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COOPERATIVE AGREEMENT ON HUMAN SETTLEMENTS AND NATURAL RESOURCE SYSTEMS ANALYSIS

THE HIERARCHY OF CENTRAL PLACES IN THE HIGHLANDS OF GUATEMALA, THEIR PERIODIC MARKETS AND TRIBUTARY AREAS

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Background, Introduction and Purposes

In 1981 the Guatemalan Institute for Municipal Development (Instituto de Fomento Municipal - INFOM) undertook a study of the central place hierarchy in a part of Guatemala. The work, underwritten in part by the United States Agency for International Development, culminated in a report entitled Organizacion del Espácio en la Franja Central de la República de Guatemala (The Organization of Space in the Central Belt of Guatemala).[1] All the urban hierarchy data presented in this work are from this INFOM publication. The INFOM study was a part of a larger AID-Government of Guatemala-supported program to aid the rural populations in Guatemala by integrating rural and urban areas in the highlands which are occupied principally by Maya-speaking farmers. Since this large AID program is intended to target sites for public investment in rural Guatemala and the focus of so much of the work done is on the urban, not rural, structure, the UMass research team is also presenting data in the present work on periodic markets as a part of the urban hierarchy presentation. These are the places where for a few hours a week "rural comes to meet urban." Here Maya farmers set up stalls in the centers of urban areas to sell the products of their small plots. The data on periodic markets originated with Professor Richard Wilkie of the University of Massachusetts - Amherst.

The purposes of this report include: 1) the characterization of the INFOM central place hierarchy of the Central Belt of Guatemala relative to an ideal central place hierarchy model; 2) an interpretation of the pattern of the Guatemalan central place hierarchy and its relationships to Maya periodic markets; and 3) a presentation and interpretation of the umlands (tributary areas) of central places in the hierarchy.

The Study Area Defined

For its central place study INFOM chose an area it refers to as the Franja Central or Central Belt. It covers all or parts of 16 contiguous departments of the country and includes 209 municipios (counties). The area and the names of the political units involved are shown on Maps 1 and 2 and on Table 1. A total of 1,987 communities were studied but their numbers included only those with 500 or more inhabitants (Map 5).

The Urban Hierarchy as Defined by INFOM

An urban hierarchy is made up of a series of central places each of which is scored on the basis of the number of business, professional, retail and service functions it contains. A central place is simply an urban center that provides goods and services for persons living outside its boundaries. A central place function is one that provides a good or service for persons living outside the boundaries of the urban center which contains this function. A central place function group includes all functions of the same type in the study area. Every central place function is housed in a central place establishment. Quite often, particularly in smaller central places, one establishment will contain more than one central place function. INFOM reports that it used functions and not establishments as the basis for its study.

The score or measure of a central place used in the INFOM study is the Global Centrality Index. This Global Index is based on the Simple Centrality Index which is a measure of the concentration of a particular central place function in a given central place and is given by:

$$C_{ix} = \frac{1000}{N_i} \times N_{ix} \quad \text{in which}$$

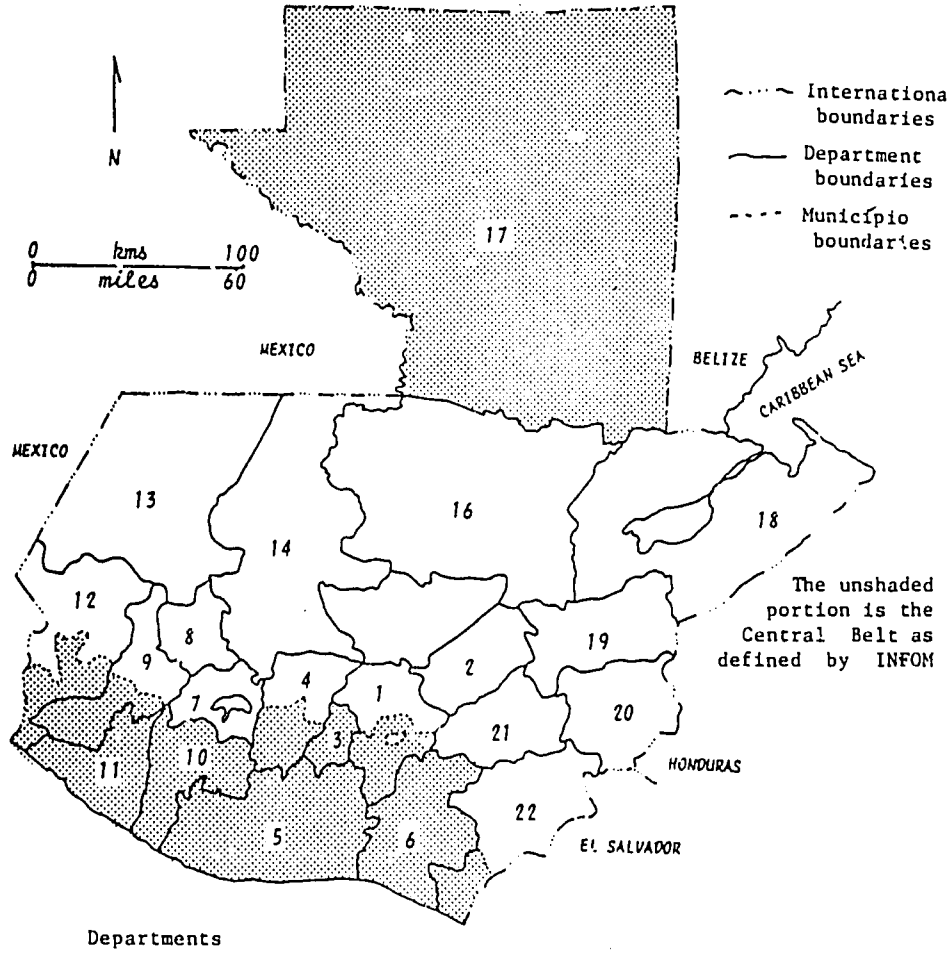
C_{ix} = Simple Centrality Index of central function i in central place x

N_i = total number of functions of central place function group i that are located in the study area, the Central Belt of Guatemala

N_{ix} = total number of functions of central place function group i that are located in central place x.

