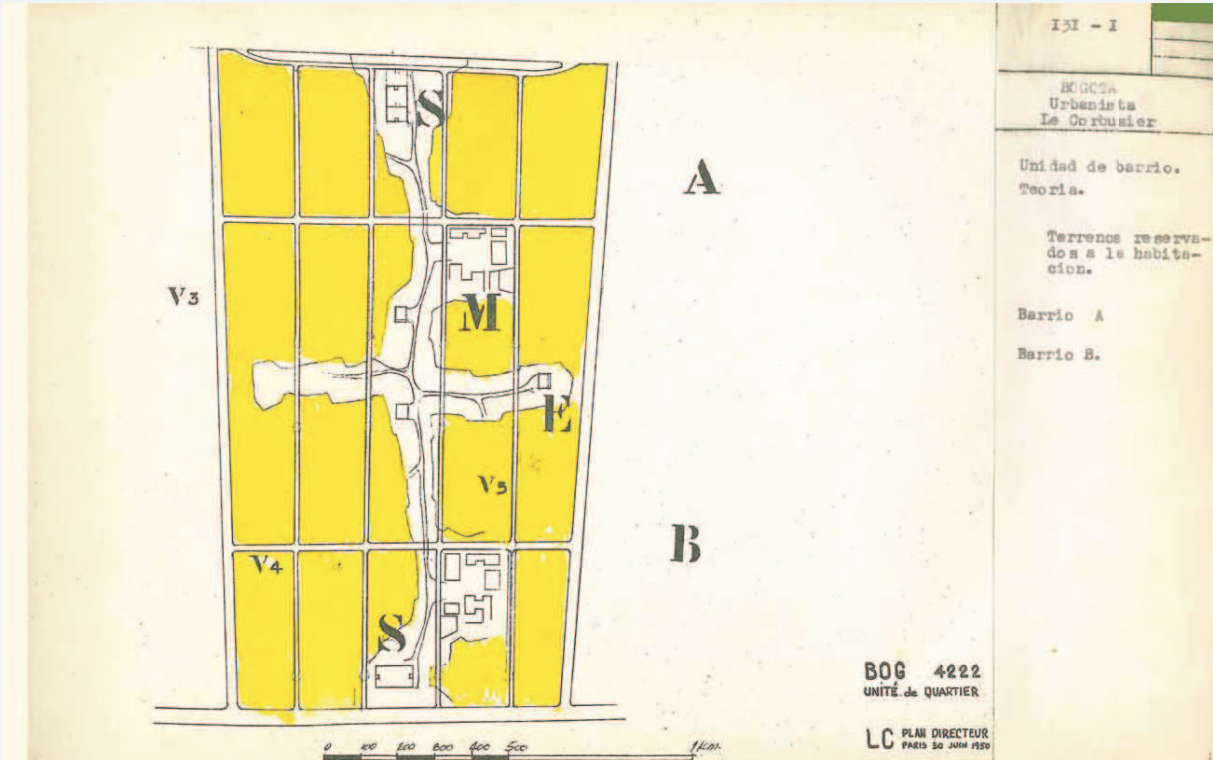


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

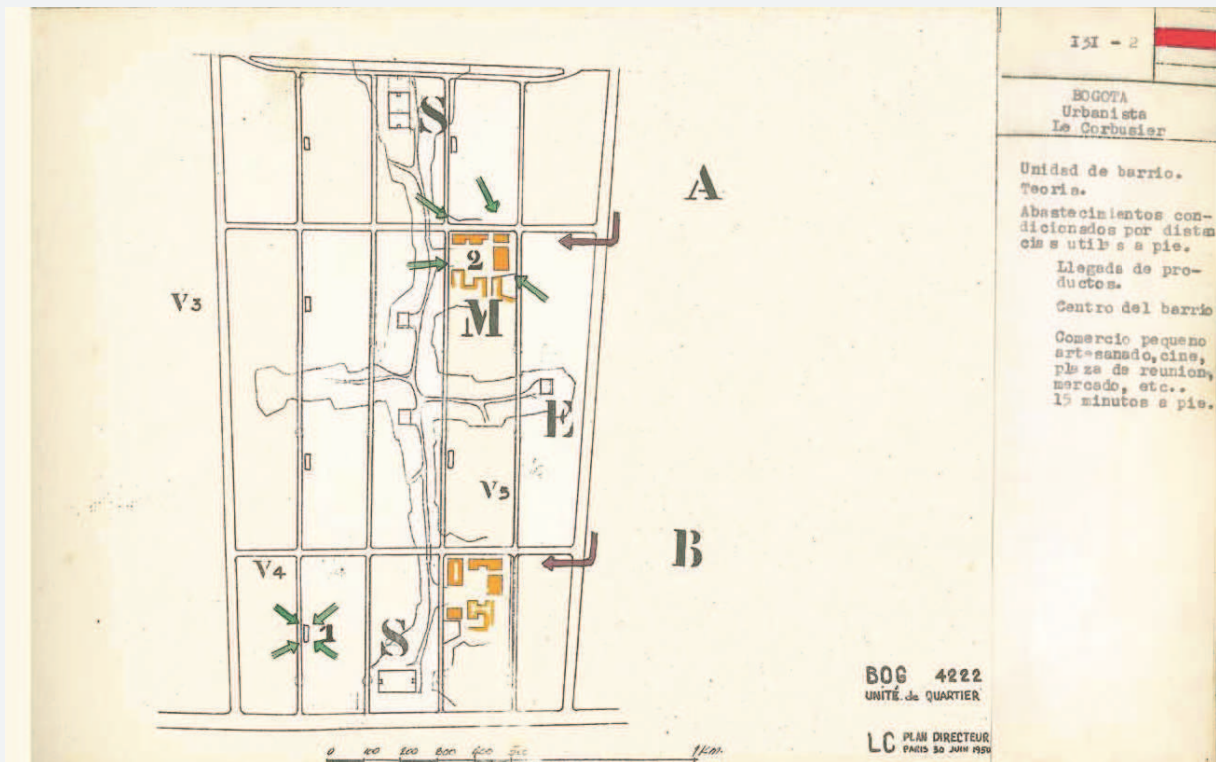


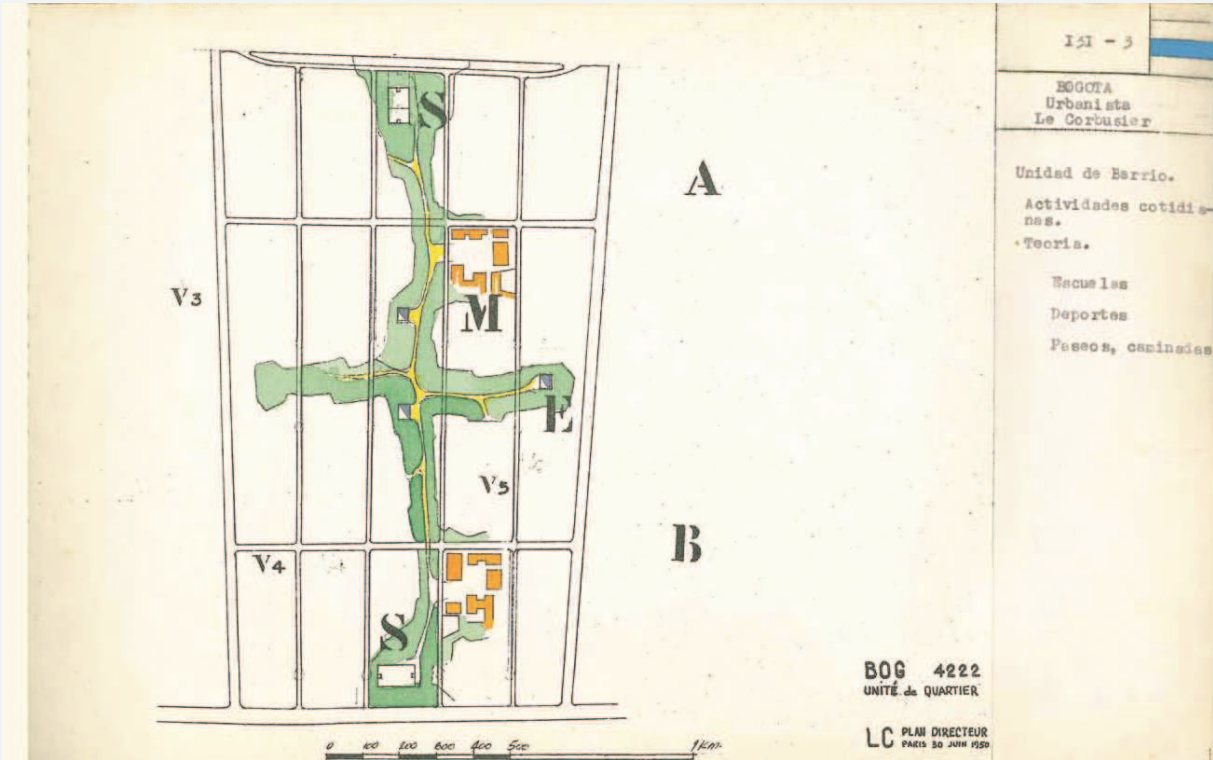


**Plan Piloto for Bogota 1951**  
Source: Fondation Le Corbusier

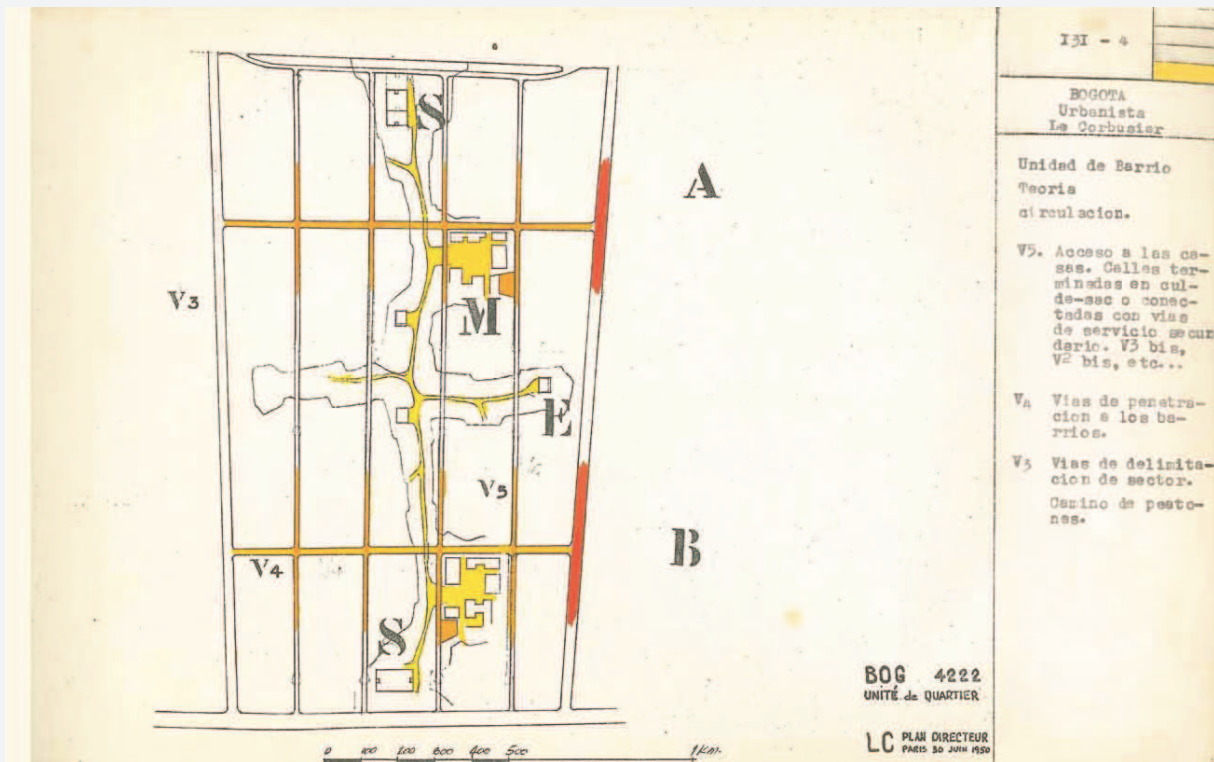


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

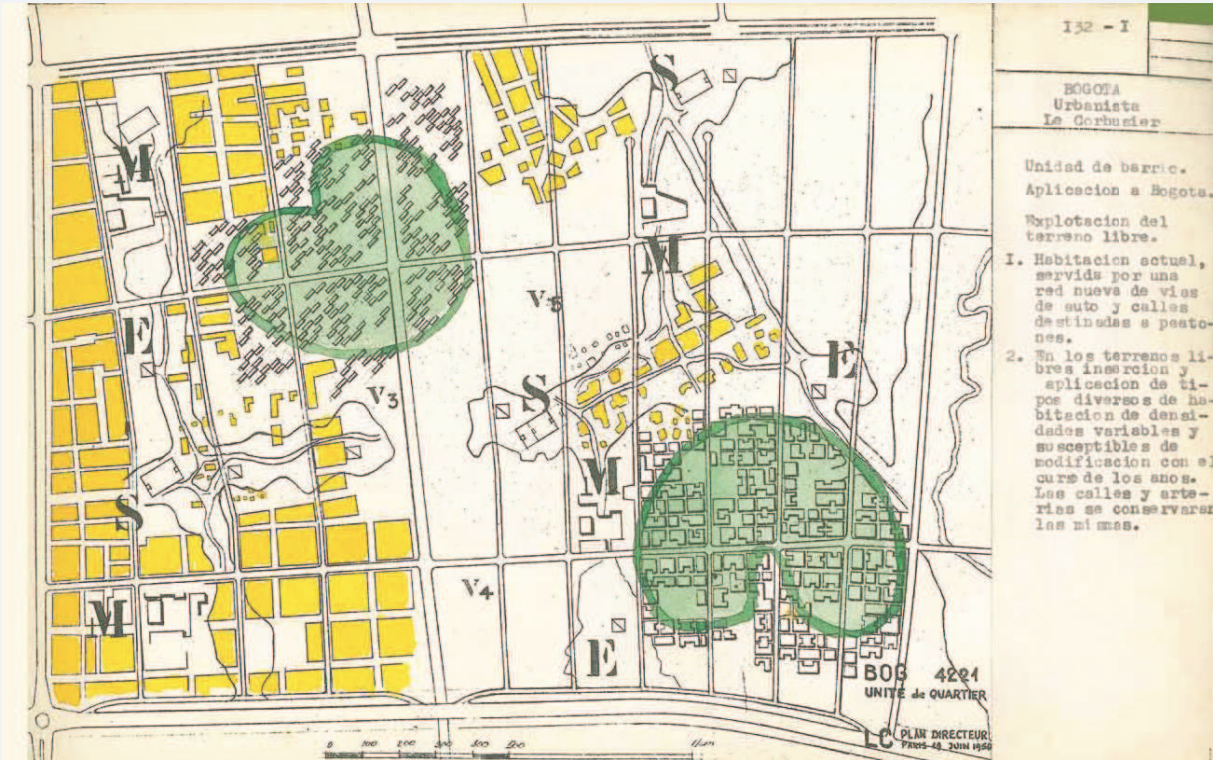




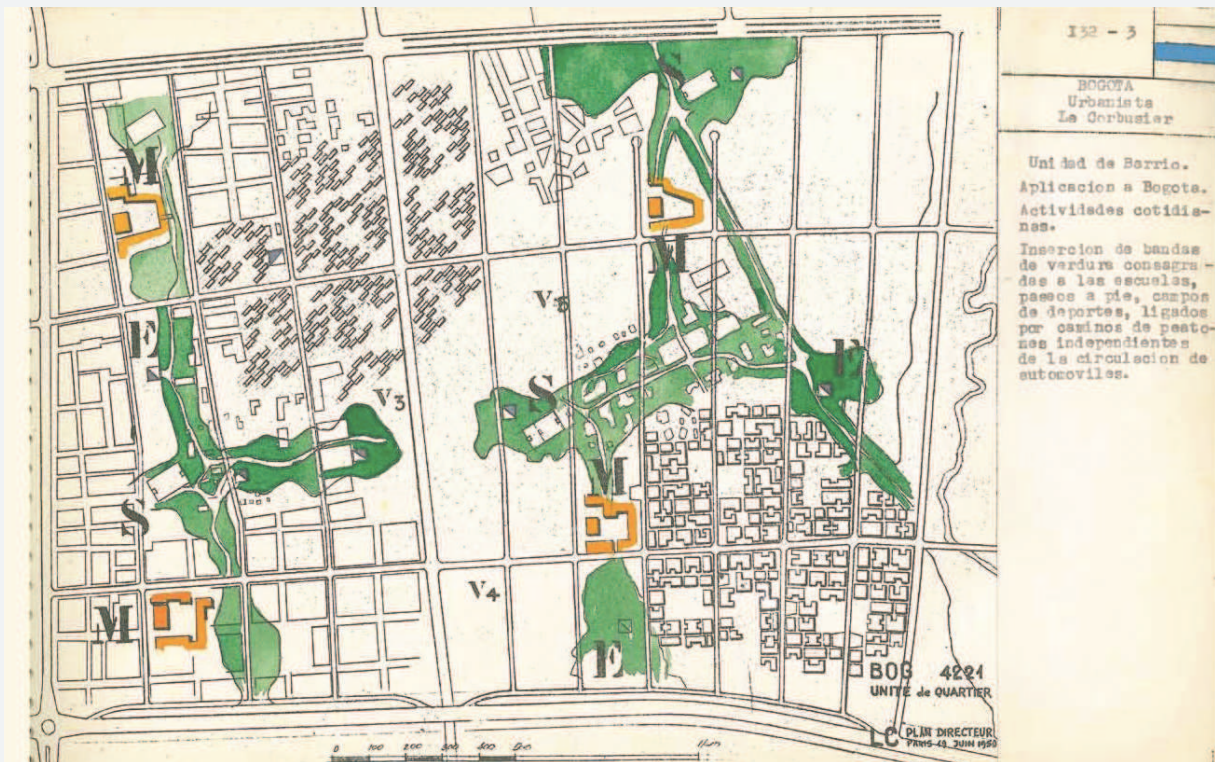
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