Map 1

THE CENTRAL BELT OF GUATEMALA AS DEFINED BY INFOM FOR ITS URBAN HIERARCHY STUDY



Departments

1. Guatemala	8. Totonicapan	16. Alta Verapaz
2. Progresso	9. Quetzaltenango	17. Petén
3. Sacatepéquez	10. Suchitepéquez	18. Izabal
4. Chimaltenango	11. Retalhuleu	19. Zacapa
5. Escuintla	12. San Marcos	20. Chiquimula
6. Santa Rosa	13. Huehuetenango	21. Jalapa
7. Sololá	14. Quiché	22. Jutiapa
	15. Baja Verapaz	

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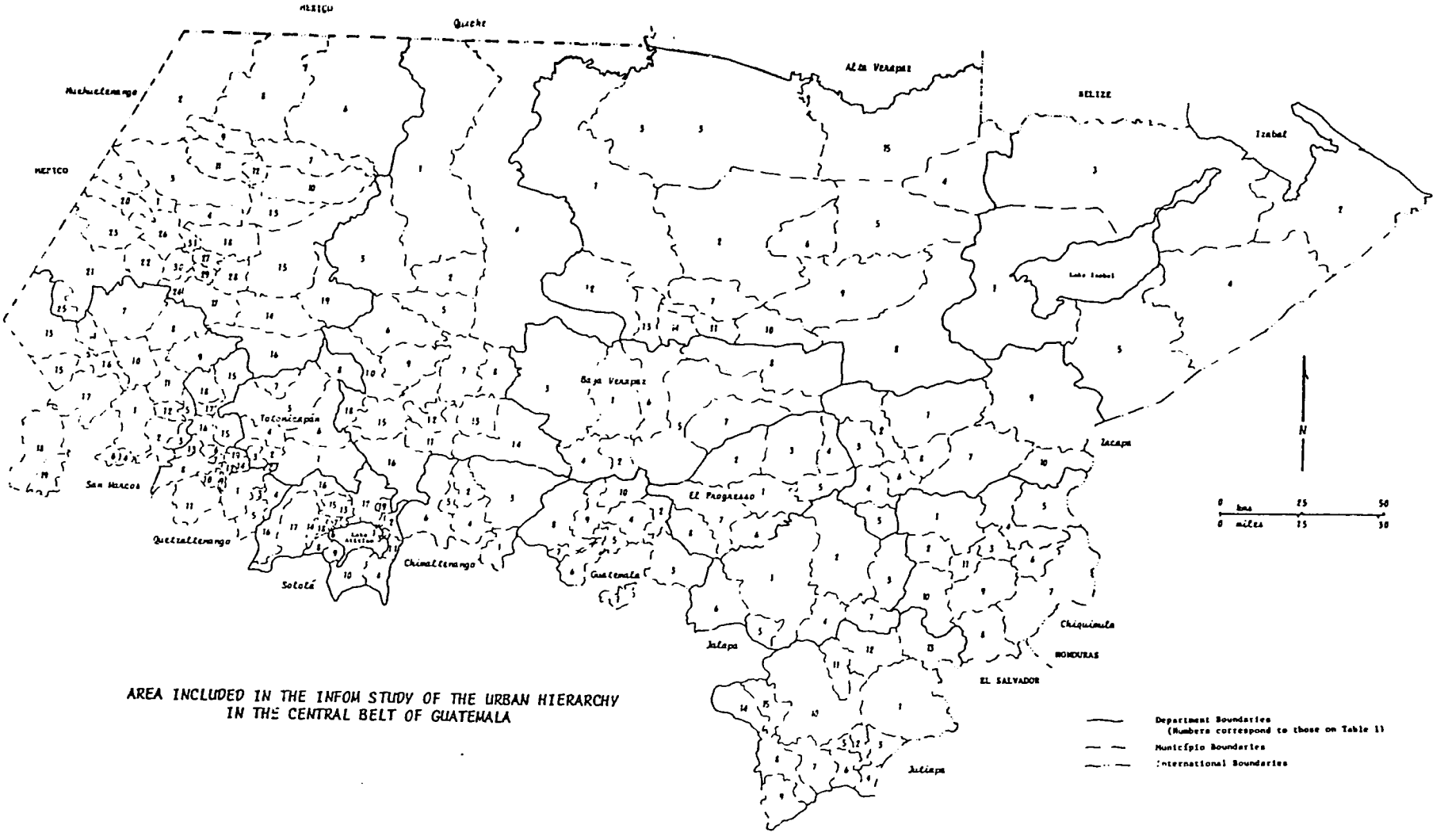
Map 2



AREA INCLUDED IN THE INFOM STUDY OF THE URBAN HIERARCHY
IN THE CENTRAL BELT OF GUATEMALA

Ludwig/Pechette

Table 1

Municípios by Departments in the Study Area

Huehuetenango

1. San Antonio Huista
2. Nentón
3. Jacaltenango
4. Concepción
5. Santa Ana Huista
6. Barillas
7. Santa Eulalia
8. San Mateo Ixtatán
9. San Sebastian Coatán
10. Soloma
11. San Miguel Acatán
12. San Rafael La Independencia
13. San Juan Ixcoy
14. Huehuetenango
15. Chiantla
16. Malacatancito
17. Santa Bárbara
18. Todos Santos Cuchumatán
19. Aguacatán
20. La Democracia
21. Cuilco
22. Istahuacán
23. La Libertad
24. San Gaspar Ixchil
25. Tectitán
26. San Pedro Necta
27. San Juan Atitán
28. San Sebastián Huehuetenango
29. San Rafael Petzal
30. Colotenango
31. Santiago Chimaltenango

Totonicapán

1. Totonicapán
2. San Cristóbal Totonicapán
3. San Andrés Xecul
4. San Francisco El Alto
5. Momostenango
6. Santa María Chiquimula
7. San Bartolo
8. Santa Lucía La Reforma

Chimaltenango

1. Chimaltenango
2. San José Poaquil
3. San Martín Jilotepeque
4. Comalapa
5. Santa Apolonia
6. Tecpán Guatemala

Quezaltenango

1. Quezaltenango
2. Salcajá
3. Almolonga
4. Cantel
5. Zunil
6. Cajolá
7. San Miguel Siguilá
8. San Juan Ostuncalco
9. San Mateo
10. Concepción Chiquirichapa
11. San Martín Sacatepéquez
12. La Esperanza
13. Palestina de Los Altos
14. Olintepeque
15. San Carlos Sija
16. Sibilia
17. Huitán
18. Cabricán
19. San Francisco La Unión

Table 1 (continued)

San Marcos

1. San Marcos
2. San Pedro Sacatepéquez
3. San Antonio Sacatepéquez
4. Esquipulas Palo Gordo
5. Río Blanco
6. San Rafael Pie de la Cuesta
7. Concepción Tutuapa
8. San Miguel Ixtahuacán
9. Sipacapa
10. Tejutla
11. Comitancillo
12. San Lorenzo
13. Tacaná
14. San José Ojetenam
15. Sibinal
16. Ixchiguán
17. Tajumulco
18. Malacatán
19. Catarina

Quiché

1. Chajul
2. San Juan
3. Nebaj
4. Uspantán
5. Cunén
6. Sacapulas
7. San Andrés Sajcabajá
8. Canillá
9. San Bartolomé Jocotenango
10. San Pedro Jocopilas
11. Chiché
12. Chinique
13. Zacualpa
14. Joyabaj
15. Santa Cruz de Quiché
16. Chichicastenango
17. Patzité
18. San Antonio Ilotenango

Baja Verapaz

1. Rabinal
2. El Chol
3. Cubulco
4. Granados
5. Salamá
6. San Miguel Chicaj
7. San Jerónimo
8. Purulhá

El Progreso

1. El Progreso
2. Morazán
3. San Agustín Acasaguastlán
4. San Cristóbal Acasaguastlán
5. El Jícaro
6. Sansare
7. Sanarate
8. San Antonio La Paz

Sololá

1. Panajachel
2. San Andrés Semetabaj
3. Santa Catarina Palopó
4. San Lucas Tolimán
5. Santa Cruz La Laguna
6. San Pablo La Laguna
7. San Marcos La Laguna
8. San Juan La Laguna
9. San Pedro La Laguna
10. Santiago Atitlán
11. San Antonio Palopó
12. Sololá
13. San José Chacayá
14. Santa Maria Visitación
15. Santa Lucía Utatlán
16. Nahualá
17. Santa Catarina Ixtahuacán
18. Santa Clara La Laguna
19. Concepción

Table 1 (continued)

Guatemala

1. Santa Catarina Pinula
2. San José del Golfo
3. Palencia
4. San Pedro Ayampuc
5. Chinautla
6. Mixco
7. San Pedro Sacatepéquez
8. San Juan Sacatepéquez
9. San Raimundo
10. Chuarrancho

Alta Verapaz

1. Cobán
2. San Pedro Carchá
3. Chisec
4. Chahal
5. Cahabón
6. Lanquín
7. San Juan Chamelco
8. Panzós
9. Senahú
10. Tucurú
11. Tamahú
12. San Cristóbal Verapaz
13. Santa Cruz Verapaz
14. Tactic
15. Fray Bartolomé de Las Casas

Zacapa

1. Río Hondo
2. Teculután
3. Usumatlán
4. Cabañas
5. San Diego
6. Huité
7. Zacapa
8. Estanzuela
9. Gualán
10. La Unión

Chiquimula

1. Chiquimula
2. San José La Arada
3. San Juan La Ermita
4. Jocotán
5. Camotán
6. Olopa
7. Esquipulas
8. Concepción Las Minas
9. Quezaltepeque
10. Ipala
11. San Jacinto

Jutiapa

1. Asunción Mita
2. Yupiltepeque
3. Atescatempa
4. Jerez
5. El Adelanto
6. Zapotitlán
7. Comapa
8. Jalpatagua
9. Conguaco
10. Jutiapa
11. El Progreso
12. Santa Catarina Mita
13. Agua Blanca
14. San José Acatempa
15. Quezada

Jalapa

1. Jalapa
2. San Pedro Pinula
3. San Luis Jilotepeque
4. Monjas
5. San Carlos Alzatate
6. Mataquescuintla
7. San Manuel Chaparrón

Izabal

1. El Estor
2. Puerto Barrios
3. Livingston
4. Morales
5. Los Amates

After this Simple Index is computed for every central place function group in a given central place, the Simple Indices for each group are summed to yield that central place's Global Centrality Index which is given by:

$$I_x = \sum_{i=1}^{n} C_{ix} \quad \text{in which}$$

I_x = Global Centrality Index of central place x

C_{ix} = Simple Centrality Index for central function group i in central place x

i = number of central function groups in central place x.

The highest Global Indices will occur in those central places that offer the most specialized, least frequently sought goods and services.

Characteristics of an Ideal Central Place Hierarchy

One of the first decisions to be made in the creation of a central place hierarchy is whether to map and classify central place functions or central place establishments. Establishments are generally easier to observe and census because a sign on the building usually tells the field researcher what type of central place function is housed there. Such signs, however, do not always indicate the other central place functions which might be housed in the same establishment. A pharmacy, for example, may also contain a lunch counter. Censusing central place functions takes much more time in the field but provides a much better picture of the central place. The establishment is not a particularly good surrogate for the function as Berry, Barnum and Tennant (1962) demonstrate in the following table showing part of the central place hierarchy in southwestern Iowa. It is taken from Yeates and Garner (1979).[2]

Central Place	Number of Establishments	Number of Functions
Red Oak	90	312
Atlantic	92	411
Griswold	50	102
Anita	50	84
Villisca	43	90
Oakland	49	97
Lewis	24	43
Elliott	26	42
Stanton	21	28

John Marshall[3] has developed seven criteria which he thinks essential to the creation of an ideal and spatially-adequate central place hierarchy. The first of his criteria holds that all centers in the system under study must be spatially interdependent. A hierarchy applies only where some mechanism is at work so that central places can affect one another's functional complexity, e.g. the number of functions of various types. In what Marshall calls "a properly identified system" the necessary mechanism is deemed to exist because the functional development of each central place is limited by some larger central place to which the smaller place is tributary. The second criterion insists upon the identification of a complete central place system. Marshall's third criterion calls for the discrete stratification of central places in the hierarchy. To meet this goal the difference in Global Centrality Indices between any two strata, or levels in the hierarchy, must be equal to or greater than the difference between the Indices within a stratum.