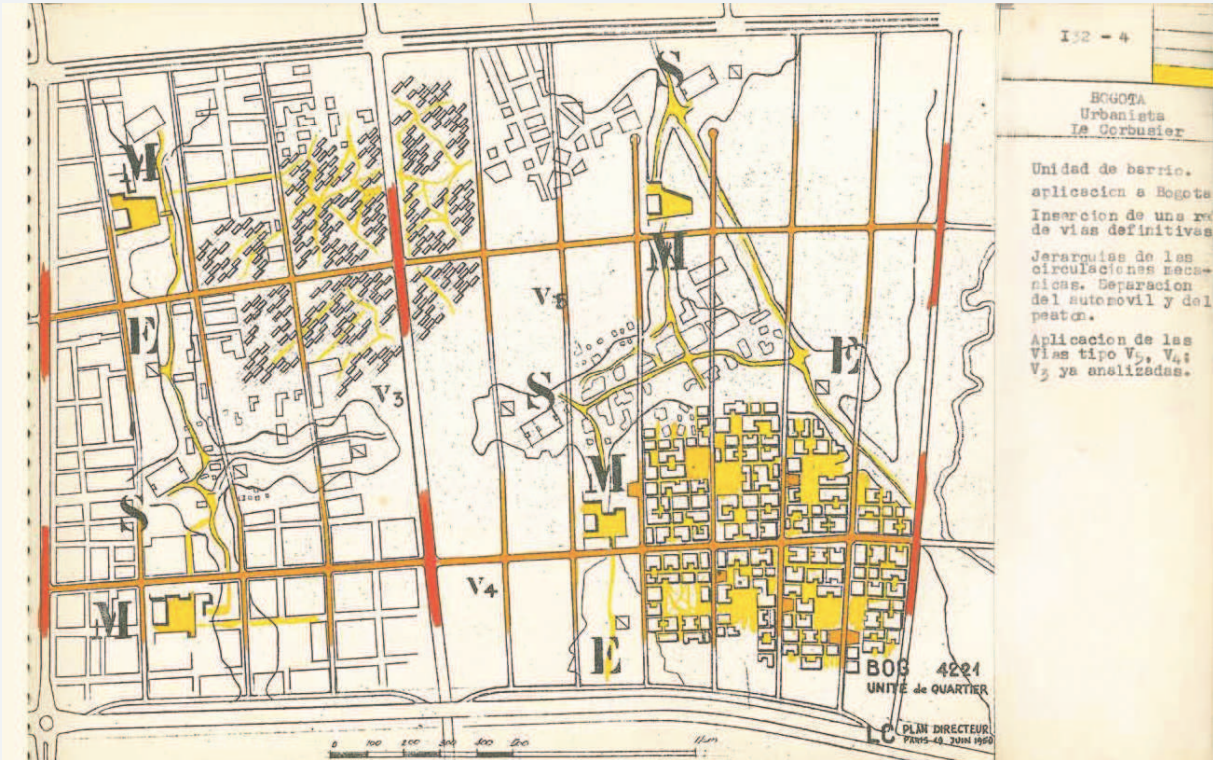
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