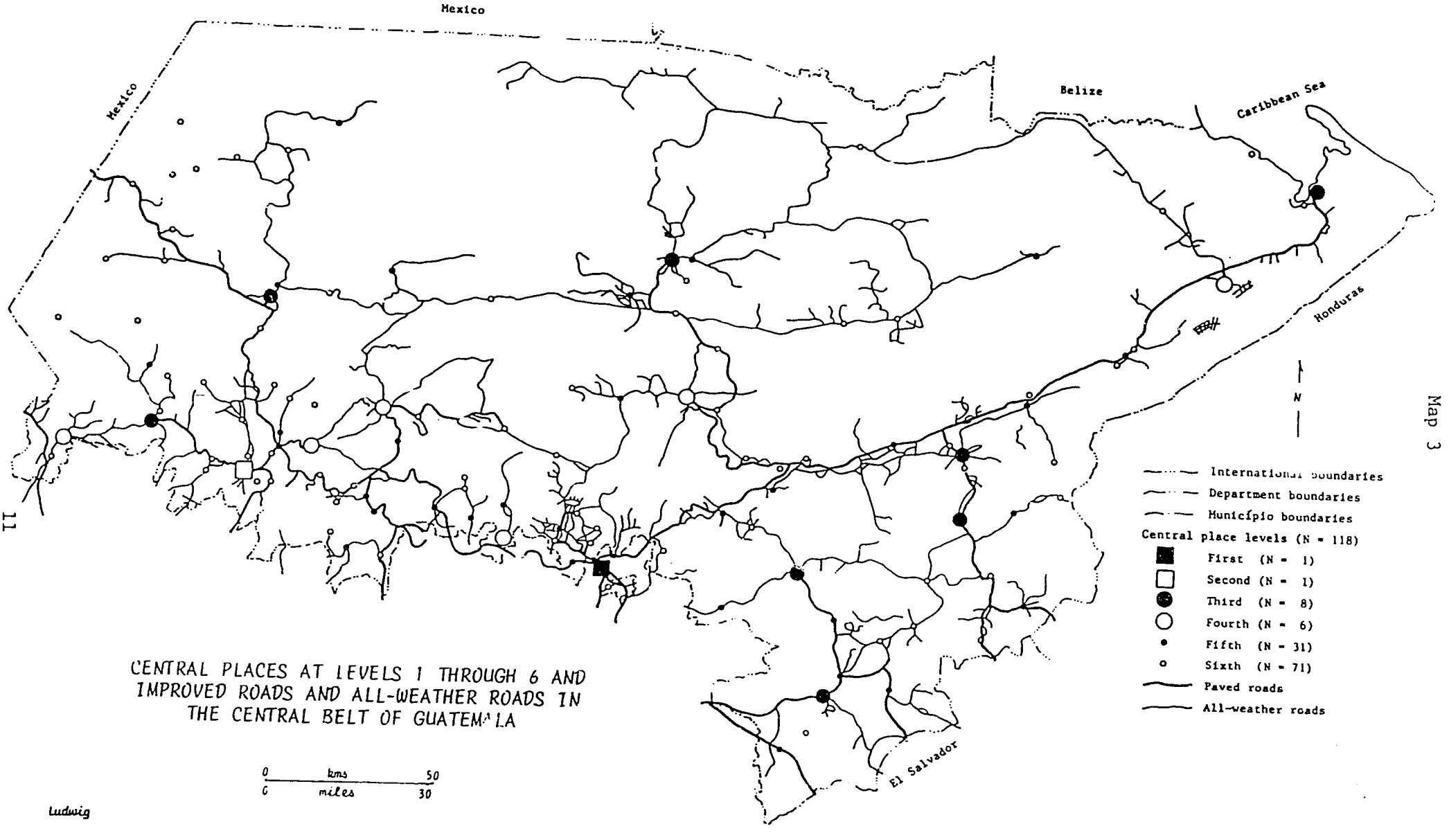
The fourth criterion states that central places at a given level in the hierarchy must perform virtually all the functions found in central places at lower levels plus additional functions not performed at lower levels. The fifth criterion requires the definition of at least three levels in a system of central places. The sixth insists that the number of central places at a given level be greater than the number at the next higher level so a pyramid of levels is formed. The seventh criterion holds that the members of each hierarchical level must occupy the interstices in the spatial pattern formed by central places at higher levels. This, he concedes, is the most difficult of all the criteria to apply empirically.

The INFOM Hierarchy and the Ideal Hierarchy

In both the text and the models to be applied to the empirical data the INFOM study explicitly states that central place functions were the building blocks from which it created the central place hierarchy. The questionnaire used, however, lists 70 functions by name, plus an "other" category, and requests the informant to fill in the No. de Negócios - Number of Businesses. In the absence of instructions to the contrary the field researcher would most likely census establishments and not seek out all functions. The need to cover 1,987 communities, most located in mountainous terrain, in less than two years might have precluded the censusing of functions in favor of the more easily gotten establishments.

The first of Marshall's criteria calls for the communities in a central place hierarchy to be spatially interdependent. What happens in one place should reverberate through the system of places. This depends upon communications, the best measure of which is the road system. The road patterns shown on Map 3 indicate that nearly all central places at level six and above are connected to the system by all-weather roads. The Central Belt's mountainous terrain, however, fragments the road network, precluding a high level of connectivity within the central place system. Obviously, access to a natural site had to precede the construction of a town there with links to the outside. That did not mean, however, that the road patterns and order of town settlement necessarily dictated the central place pattern. As other towns developed and as their links to other places developed possibilities for access changed at all places in the system and the functional sizes of these places, their Global Centrality Indices, also changed. The location of political-administrative or industrial activities can, over time, create shifts in the pattern of central places. Guatemala City, the only first level central place, was founded by the Spanish and in 1570 became the political center of the region. In the ensuing centuries Guatemala City, as have most Latin American capitals outside of Brazil, has arrogated to itself the chief functional roles in nearly every central place activity. Yet, given the difficulty of communication in the mountainous terrain it may not have strong links to other central places below it in the hierarchy. Quetzaltenango's financial and industrial take-off in the late 19th century is observed by INFOM researchers to have given it a degree of autonomy from Guatemala City thus weakening to some degree the interdependence called for in this criterion.

The second Marshal criterion, that requiring a complete system, is not met in the INFOM study. In the first place the study includes only communities with populations of 500 or more. This act arbitrarily rules out of the study any number of central place functions simply because they occur in towns below a certain population level. The census is of central functions; population size does not play a role in such a census and should not be considered. Secondly, as Map 1 indicates the study area excludes more than one-half of the country.



CENTRAL PLACES AT LEVELS 1 THROUGH 6 AND IMPROVED ROADS AND ALL-WEATHER ROADS IN THE CENTRAL BELT OF GUATEMALA

Map 3

Marshall's third criterion is severely violated by the INFOM ranking of central places that allows overlap between hierarchical levels. Table 2 indicates the degree of these violations. At level 3, Chiquimula's 810.6 Global Centrality Index was deemed to be a result of poor field observation so the INFOM researchers moved it above Jalapa. The researchers also decided to treat San Pedro Sacatepéquez and its close neighbor San Marcos as one central place thereby making Jalapa's Index of 1648.8 the lowest of level 3 and eliminating the overlap between the third and fourth levels. At level 5, Esquipulas' Index of 1072.8 overlap level 4, but this place was moved down by the INFOM researchers because the presence of so many shops selling candles to pilgrims skewed the Index on the high side. Why Nebaj remained at level 5 while it was overlapped by nearly all places at level 6 is not explained anywhere in the INFOM report. At level 6 no explanation is given for the high Index of 1165.7 for Santo Tomás de Castilla, a neighbor of the port city of Puerto Barrios. Neither is it made clear why the 326.6 and 243.5 Indices of El Rodeo and Santa Cruz, respectively, do not permit their being moved up from level 7.

The Marshall criterion requiring central places at a given level to contain all the functions of lower level central places plus some additional functions not found in lower level places is untestable in the INFOM study. None of the raw data are made available in the report and nowhere does the study explicitly state that this criterion applies. INFOM defined seven hierarchical levels in the study thus surpassing Marshall's base limit of three levels. The levels in the hierarchy do not form a pyramid as called for by Marshall in criterion 6. There are more level 3 (8) than level 4 (4) central places. The seventh criterion is the basis for the following section of this work.

Interpretation of the Spatial Patterns of the Guatemalan Urban Hierarchy

Marshall's seventh criterion holds that all lower-level places occupy the interstices between higher level places. This is a spatial criterion and one he recognizes to be very difficult of application to empirical conditions. Nevertheless it will serve as a basis for interpreting the patterns of the several levels. The only first level central place in the country is Guatemala City, but it is technically not included in the study (Map 4). Although it was founded by the Spanish conquistadors as a political-administrative center for control of the dispersed Maya populations it is off-center relative to both the Central Belt and the country as a whole since a highland basin site was critical to its initial location.

Table 2

Central Places at Levels One Through Six, Their Global Centrality Indices and Their 1979 Population Estimates

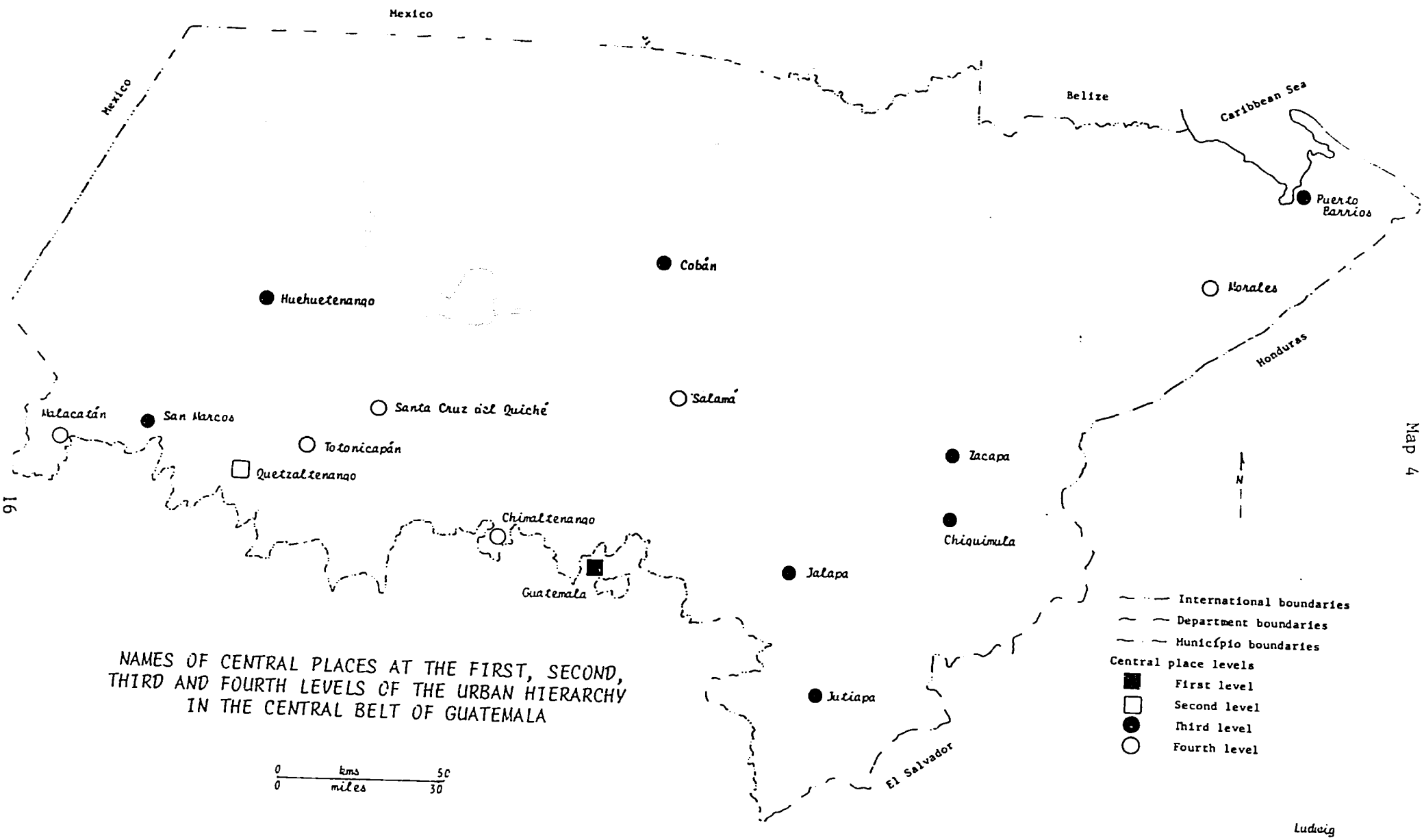
Level	Central Place	Global Centrality Index	1979 Population
1	Guatemala City		
2	Quetzaltenango	11,998.2	77,554
3	Huehuetenango	3,661.3	18,481
	Cobán	3,572.7	17,147
	Puerto Barrios	3,448.4	43,168
	Zacapa	2,300.2	21,397
	Jutiapa	1,799.7	13,802
	San Marcos	1,671.0	7,532
	Jalapa	1,648.8	19,730
	San Pedro Sacatepeque	1,481.8	15,265
	Chiquimula	810.6	22,136
4	Totonicapán	1,506.0	13,027
	Santa Cruz del Quiché	1,409.8	12,897
	Chimaltenango	1,409.8	18,104
	Morales	1,263.9	10,166
	Salamá	1,167.8	7,282
	Malacatán	1,043.4	4,584
5	Esquipulas	1,072.8	10,336
	San Pedro Carchá	923.9	6,530
	Panajachel	920.6	2,647
	Asunción Mita	732.6	12,895
	Gualán	724.0	8,788
	San Juan Sacatepeque	689.8	6,325
	Jocotán	640.5	3,248
	Sololá	633.7	5,578
	Barillas	613.1	3,935
	Tecpán Guatemala	610.1	7,362
	Mataquescuintla	544.3	4,238
	Mixco	500.4	38,278
	San Cristóbal Totonicapán	490.7	6,343
	El Progresso (El Progresso Department)	482.8	5,693
	Rabinal	459.4	5,328
	Jalapatagua	449.1	3,022
	Tejutla	444.0	1,727
	Santiago Atitlán	440.6	26,382
	San Cristóbal Verapaz	437.7	5,991
	Monjas	415.4	6,882
	Los Amates	400.2	2,772
	San Martin Jilotepeque	399.6	5,095
	Chiantla	392.3	3,049
	El Estor	349.5	5,380
	Teculután	341.9	4,222
	El Progresso (Jutiapa Department)	326.7	8,144
	Chichicastenango	301.1	4,586
	Sanarate	282.8	7,325
	San Juan Comalapa	217.5	14,472
	San Francisco El Alto	167.6	2,827
	Nebaj	121.1	6,199