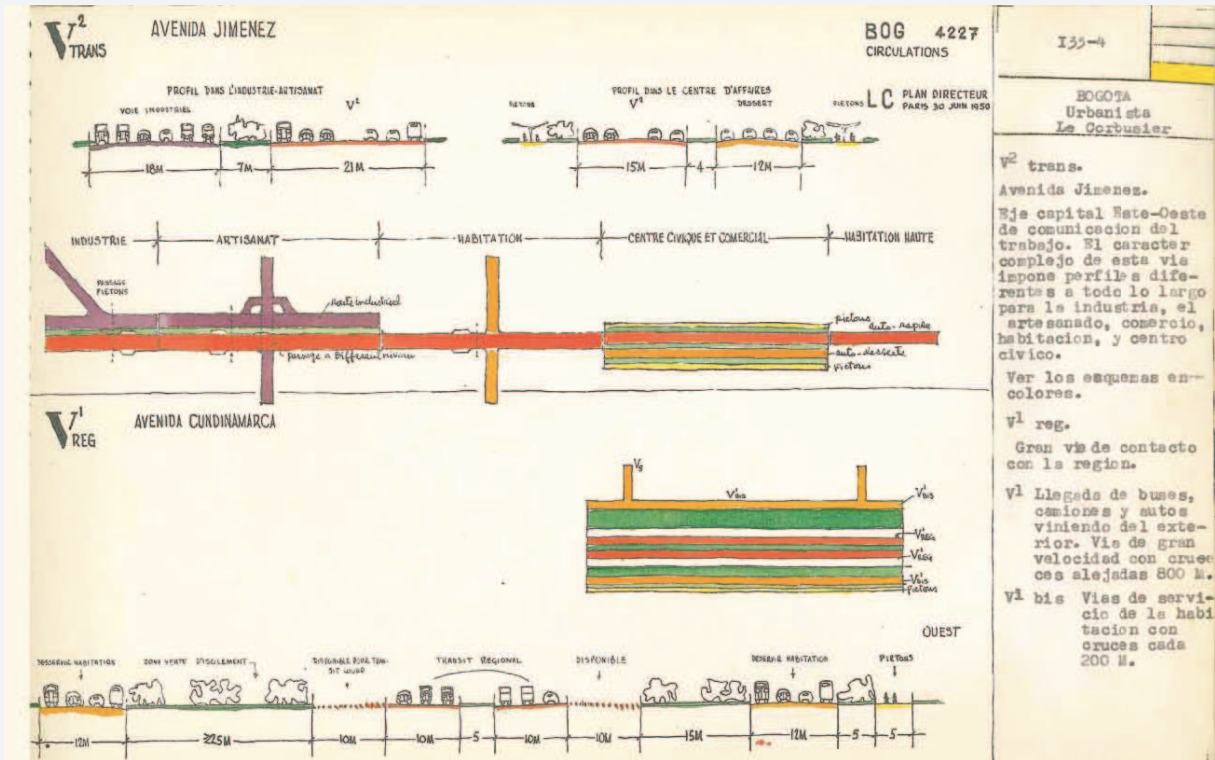


Plan Piloto for Bogotá 1951  
Source: Fondation Le Corbusier

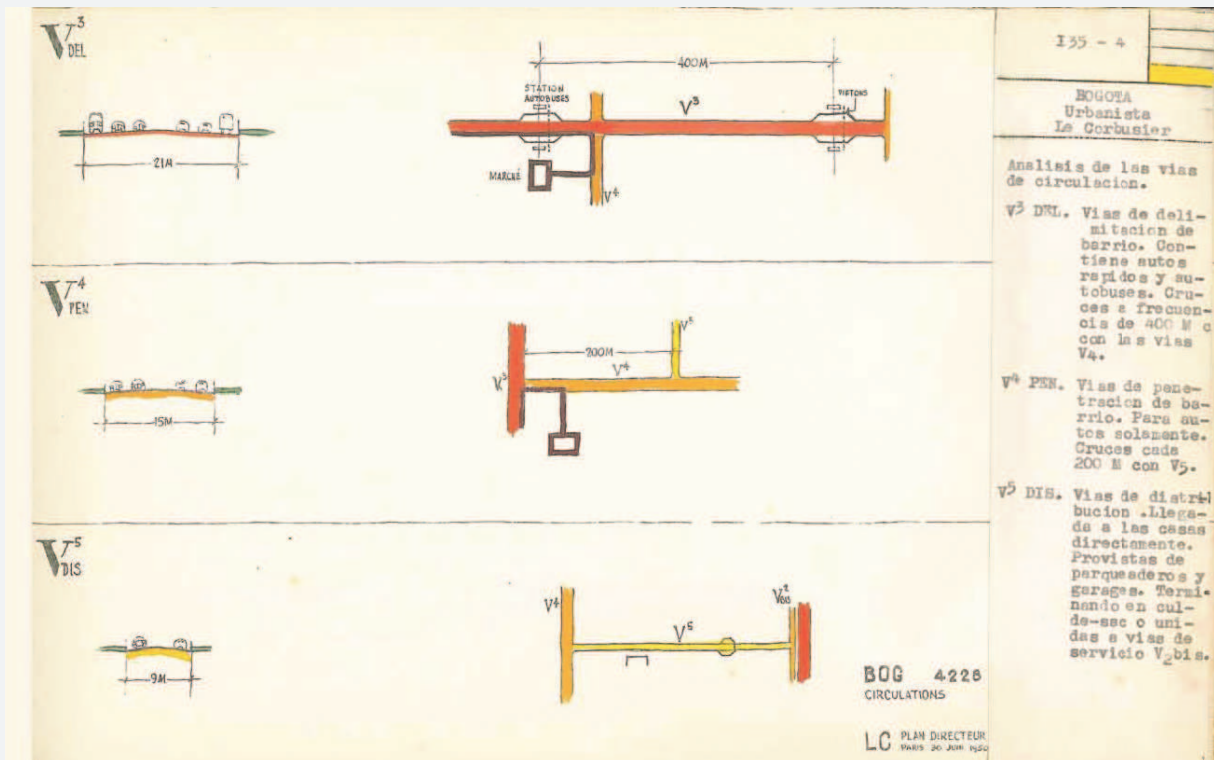


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

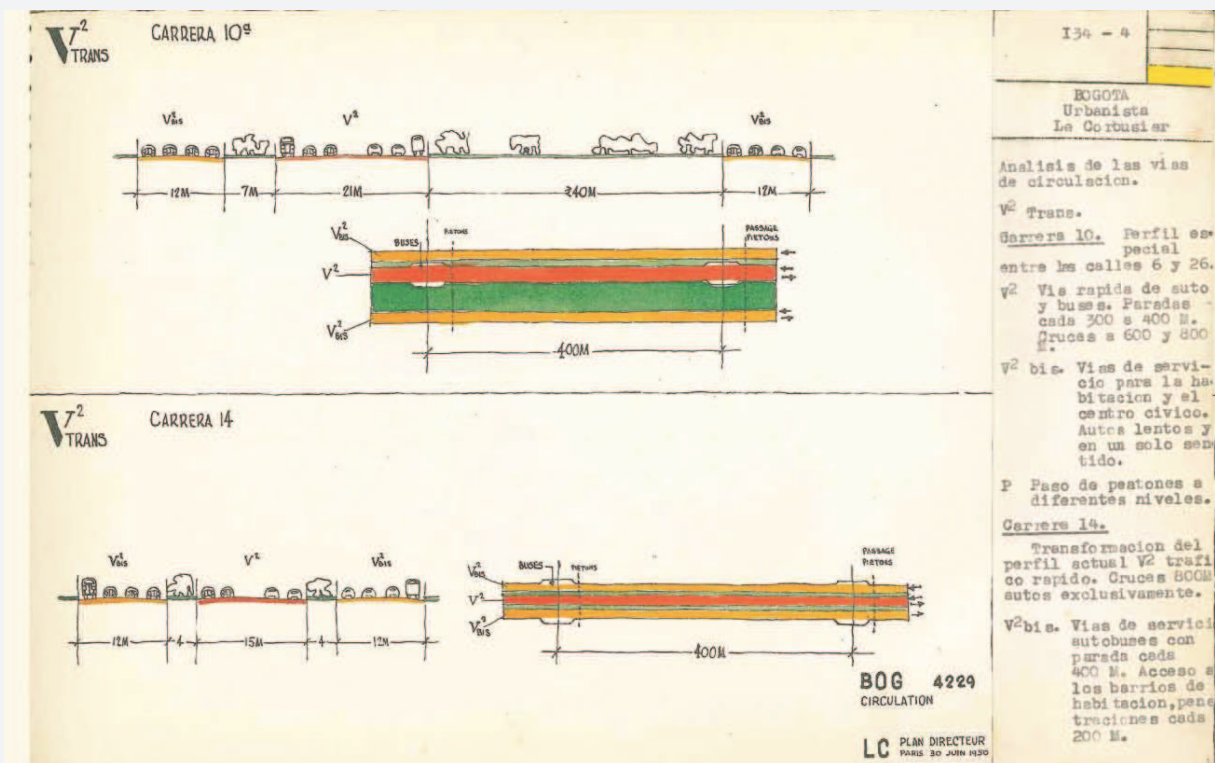


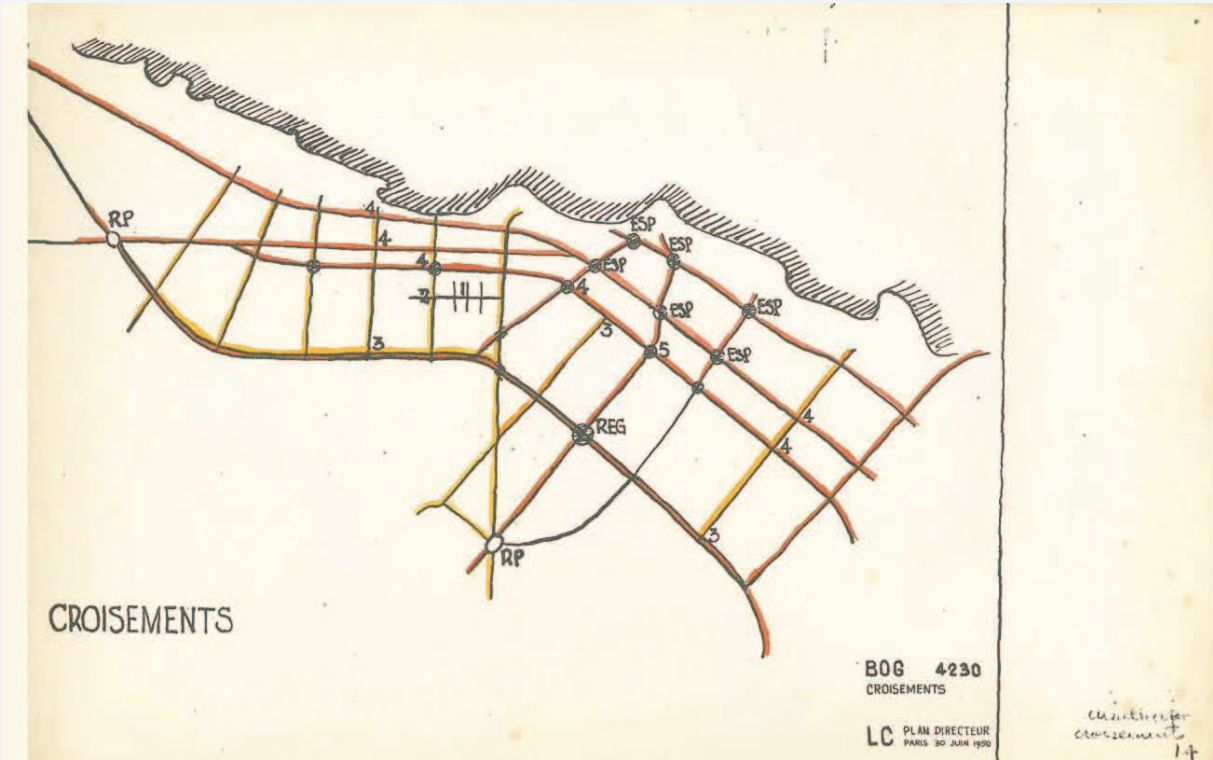


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

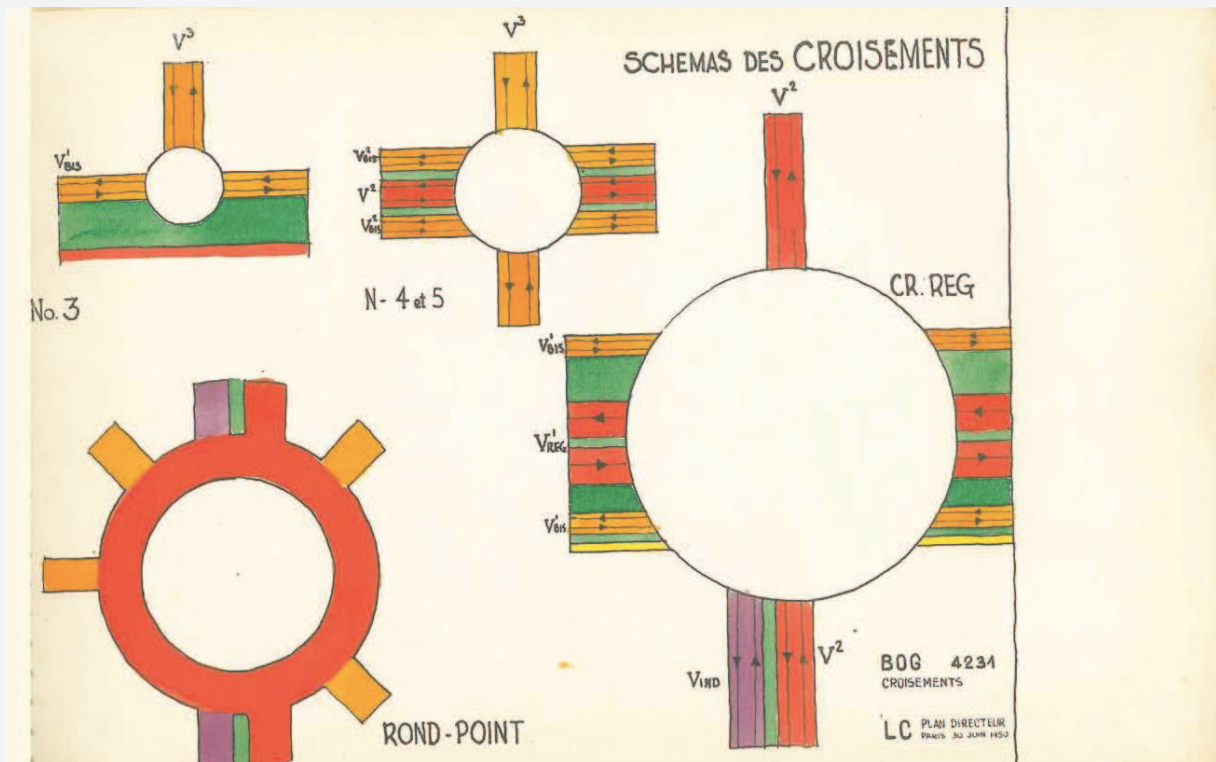


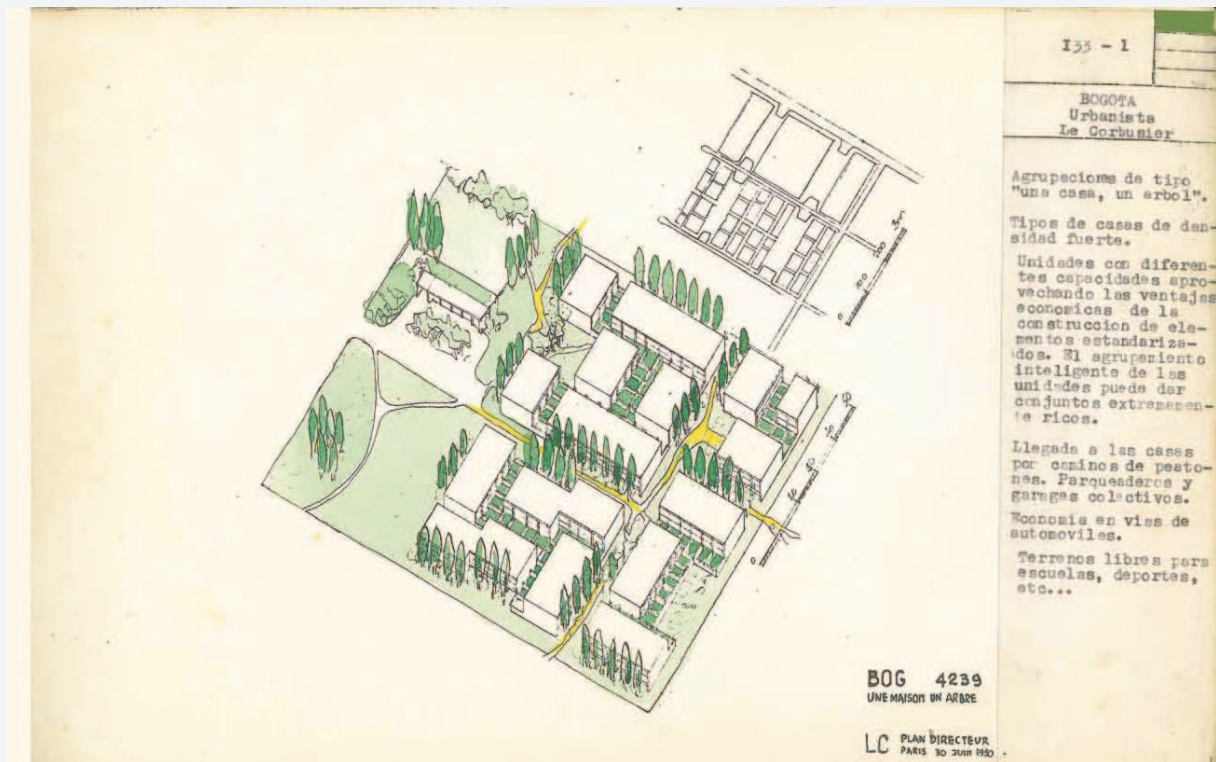
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