Table 2 (continued

Level	Central place	Global Centrality Index	1979 Population
6	Santo Tomas de Castilla	1,165.7	6,469
	El Pinal	618.5	900
	Chiché	385.4	1,888
	San Juan Ostuncalco	381.1	7,602
	Concepción Tutuapa	375.7	548
	San Pedro La Laguna	375.0	8,212
	San Pedro Scatapéquez	346.5	5,296
	Joyabaj	330.9	3,310
	Tactic	316.1	2,739
	Santa Catarina Mita	304.1	6,042
	La Union	287.6	779
	Jacaltenango	283.9	6,418
	Comitancillo	277.8	823
	Fray Bartolomé de Las Casas	257.7	4,905
	Purulha	253.6	1,639
	Livingston	244.2	5,279
	Quirigua	234.9	3,937
	Santa Eulalia	234.7	2,660
	Teleman	230.4	3,783
	Momostenango	228.9	9,456
	Ipala	223.0	4,549
	Nahualá	220.9	2,449
	Salcaja	214.7	8,205
	Estanzuela	200.8	6,082
	Palencia	198.4	3.474
	Sansare	190.6	2,331
	Santa Catarina Pinula	189.6	3,756
	San Lucas Tolimán	188.4	7,684
	La Fragua	184.9	1,627
	El Rancho	178.3	3,733
	Uspantán	175.4	2,986
	San Antonio Huista	169.9	3,949
	Cubulco	169.5	2,378
	Morazán	167.3	5,414
	La Democracia	162.8	1,188
	Pachallum	161.8	1,139
	San Carlos Sija	161.7	2,793
	Saquitacaj	160.8	1,325
	Lo de Bran I	159.0	2,557
	San Augustin Acasaguastlán	154.5	4,269
	Cabrican	151.9	922
	San Jose Caben	148.8	2,744
	San Juan Chamelco	145.3	2,776
	San Raimundo	145.1	2,051
	Santa Maria Chiquimula	139.7	2,700
	Olintepeque	139.7	3,338
	Catarina	139.1	1,727
	Argueta	138.4	1,457
	San Jose Poaquil	136.0	3,141
	Tacaná	134.2	1,913
	Cuilco	132.0	1,228
	La Tinta	128.2	6,309
	Chillani	126.5	1,433

Table 2 (continued)

Level	Central Place	Global Centrality Index	1979 Population
6	Almolonga	125.4	9,816
	El Rico	121.7	1,028
	Quetzaltepeque	116.3	2,758
	Nenton	115.4	1,736
	San Bartolo	115.1	1,027
	Aguacatán	113.1	1,529
	San Jerónimo	112.9	2,301
	Fronteras	109.4	1,937
	Agua Blanca	105.2	3,184
	Malacatancito	104.7	1,000
	San Pedro Necta	103.0	1,755
	San Miguel Acatán	101.8	2,402
	Ixtahuacán	99.8	2,358
	Mayuelas	99.5	1,134
	Concepción Chiquirichapa	98.7	3,221
	Santa Lucia Utatlán	97.5	1,023
	Shupa	96.8	694
	Cantel	96.2	3,221
7 (first five)	El Rodeo	326.6	1,082
	Santa Cruz	243.5	736
	Esmeralda	95.3	1,487
	San Pedro Soloma	93.1	3,542
	Palestina de los Altos	92.9	1,218
7 (last five)	El Adelanto	1.7	1,003
	Buena Vista	1.7	1,057
	Tzununa	1.7	6,360
	Lacama II	1.7	1,507
	Xecachelaj	1.7	704



NAMES OF CENTRAL PLACES AT THE FIRST, SECOND, THIRD AND FOURTH LEVELS OF THE URBAN HIERARCHY IN THE CENTRAL BELT OF GUATEMALA