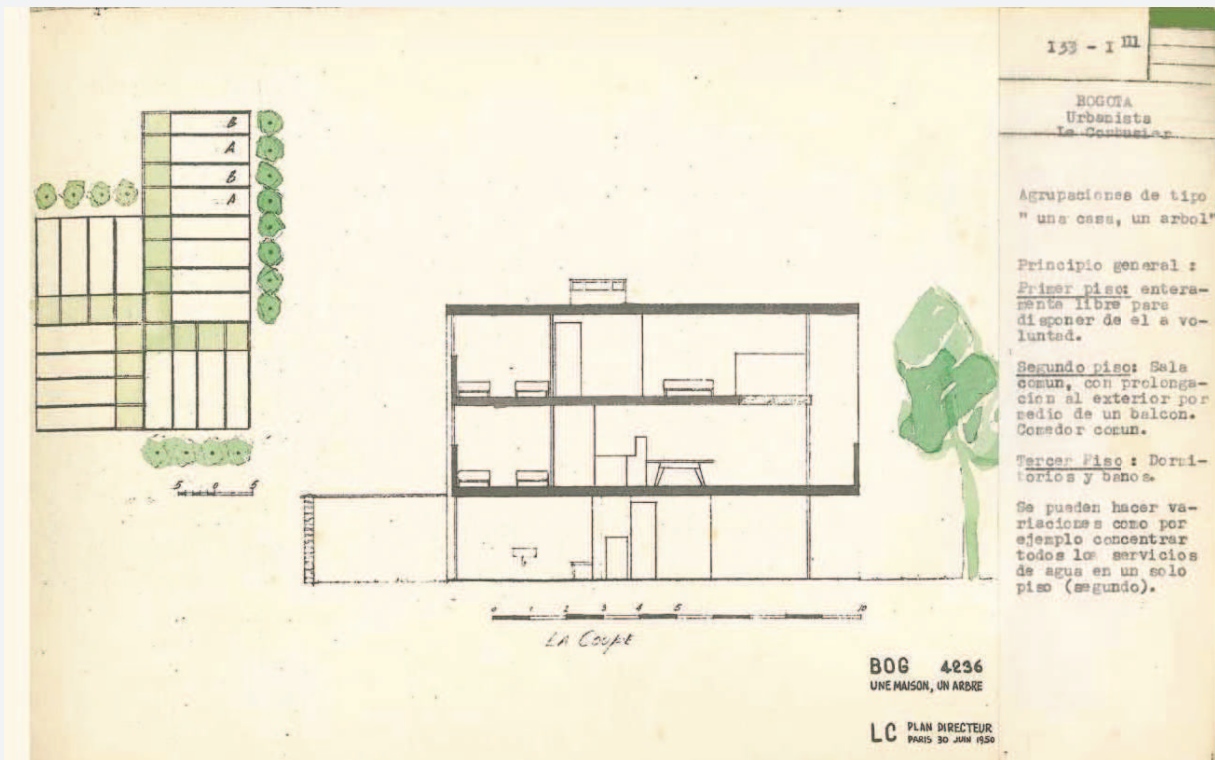


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

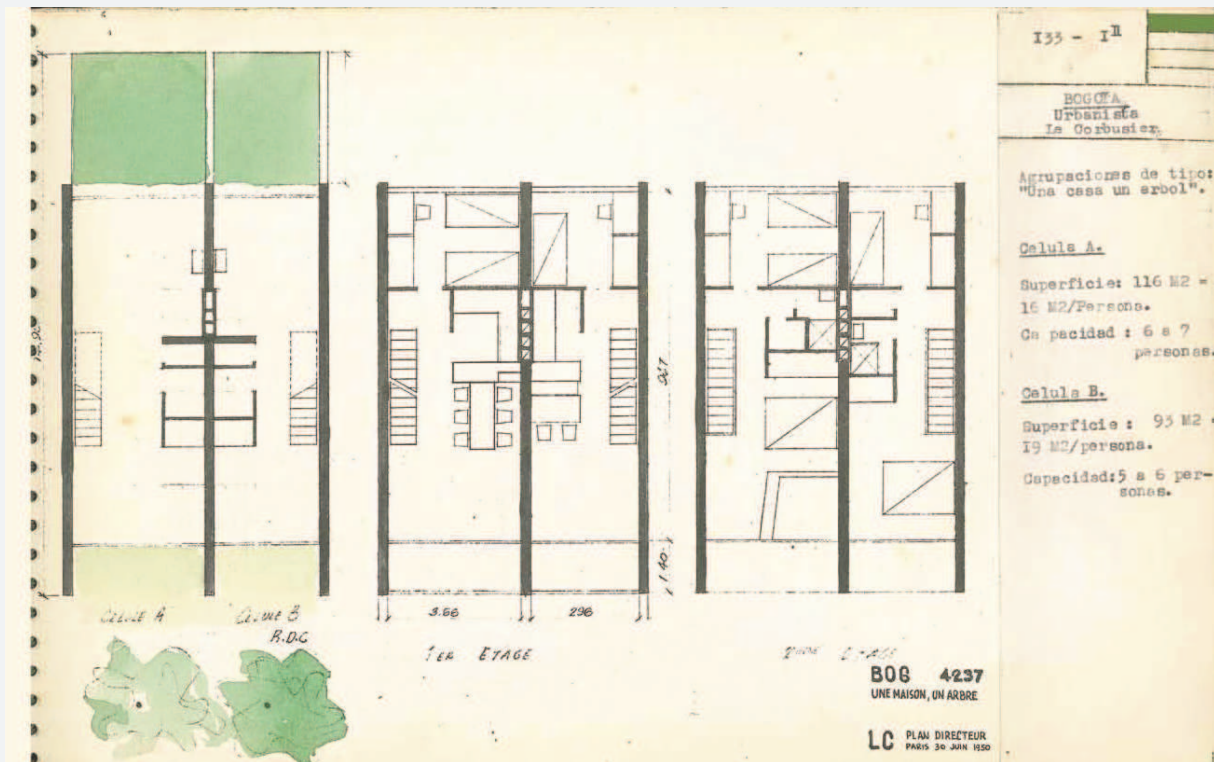




Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

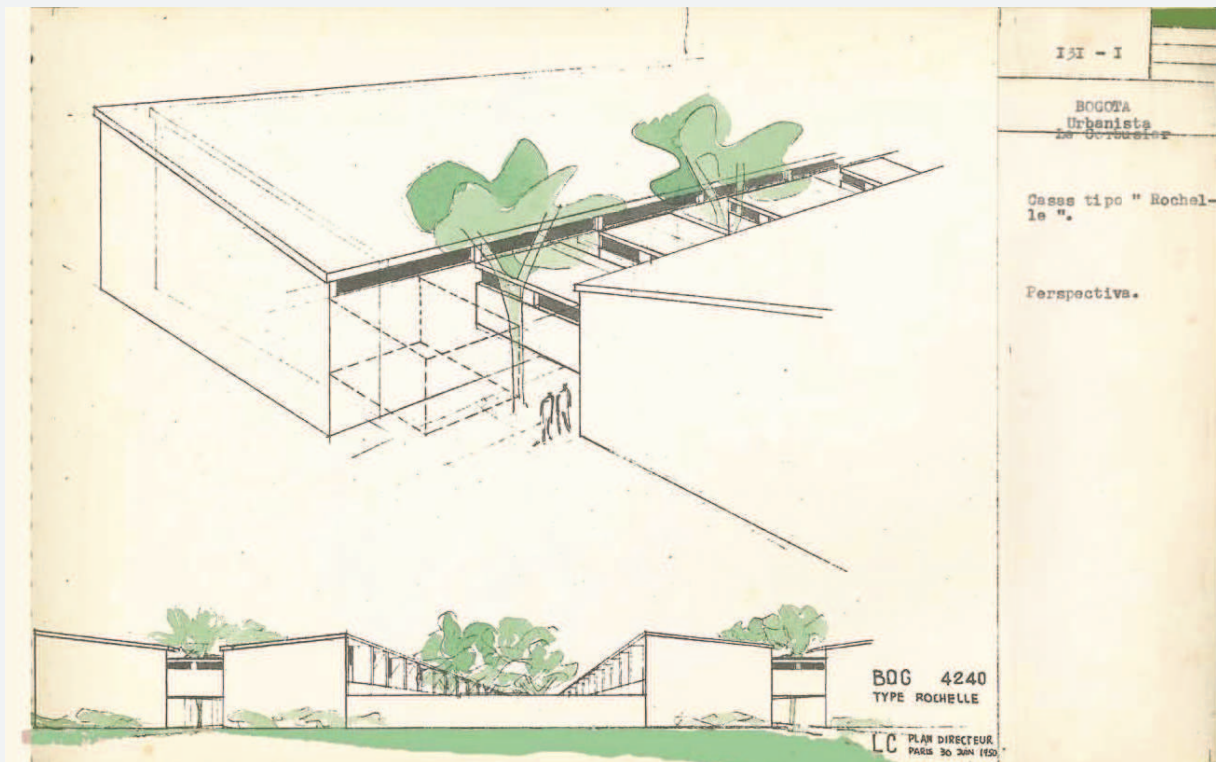


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



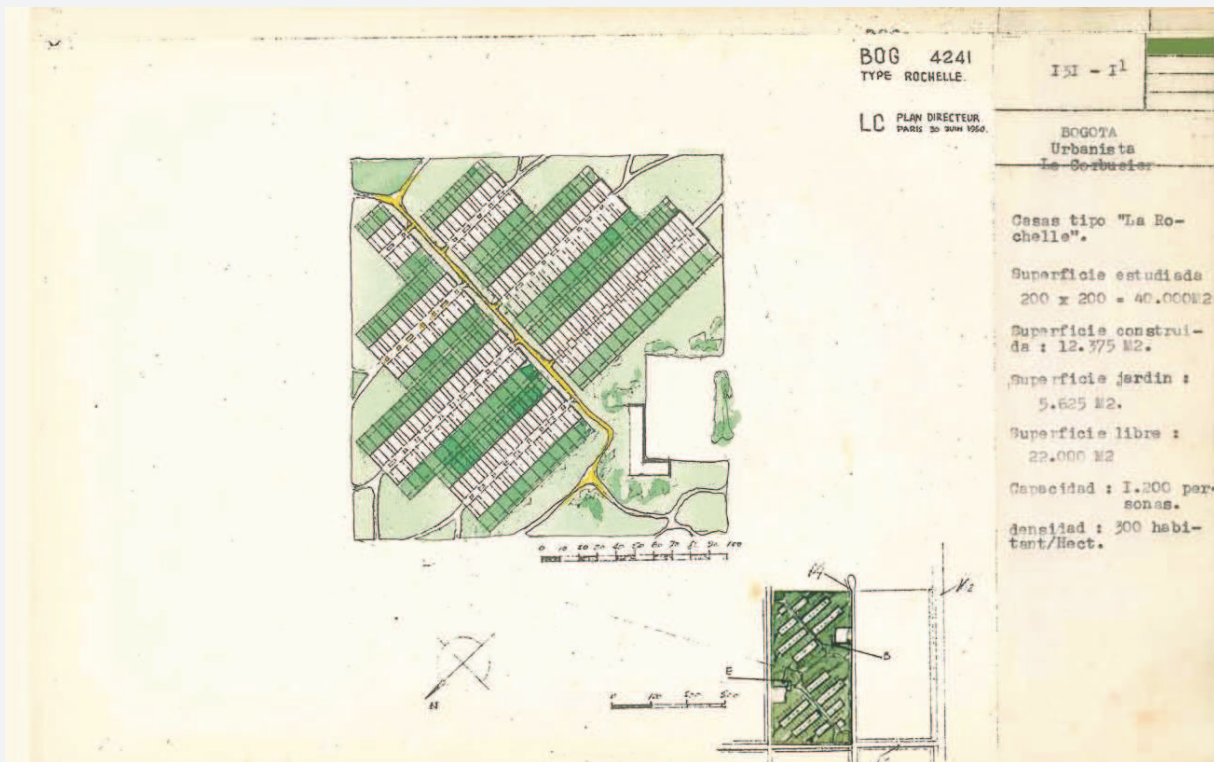
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



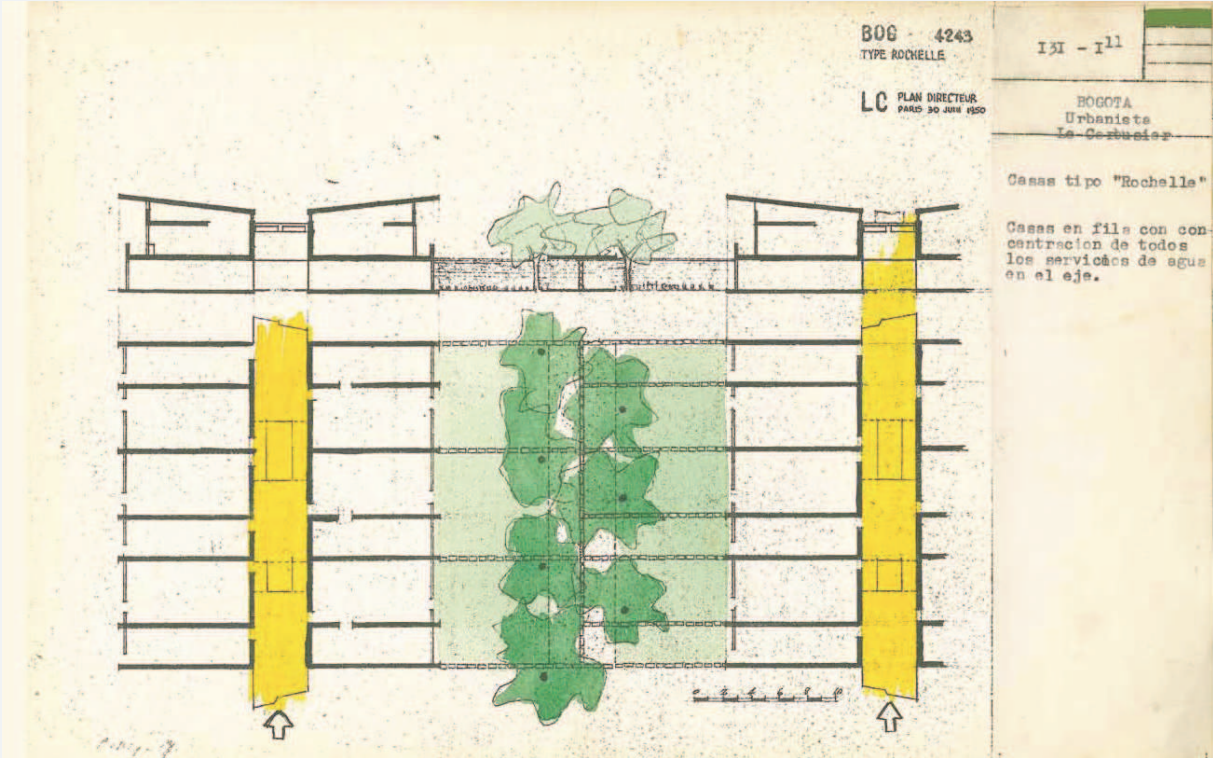




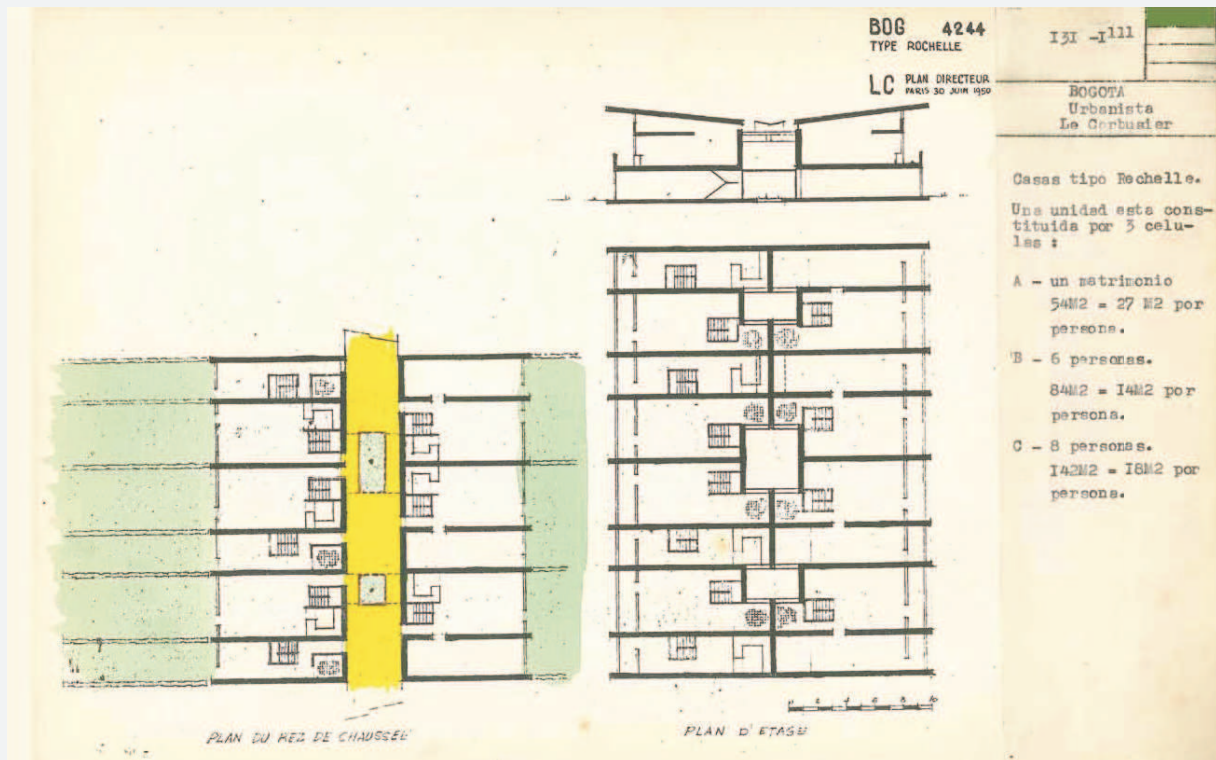
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



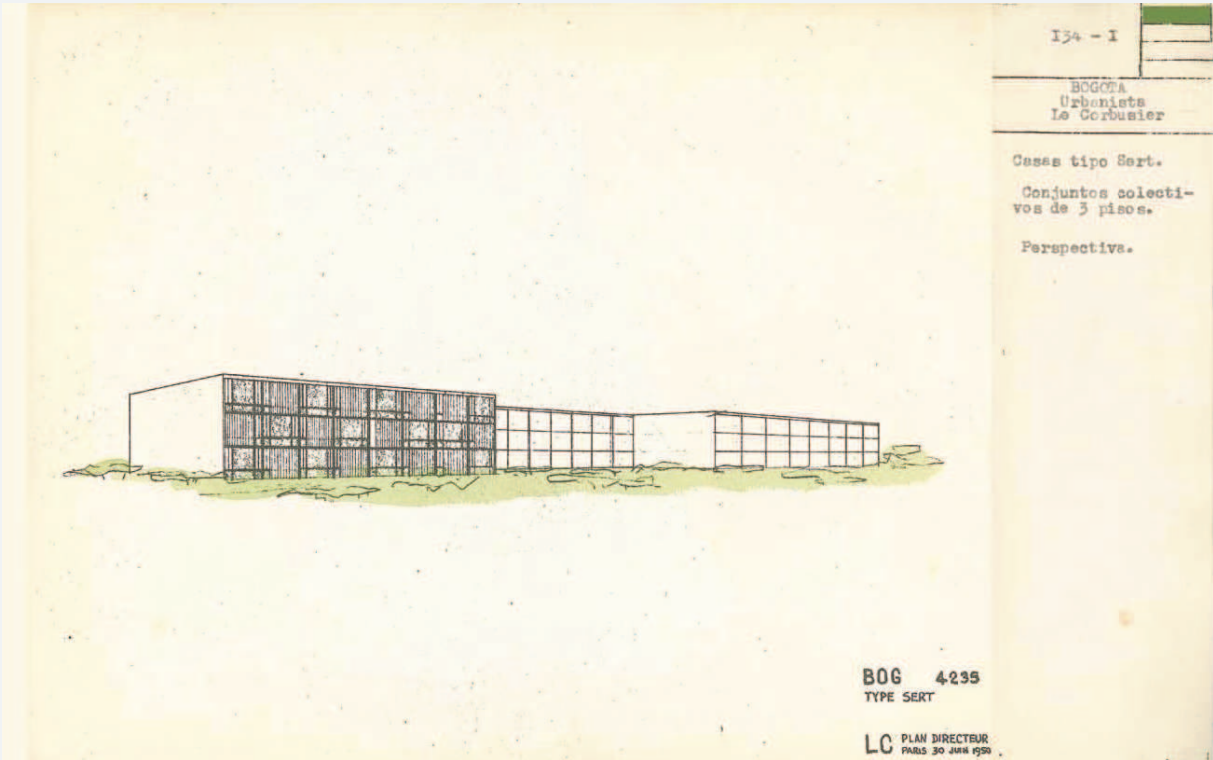
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



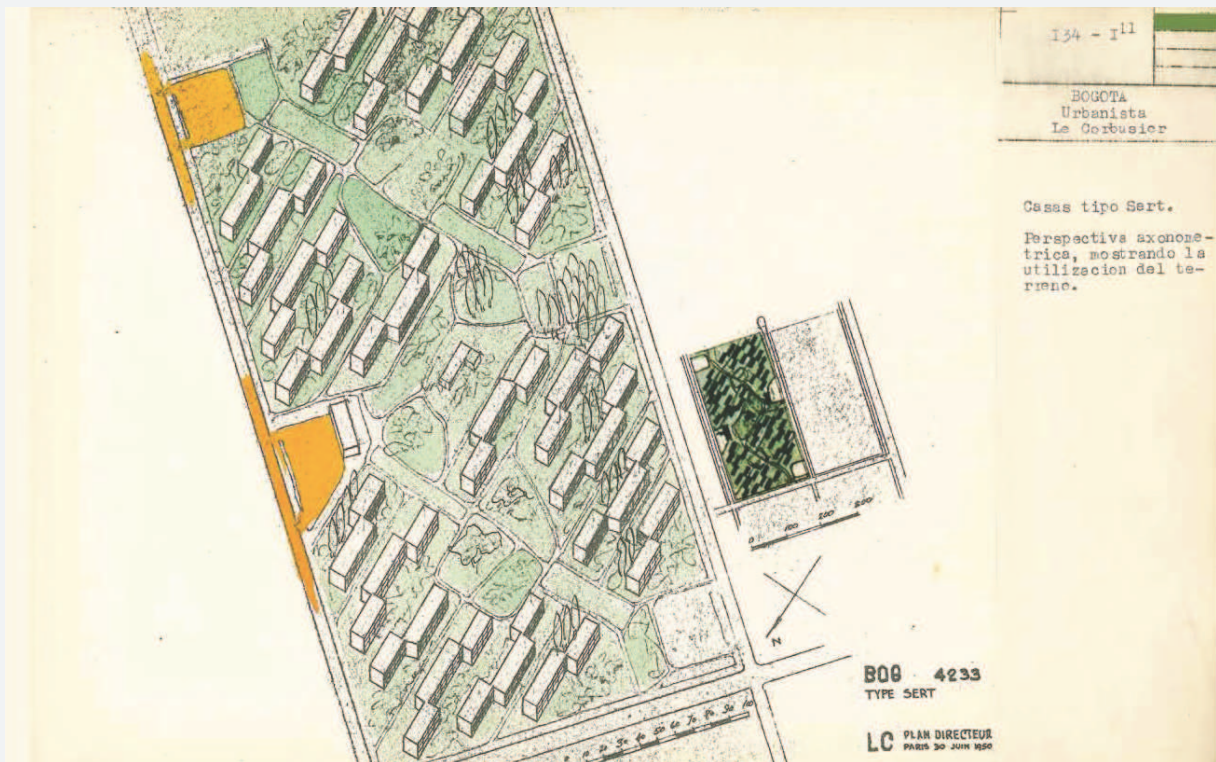
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