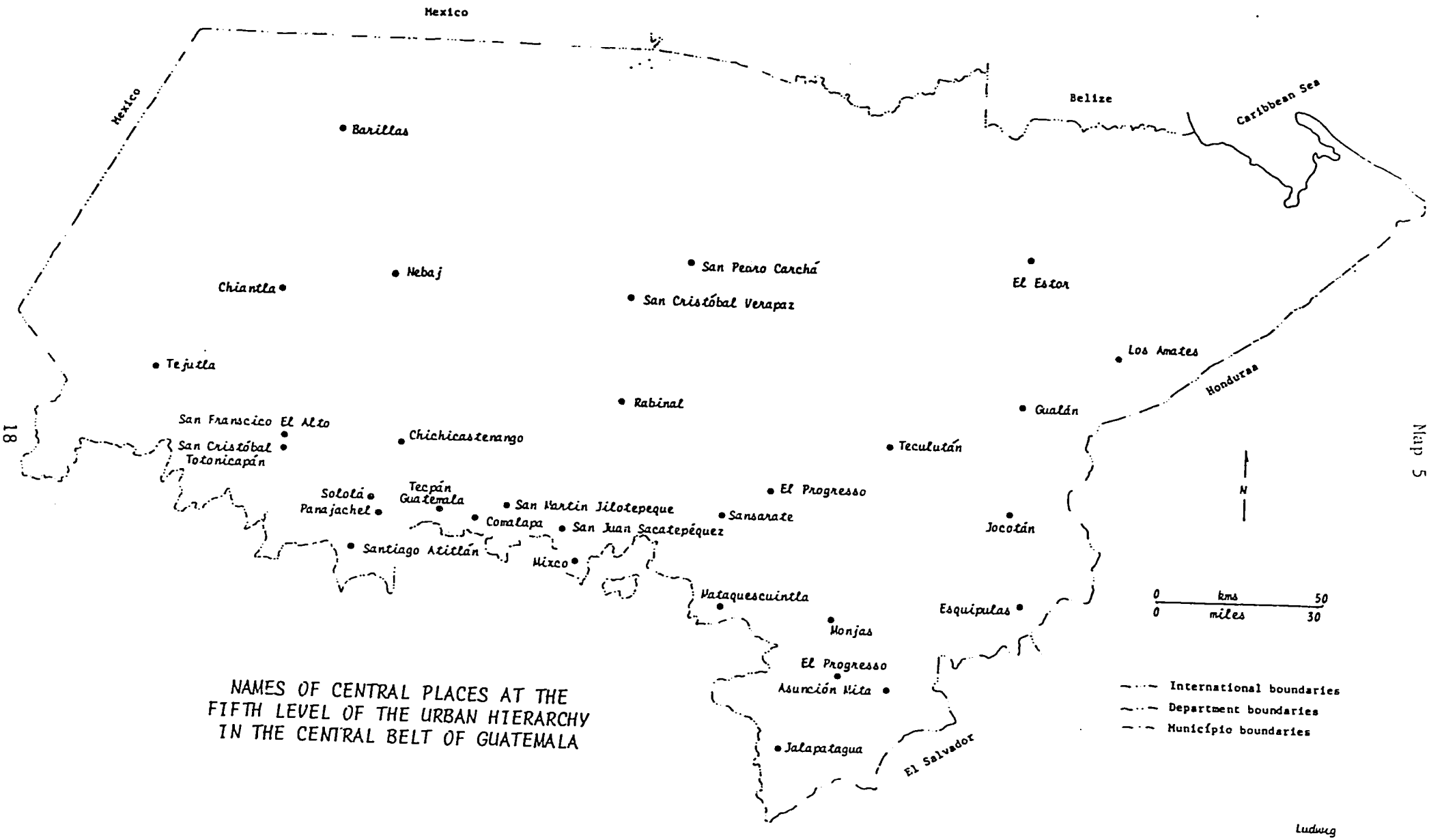
Map 4

The only level 2 central place defined in the study is Quetzaltenango (Map 4). It was an important colonial city which by the late nineteenth century had developed manufacturing industries, electric power, banking systems and strong communications links to most of the western highlands all of which gave it a certain autonomy relative to Guatemala City. Its history and functions suggest that it is the economic center of a large area in the western highlands and is not always sensitive to economic developments in the eastern part of Guatemala. In the ideal central place hierarchy there should be at least two level 2 central places. Another may well lie outside of the Central Belt. It may not be stretching the reader's spatial credulity too much to suggest that Quetzaltenango does occupy the classic position of a level 2 central place in that a very large number of lower order places are to be found between it and Guatemala City. None of them, however, are level 3 places.

The eight level 3 central places tend to occupy an arc of locations beyond the higher order places, Guatemala City and Quetzaltenango. No level 3 central place lies between these two larger places, however. The INFOM study points out that Huehuetenango, Cobán and possibly the San Marcos/San Pedro Sacatepéquez node owe many of their central place functions to their well developed tributary areas, although the San Marcos node benefits from the surrounding coffee production and Coban from petroleum and minerals and its role as a tourist center. Puerto Barrios, the nation's chief port, is connected by rail and highway links through the Rio Motágua valley to Guatemala City. Zacapa lies along these routes and together with Puerto Barrios probably benefits more from these linkages than from their regional tributary areas. INFOM suggests that strong highway links to the rest of Central America are the major factors in the levels attained by Chiquimula and Jutiapa.

Among the level 4 central places only Morales and Salamá appear to be between centers at higher levels and these are some distance away (Map 5). Most of the central places at level 5 are located between places at higher levels (Map 5). There are a few closely-paired centers which upset this broad distribution. They include San Francisco El Alto/San Cristóbal Totonicapán and Sololá/Panajachel, whose apparent proximity on the map is considerably extended by the mountainous terrain between them. Level 6 centers cluster heavily in the western highlands and spread to the northwest, as well. This latter condition precludes many of these central

Map 5



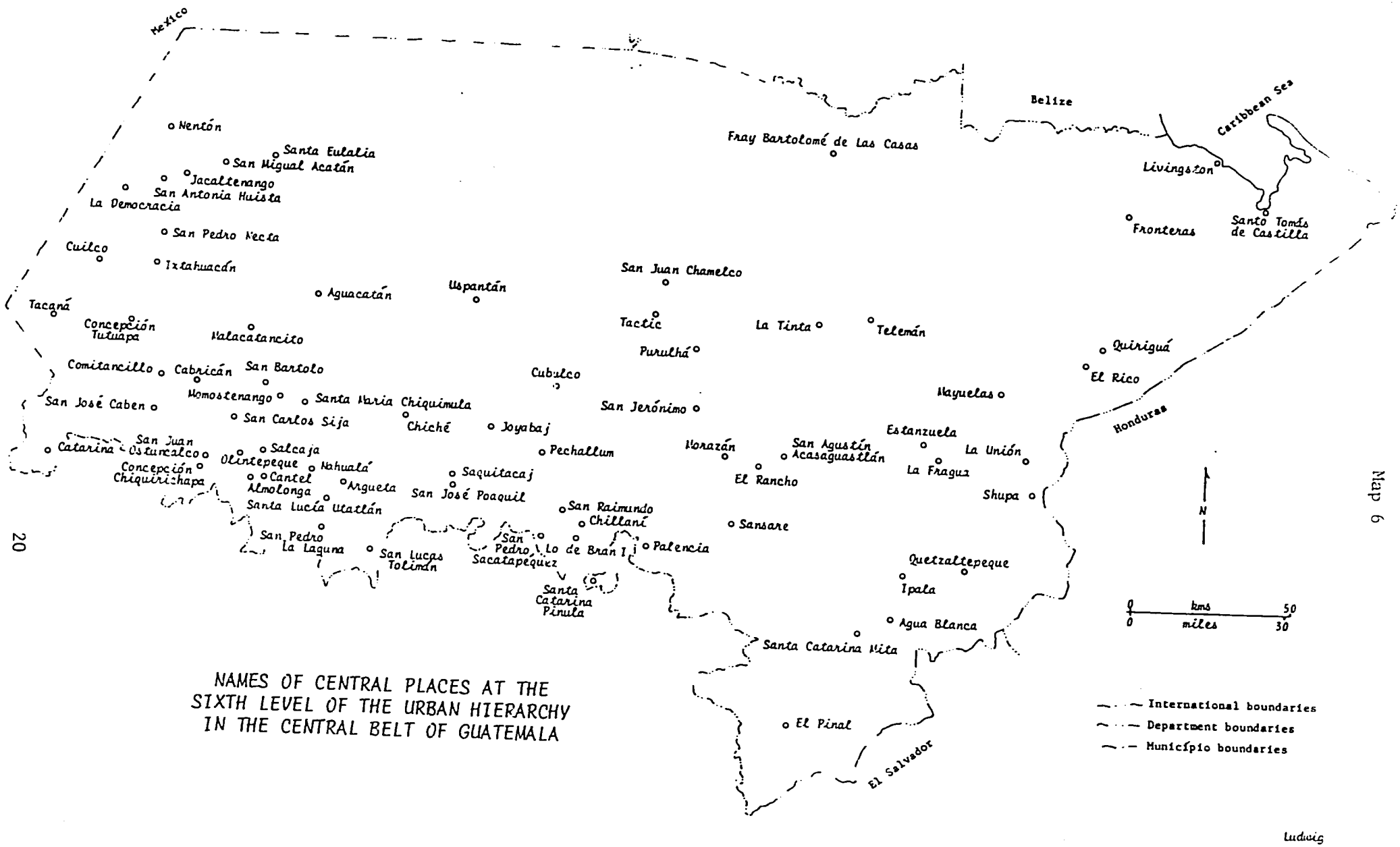
NAMES OF CENTRAL PLACES AT THE FIFTH LEVEL OF THE URBAN HIERARCHY IN THE CENTRAL BELT OF GUATEMALA