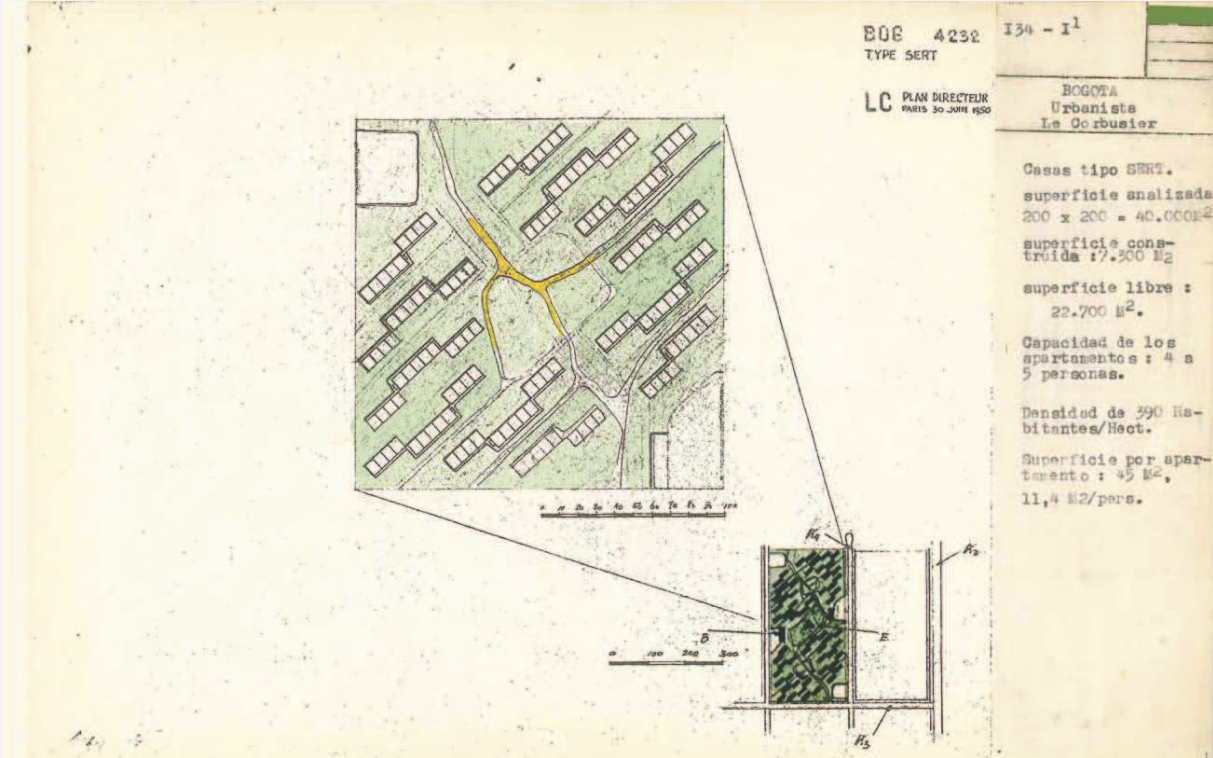
Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier

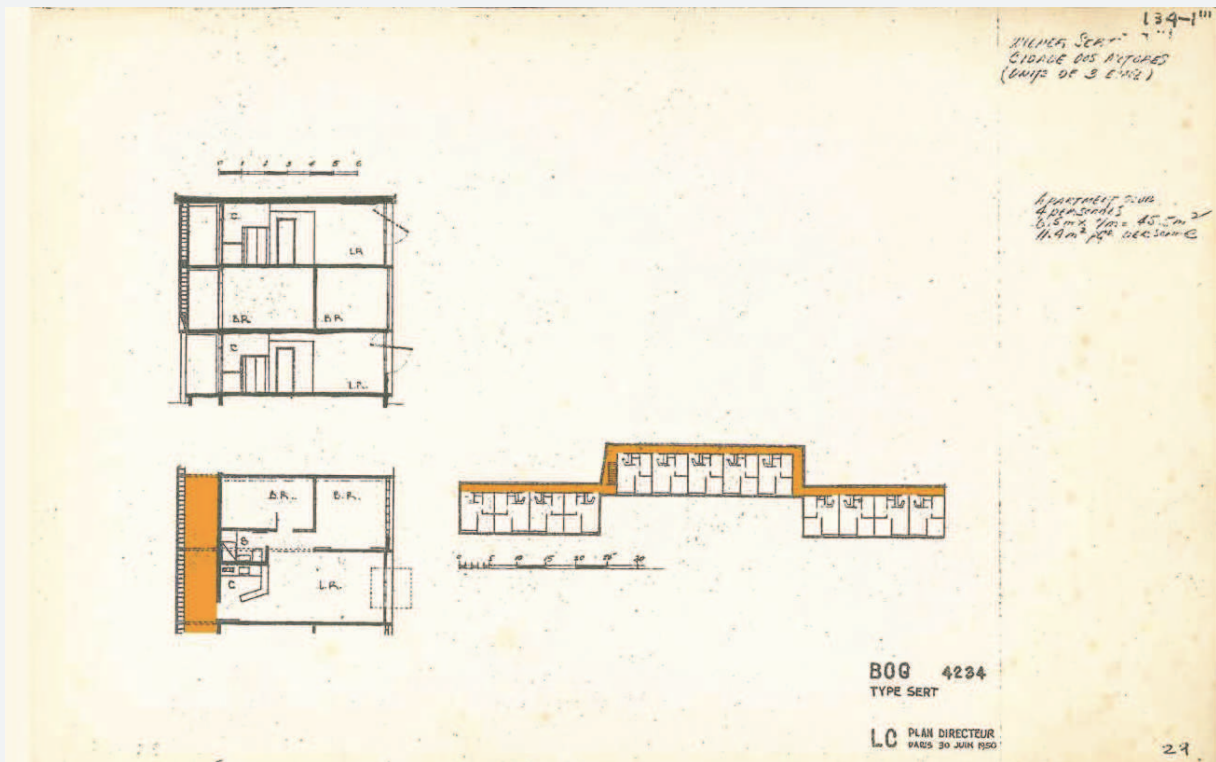


Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier



Plan Piloto for Bogota 1951  
Source: Fondation Le Corbusier







**Plan de Ordenamiento Territorial, Secretaria de Planeacion**

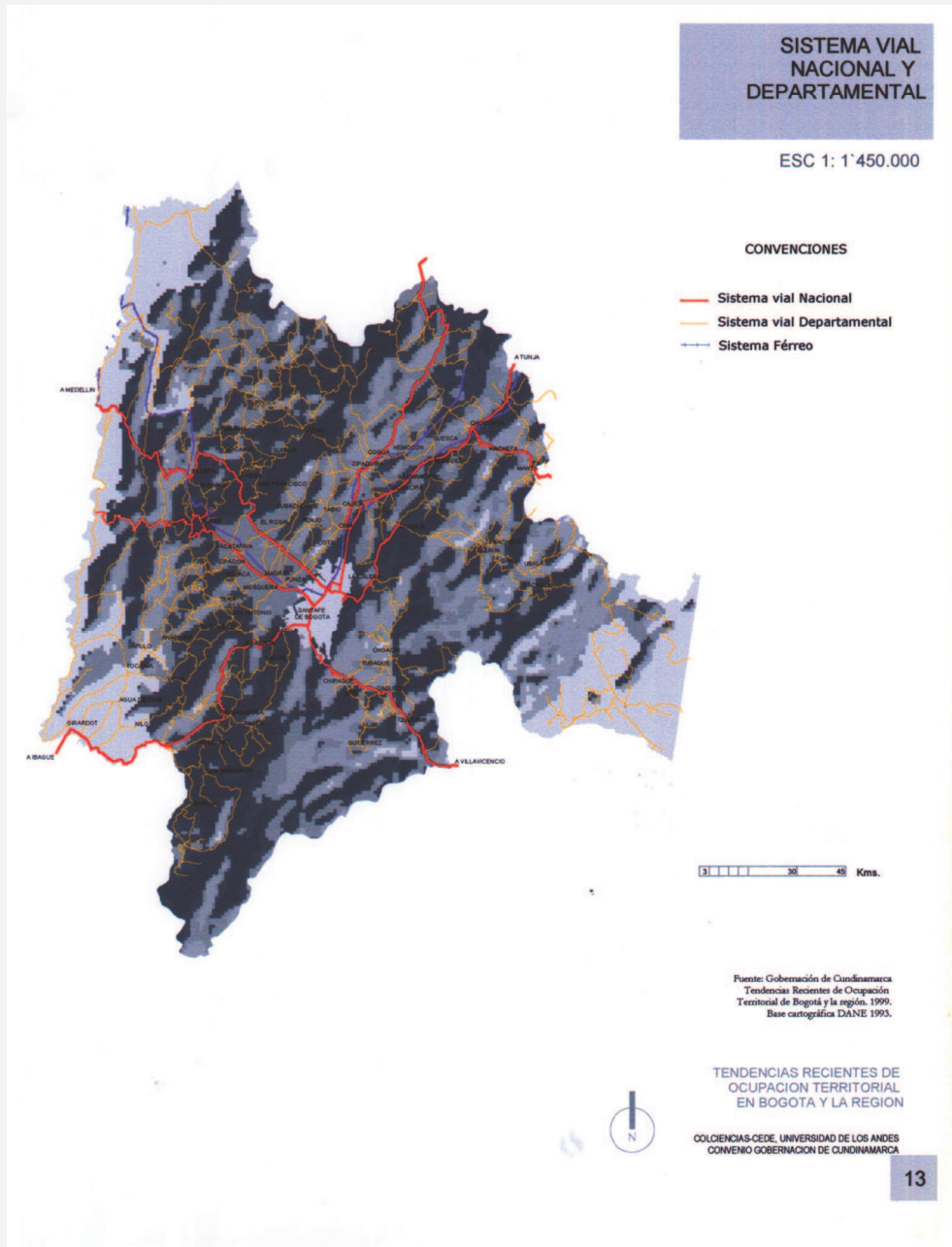


Chart 13 National and Territorial Roads System  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

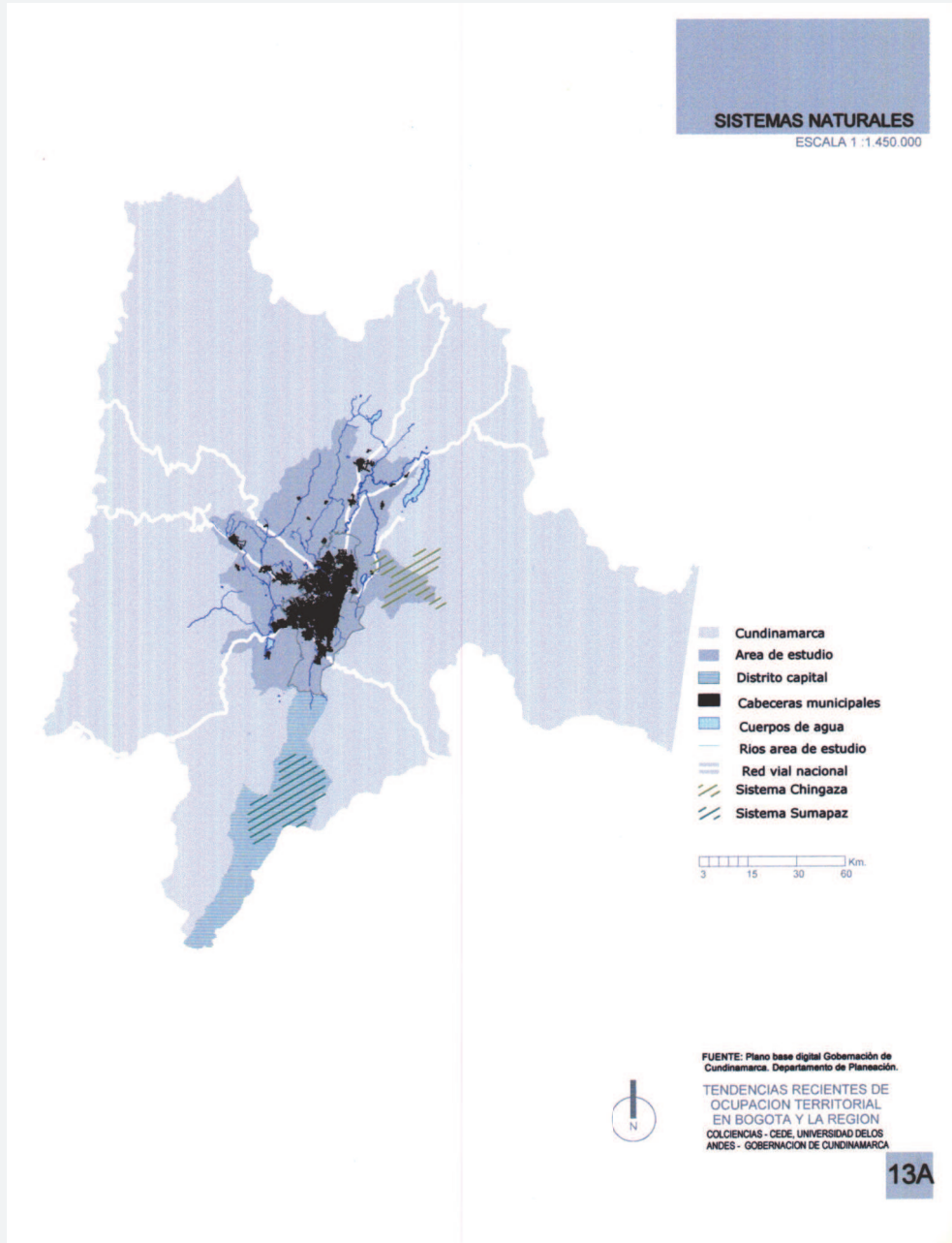


Chart 13A\_Natural Systems  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

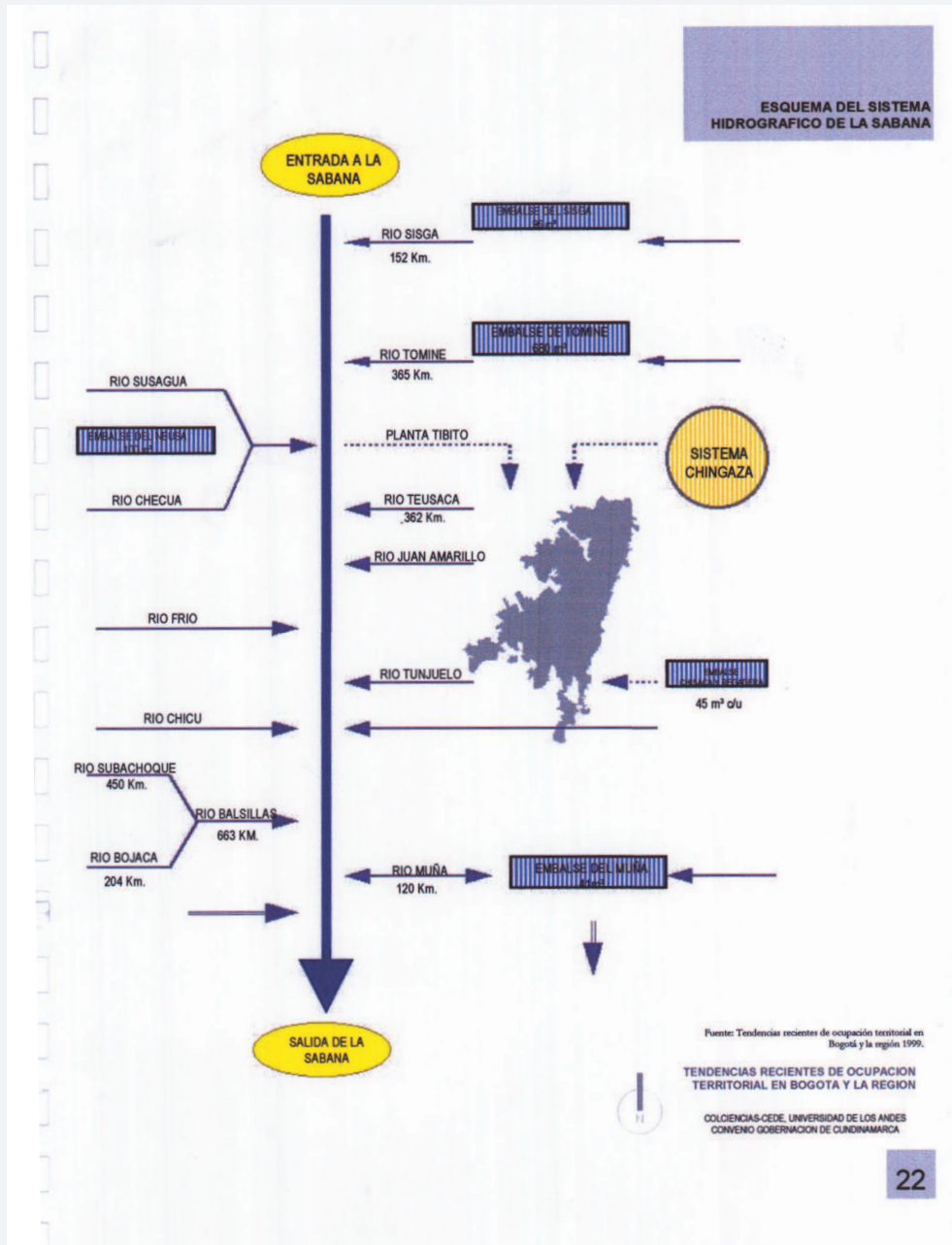


Chart 22\_Hydrographic System of Sabana  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

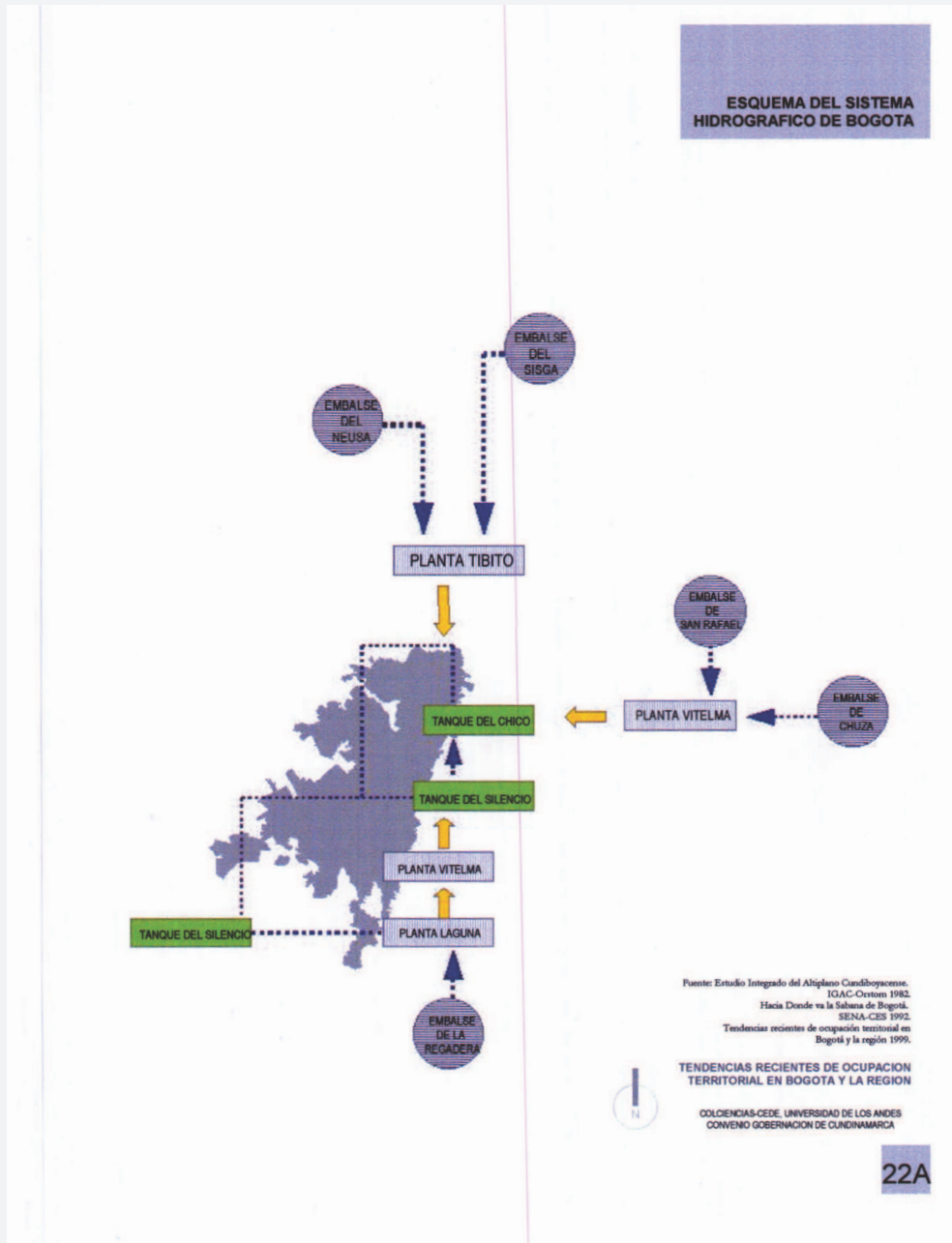


Chart 22A\_Hydrographic System of Bogota  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

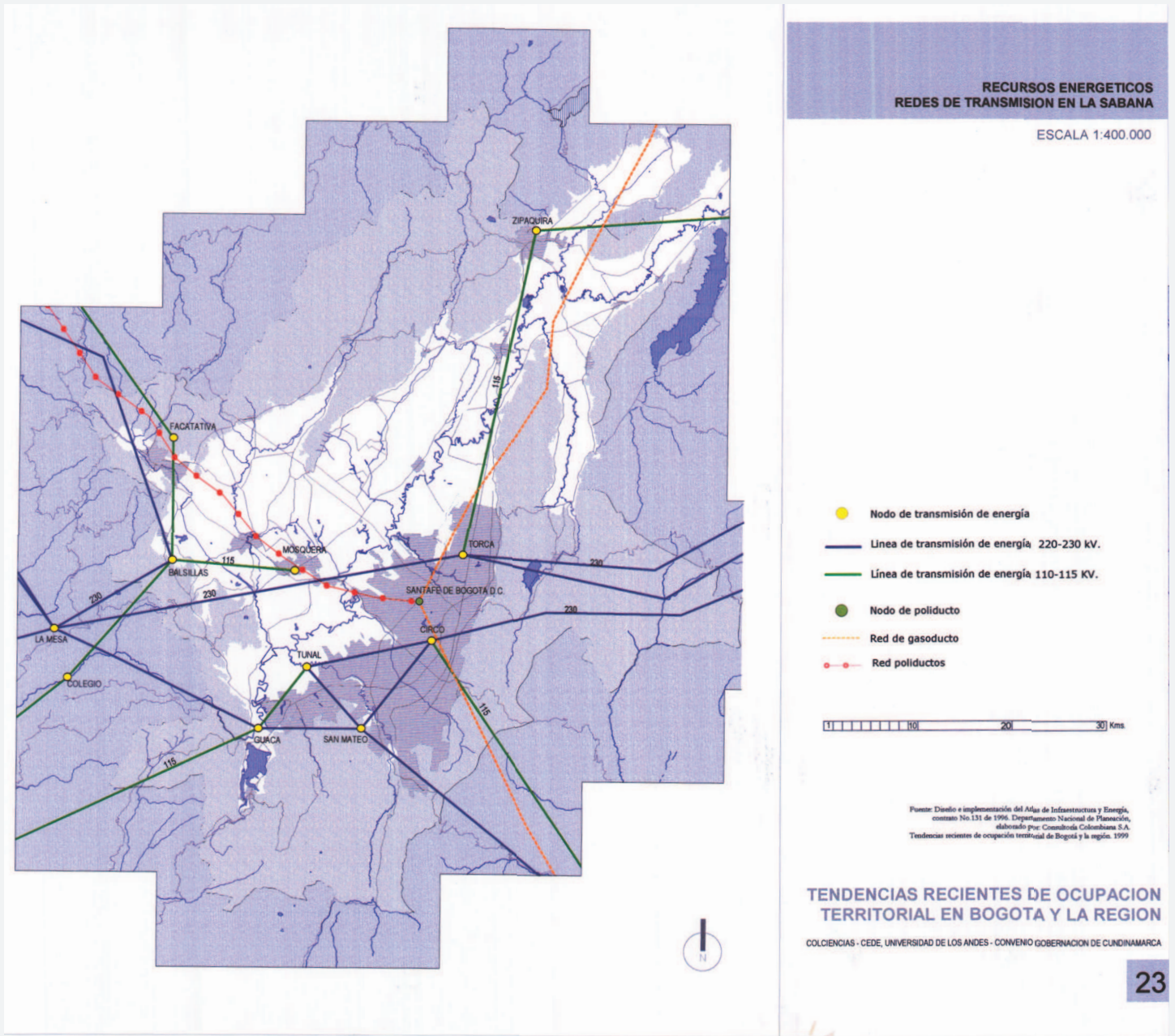


Chart 23\_Energy Supplies Network in the Sabana  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion



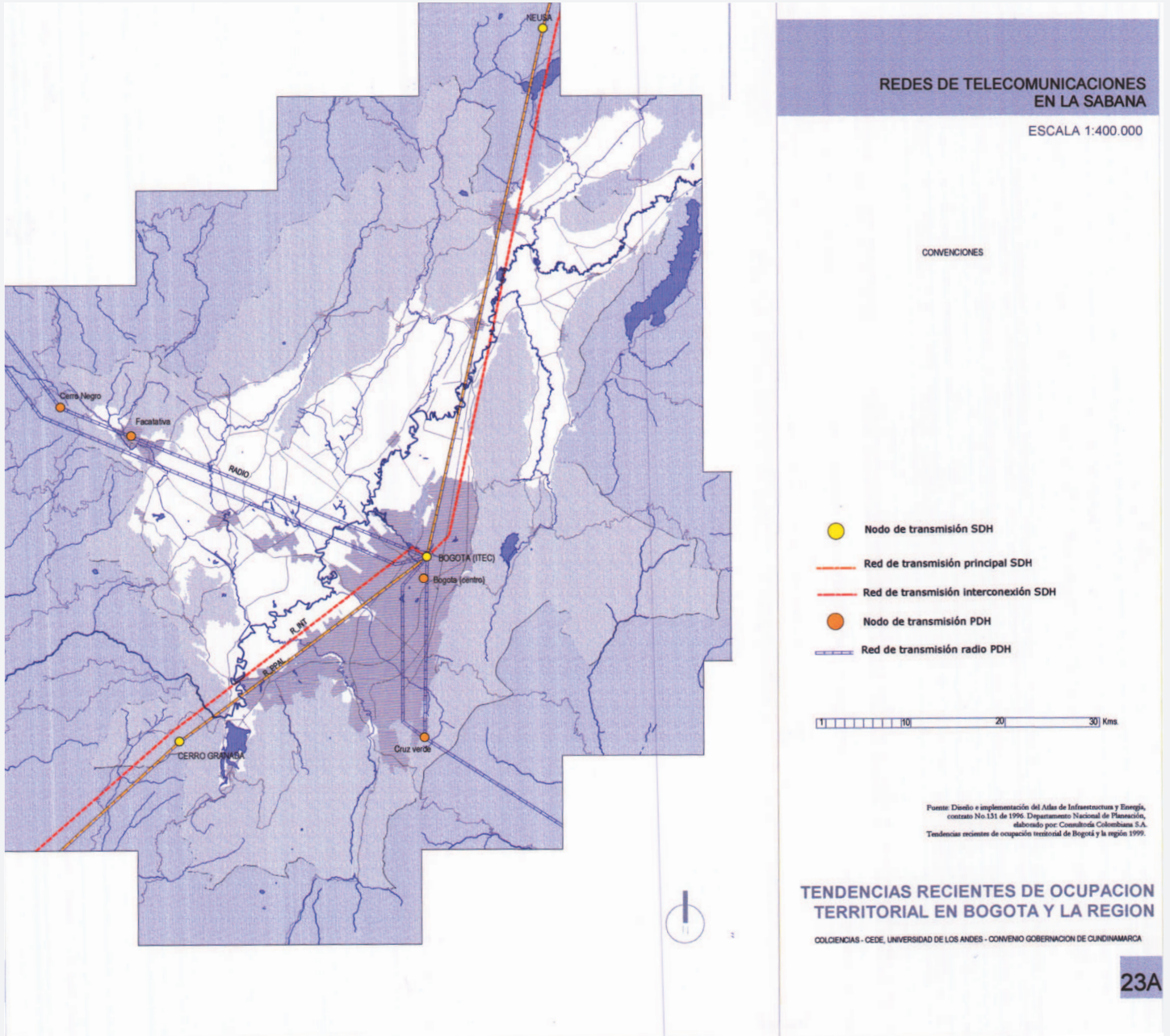


Chart 23A\_Communication Network in the Sabana  
 Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

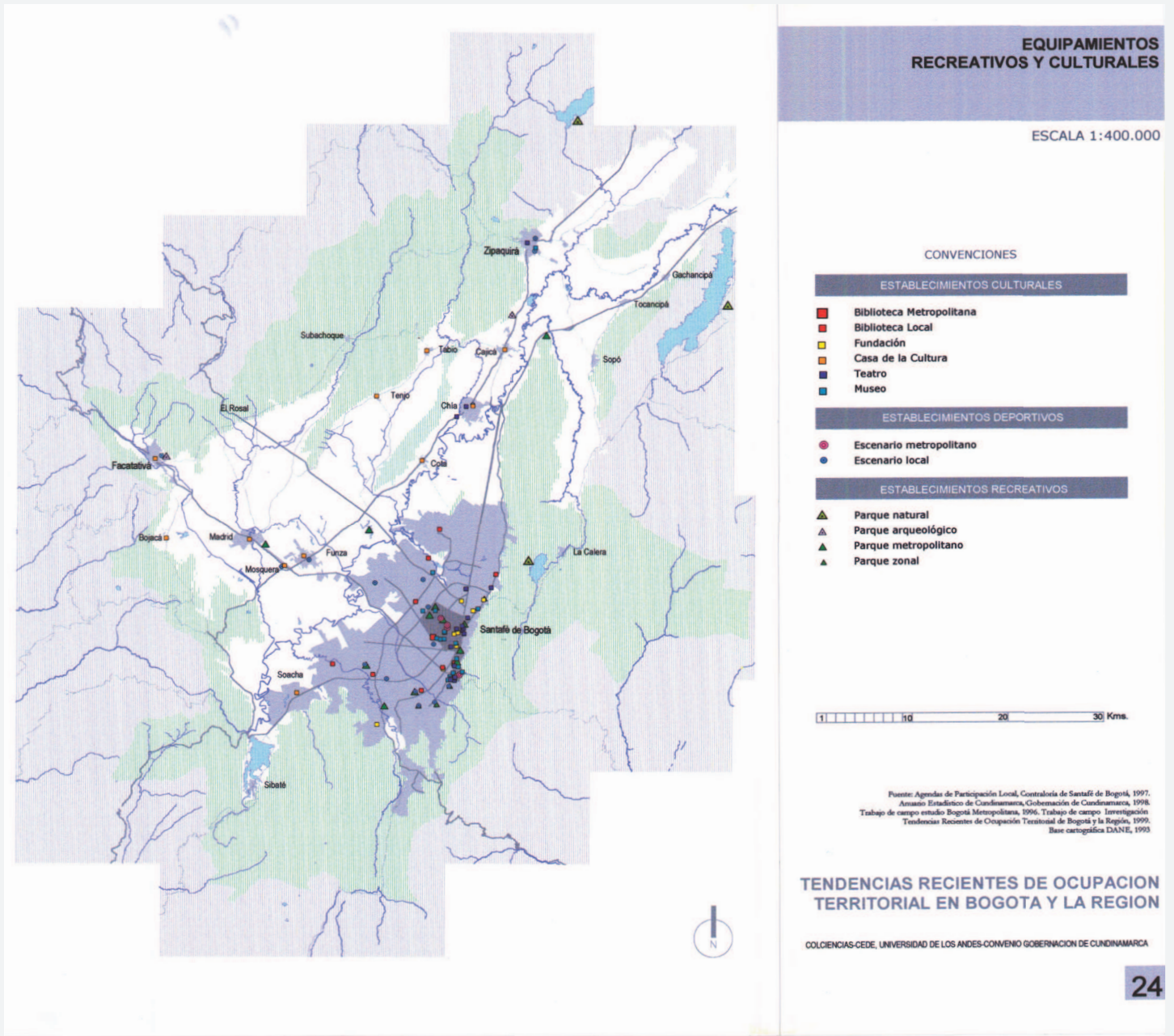


Chart 24 Cultural and Educational Facilities  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

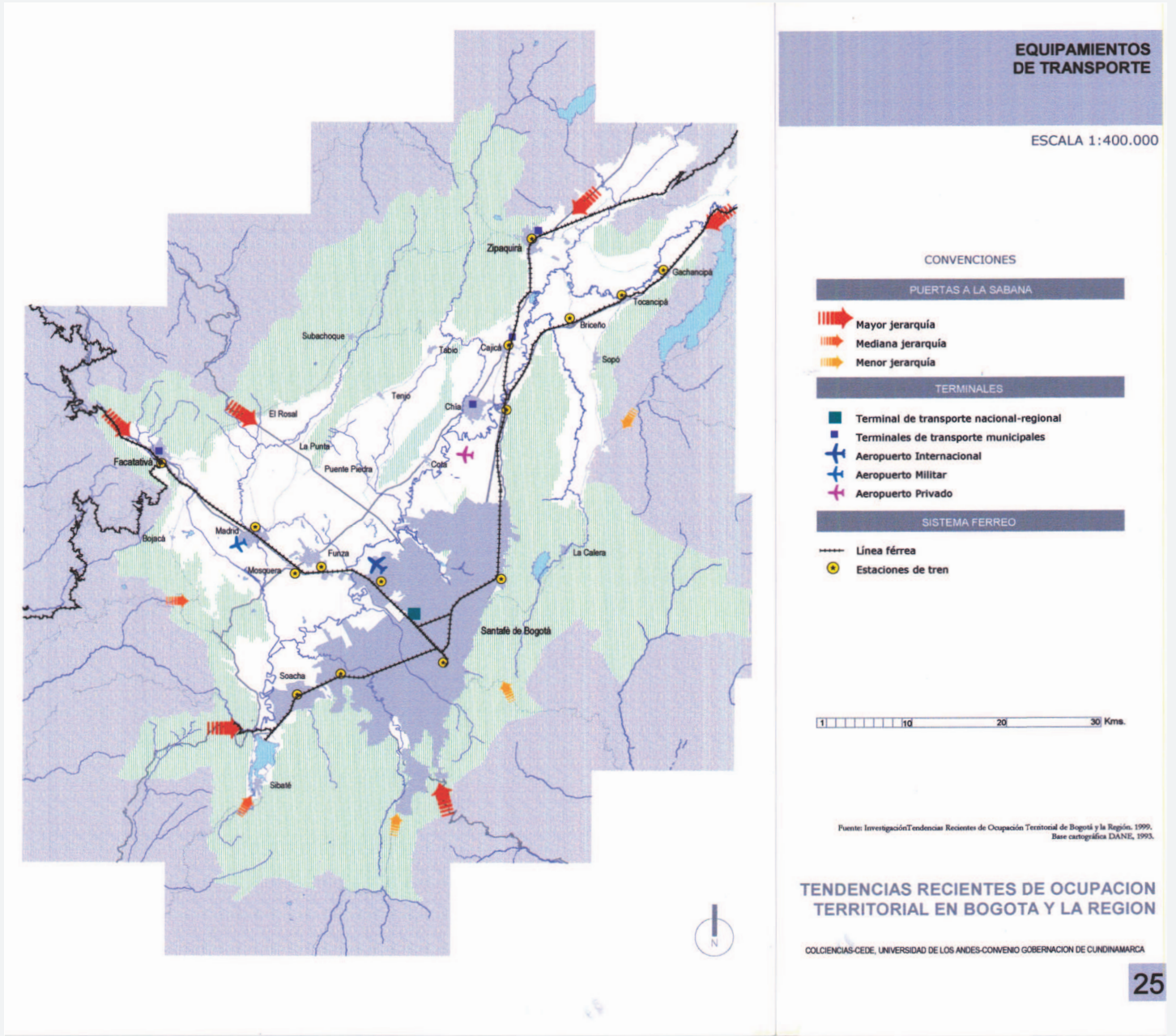


Chart 25\_Transport Facilities  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

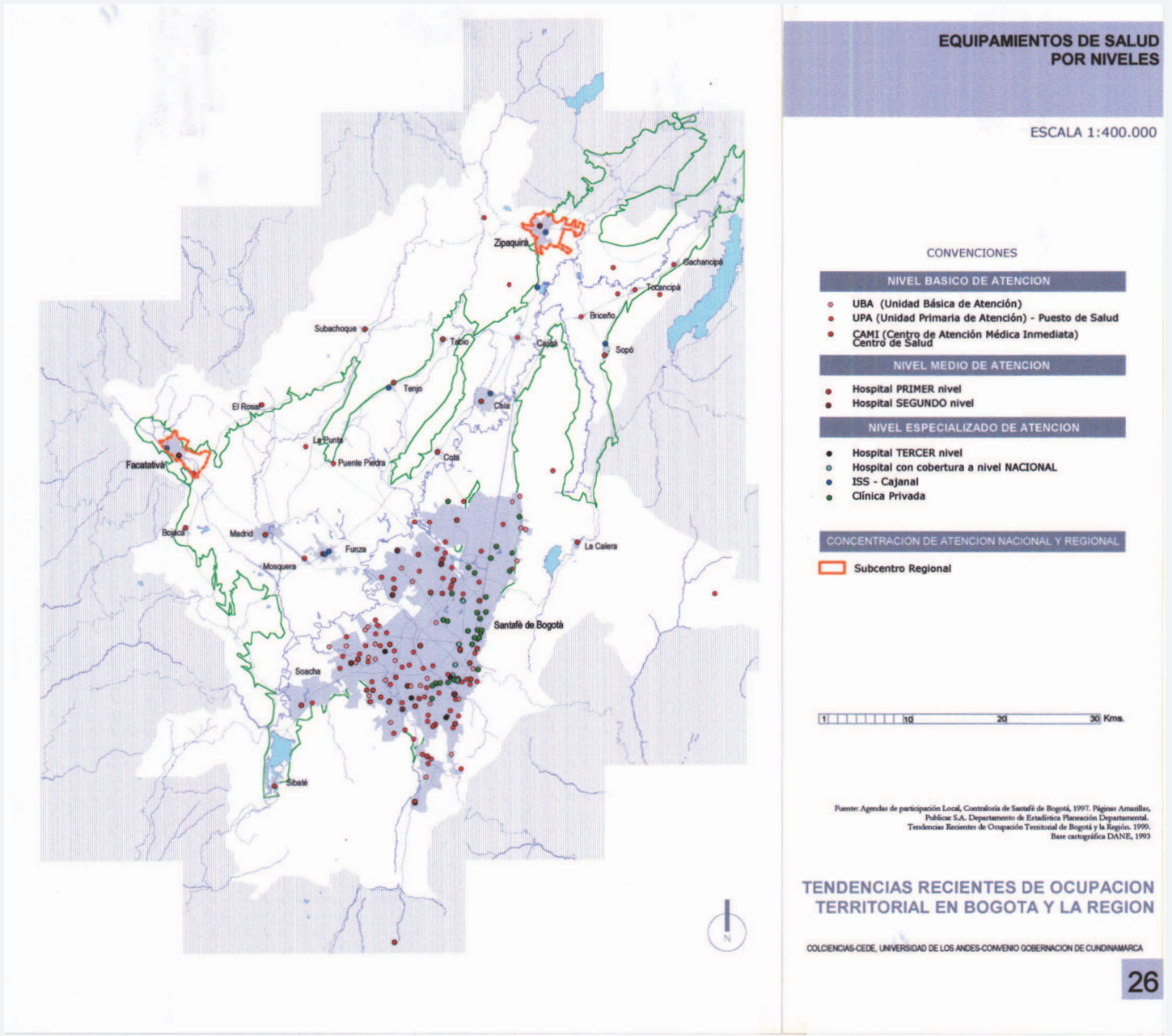


Chart 26\_Healthcare Facilities  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

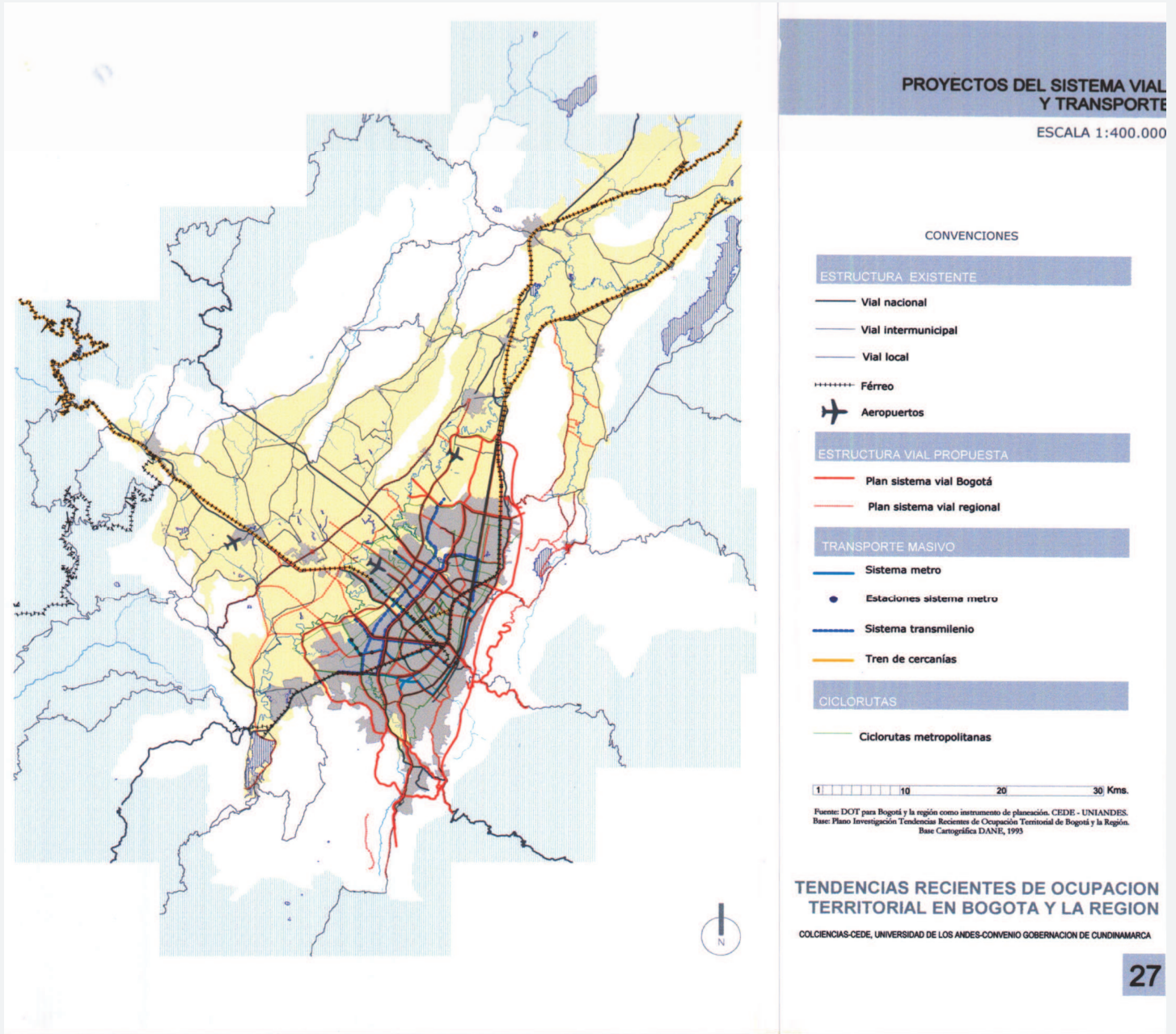
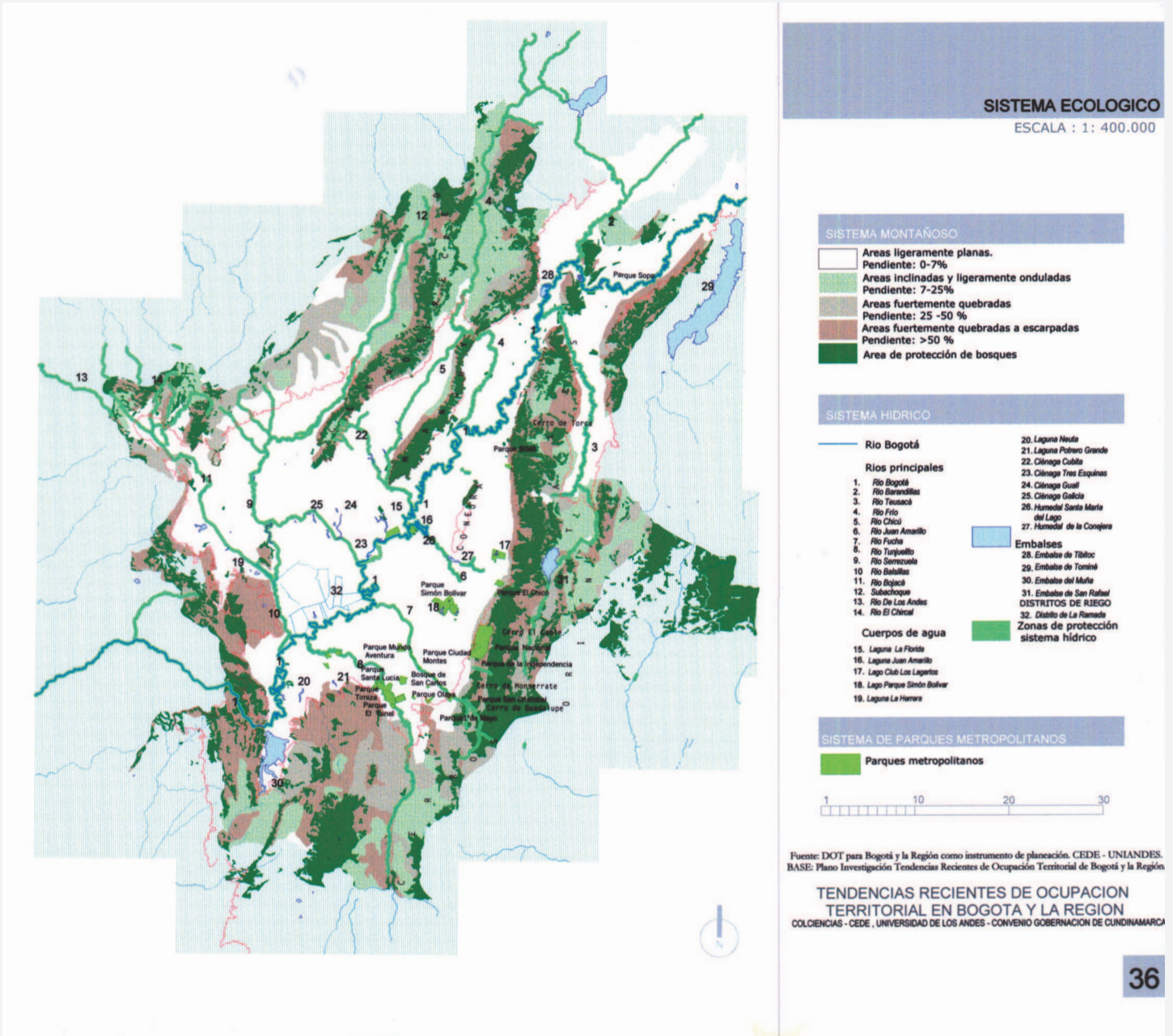


Chart 27\_Roads and Transport Systems Project  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion



**SISTEMA ECOLOGICO**

ESCALA : 1 : 400.000

**SISTEMA MONTAÑOSO**

- Areas ligeramente planas. Pendiente: 0-7%
- Areas inclinadas y ligeramente onduladas. Pendiente: 7-25%
- Areas fuertemente quebradas. Pendiente: 25 -50 %
- Areas fuertemente quebradas a escarpadas. Pendiente: >50 %
- Area de protección de bosques

**SISTEMA HIDRICO**

- Río Bogotá**
- Ríos principales**
1. Río Bogotá
  2. Río Barandillas
  3. Río Teusacá
  4. Río Frio
  5. Río Chicó
  6. Río Juan Amarillo
  7. Río Fucha
  8. Río Turjuelito
  9. Río Somocastro
  10. Río Bahicillas
  11. Río Bojacá
  12. Subachoque
  13. Río De Los Andes
  14. Río El Chical
- Embalses**
20. Laguna Nevita
  21. Laguna Polvoro Grande
  22. Ciénaga Cubita
  23. Ciénaga Tres Esquinas
  24. Ciénaga Guail
  25. Ciénaga Galita
  26. Humedal Santa María del Lago
  27. Humedal de la Conejera
  28. Embalse de Tibitoc
  29. Embalse de Tomín
  30. Embalse del Muña
  31. Embalse de San Rafael
- DISTRITOS DE RIEGO**
32. Distrito de La Flaneta
- Zonas de protección sistema hídrico**
- Cuerpos de agua**
15. Laguna La Florida
  16. Laguna Juan Amarillo
  17. Lago Club Los Lagartos
  18. Lago Parque Simón Bolívar
  19. Laguna La Hembra

**SISTEMA DE PARQUES METROPOLITANOS**

- Parques metropolitanos



Fuente: DOT para Bogotá y la Región como instrumento de planeación. CEDE - UNIANDES. BASE: Plano Investigación Tendencias Recientes de Ocupación Territorial de Bogotá y la Región

**TENDENCIAS RECIENTES DE OCUPACION TERRITORIAL EN BOGOTA Y LA REGION**  
COLCIENCIAS - CEDE , UNIVERSIDAD DE LOS ANDES - CONVENIO GOBERNACION DE CUNDINAMARCA

Chart 36\_Ecological System  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

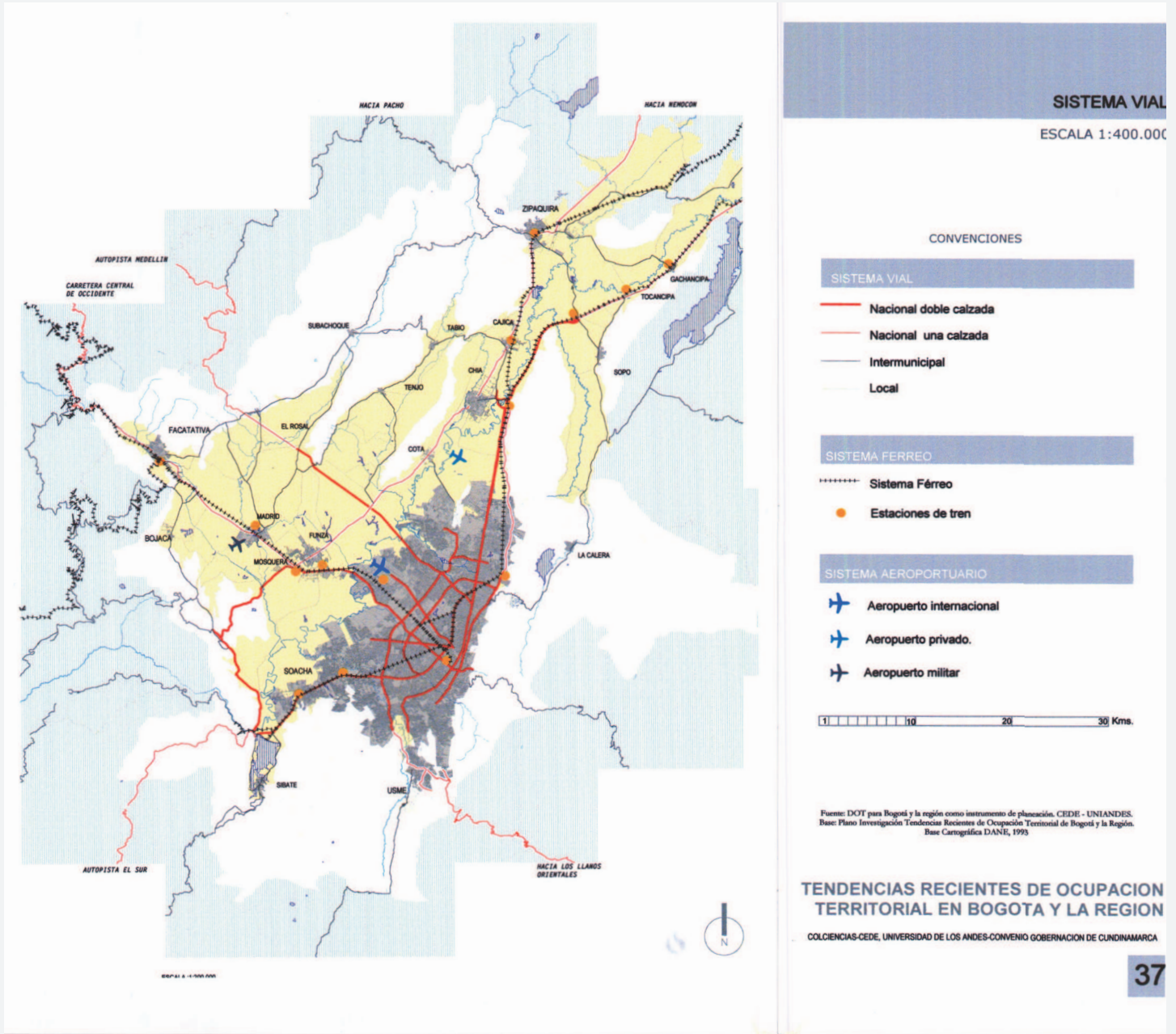


Chart 37\_ Infrastructural Network  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion

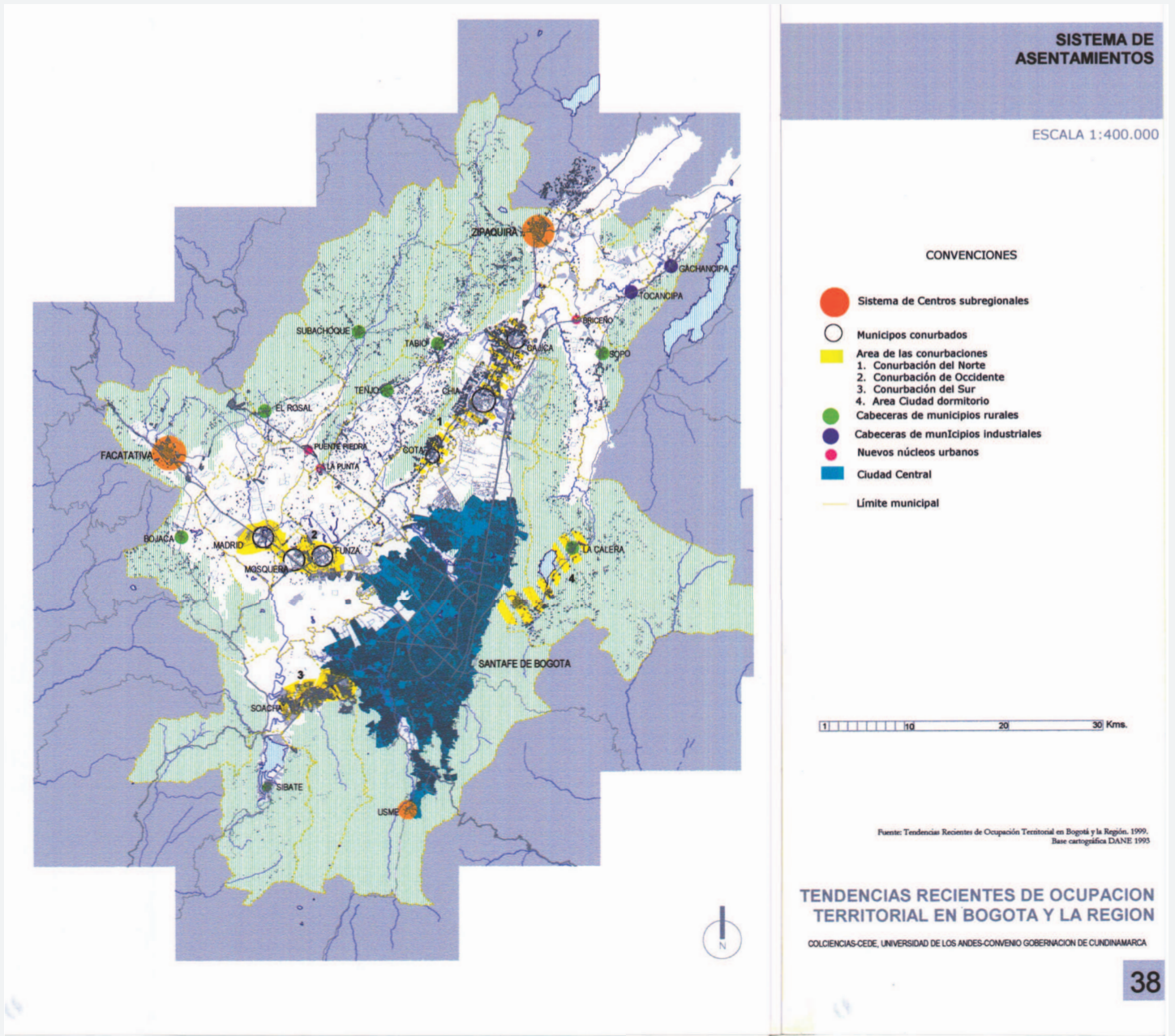


Chart 38 Settlements System  
Source: Plan de Ordenamiento Territorial, Secretaria de Planeacion







**Key Words**



## Interrelational Space

*"interspaces contain the matrix of the modification design of architectonic, urban and regional configurations, infringing the various scales, to draw a conscious form of the settlement." (Gli "interspazi" contengono le matrici del disegno modificativo degli assetti architettonici, urbani e territoriali, trapassandone le scale, per attingere una consapevole forma dell'abitato.)"*

Sergio Crotti

---

Sergio Crotti, *Interspazi: dai siti pubblici ai luoghi comuni*, in P.Caputo (a cura di) *Le architetture dello spazio pubblico*, Electa, Milano, 1997

## Form

*"My sole purpose is to correlate with mathematical statement and physical law certain of the simpler outward phenomena of growth and structure or form, while regarding the fabric of the organism, ex hypothesi, as a material and mechanical configuration."*

*D'Arcy Wentworth Thompson*

## Sintropy

*"It is by avoiding the rapid decay into the inert state of "equilibrium" that an organism appears so enigmatic; so much so, that from the earliest times of human thought some special non-physical or supernatural force (vis viva, entelechy) was claimed to be operative in the organism, and in some quarters is still claimed. How does the living organism avoid decay? The obvious answer is: By eating, drinking, breathing and (in the case of plants) assimilating. The technical term is metabolism. The Greek word "μεταβολή" means change or exchange. Exchange of what? ... . Every process, event, happening -call it what you will; in a word, everything that is going on in Nature means an increase of the entropy of the part of the world where it is going on. Thus a living organism continually increases its entropy -or, as you may say, produces positive entropy -and thus tends to approach the dangerous state of maximum entropy, which is of death. It can only keep aloof from it, i.e. alive, by continually drawing from its environment negative entropy -which is something very positive as we shall immediately see. What an organism feeds upon is negative entropy. Or, to put it less paradoxically, the essential thing in metabolism is that the organism succeeds in freeing itself from all the entropy it cannot help producing while alive."*

## Disorder

*“Non è dunque la distribuzione atomica ma piuttosto l’ipotesi del disordine elementare a costituire il vero e proprio perno del principio dell’aumento dell’entropia e, per tanto, la condizione preliminare dell’esistenza dell’entropia stessa. [...] Senza il disordine elementare non esiste né entropia né processo irreversibile.”*

*Max Plank*

*“Il disordine non è l’assenza di qualsiasi ordine, ma piuttosto lo scontrarsi di ordini privi di mutuo rapporto.”*

*Rudolf Arnheim*

*“Il termine disordine si applica opportunamente a quelli stati fisici nei quali una molteplicità di elementi segue vie per la massima parte indipendenti, ma che, per brevi periodi entrano in correlazione fisica.”*

*Wolfgang Köhler*

*“Il disordine dipende dalla dispersione casuale di ordini limitati.”*

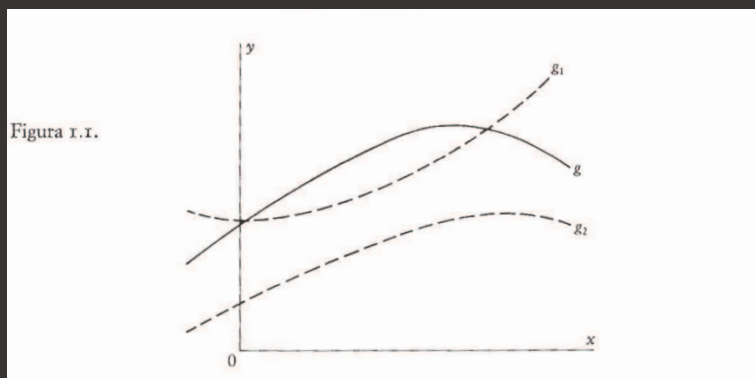
*James Kern Feibleman*

*[i] Arnheim, R. “Order and complexity.”*

## Quality

The use of the term qualitative in science, especially in physics, has a pejorative character; Thom says how a physicist has reminded him of a saying Rutherford used: "qualitative is nothing but poor quantitative". Thom uses the following example: suppose that an experimental research of a phenomenon  $\Phi$  obtains the experimental curve  $g$ , with an equation  $y=g(x)$ . In order to explain the  $\Phi$  phenomenon, the theorist has two theories  $\theta_1$  and  $\theta_2$ ; each of these theories predicts  $y=g_1(x)$  and  $y=g_2(x)$  respectively; none of these theories adapts perfectly to the experimental curve  $y=g(x)$ ; the curve  $Y=g_1(x)$  adapts better quantitatively, in that within the considered interval the integral of the difference  $\int |g-g_1| dx$  is less than  $\int |g-g_2| dx$ ; while the curve  $y=g_2(x)$  has the same shape or form of the experimental curve  $g$ ; in such situation it is probable that the theorist would prefer the theory  $\theta_2$  against theory  $\theta_1$ ; even if the quantitative error is much higher, it may actually be hypothesized that that the theory  $\theta_2$ , which leads to a curve with the same trend as the experimental curve  $g$ , may reveal more about the underlying mechanisms of the phenomenon  $\Phi$ , than with the more quantitatively exact theory  $\theta_1$ .

As Thom justifies, this example does not have any demonstrative value, but still it illustrates the natural tendency to give form an intrinsic value, and as Thom, in this thesis this tendency is pushed to its extreme consequences.



René Thom, *Stabilità strutturale e morfogenesi. Saggio di una teoria generale dei modelli*, Milano, Einaudi, 1980 p.7



## Entropy

*“... he found in entropy the measure of disorganization for a closed system an adequate metaphor to apply to certain phenomena in his own world. He saw, for example, the younger generation responding to Madison Avenue with the same spleen his own had for Wall Street: and in America “consumerism” discovered a similar tendency from the least to the most probable, from ordered individuality to a kind of chaos. He found himself, in short, restating Gibbs’ prediction in social terms, and envisioned a heat death for his culture in which ideas, like energy, would no longer be transferred, since each point in it would ultimately have the same quantity of energy; an intellectual motion would accordingly cease.”*

Thomas Pynchon

*“Let me first emphasize that it is not a hazy concept or idea, but a measurable physical quantity just as the length of a rod, the temperature at any point of a body, the heat of fusion of a given crystal or the specific heat of any given substance. At the absolute zero point of temperature (roughly  $-273^{\circ}\text{C}$ ) the entropy of any substance is zero. When you bring the substance into any other state by slow, reversible little steps (even if thereby the substance changes its physical or chemical nature or splits up into two or more parts of different physical or chemical nature) the entropy increases by an amount which is computed by dividing every little portion of heat you had to supply in that procedure by the absolute temperature at which it was supplied – and by summing up all these small contributions. To give an example, when you melt a solid, its entropy increases by the amount of heat of fusion divided by the temperature at the melting point. You see from this that the unit in which entropy is measured is  $\text{cal}/^{\circ}\text{C}$  (just as the calorie is the unit of heat or the centimeter is the unit of length).” [...] “I have mentioned the technical definition...”*

*“An isolated system or a system in uniform environment (which for the present consideration we do best to include as a part of the system we contemplate) increases its entropy and more or less rapidly approaches the inert state of maximum entropy. We now recognize this is a fundamental law of physics to be just the natural tendency of things to approach the chaotic state (the same tendency that the books of a library or the piles of papers and manuscripts on a writing desk display) unless we obviate it. (the analogue of heat motion, in this case, is our handling those objects now and again without troubling to put them back in their proper places.)”*

E. Schrodinger p.72

---

T. Pynchon, in Albert Pope, *Ladders*, Rice University School of Architecture and Princeton Architectural Press; New York, 1996, p. 208