places from lying between higher level centers (Map 6). The 1,869 central places at level 7 are concentrated in the highlands west of Lake Atitlán (Map 7). These centers are small in both population and numbers of functions and are probably the truest of central places in the country, each providing a few goods and services to the surrounding Maya farmers. Their numbers and density seem to recapitulate very well the distribution of rural Maya populations.

Periodic Markets in the Urban Hierarchy

Many Maya farmers sell the products of their small garden plots by travelling to a nearby town that has a periodic market. There, usually in the town plaza or on a blockaded street, temporary stalls are set up to house the merchandise. Market days vary among towns and some have more than one per week. The biggest markets usually occur on Sundays, the most popular day for periodic markets in western Guatemala. When Maya farmers leave their plots to sell they become temporary residents of the communities in which the market is located. If public monies are to be allocated to aid rural people by offering them such urban functions as medical, legal and agricultural aid, educational opportunities and useful new goods, then these functions might best be located in market towns frequented by rural peoples.

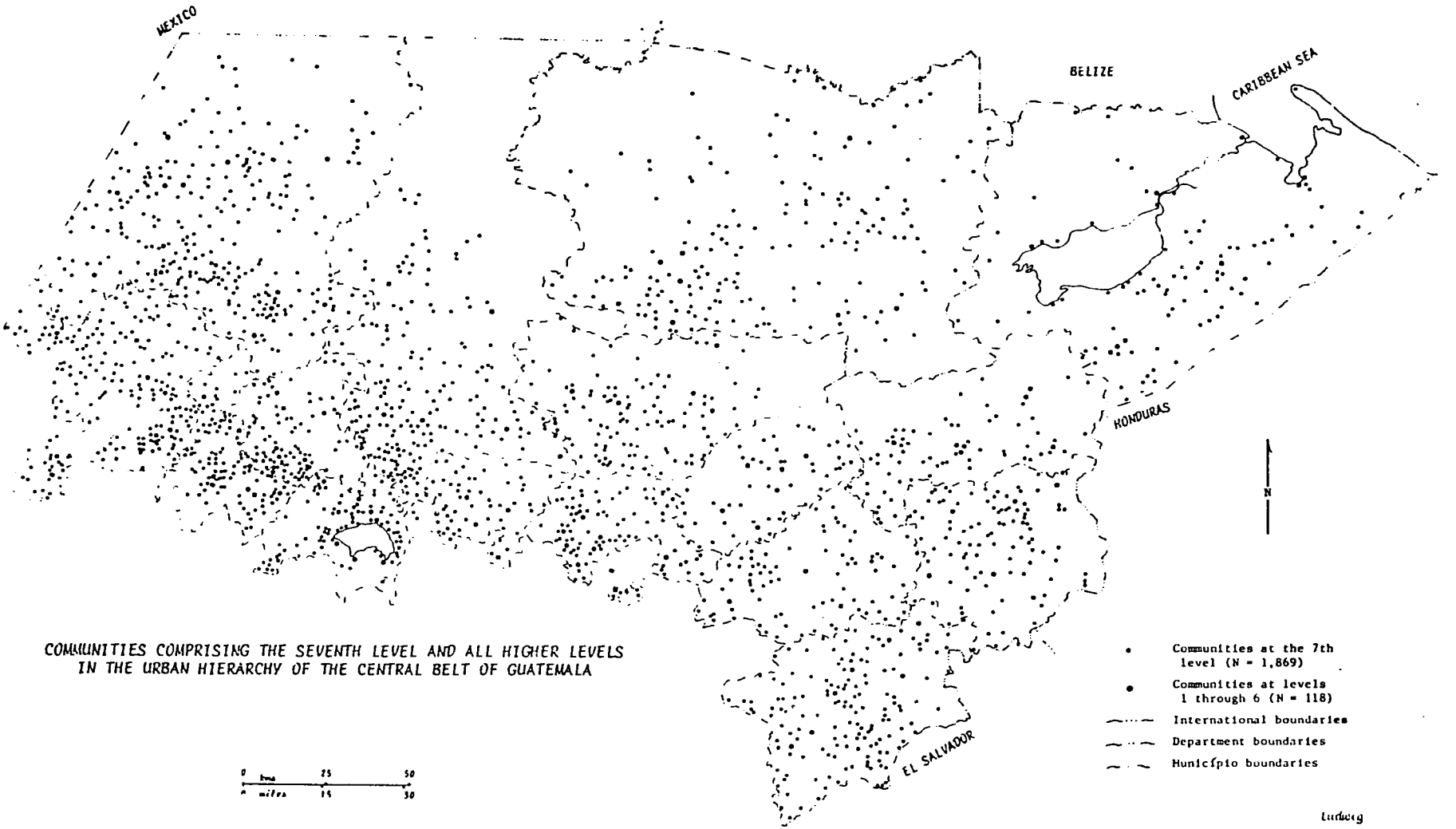
In 1980 Professor Richard Wilkie censused the vendors in periodic markets in the western highlands of Guatemala. Thirty-nine of these markets occur in central places defined by INFOM in the Central Belt. These are shown on Map 8 and the numbers of vendors in each market are listed on Table 3. Where two periodic markets were censused in one week the largest was recorded for this work. The numbers of vendors at periodic markets in central places at levels 6 and 7 coincides closely with the Global Centrality Index of these central places (Figure 1). The Pearson r for this realtionship is .793 and is significant at the .01 level. The relationship breaks down, however, beyond the fifth level. Map 9 shows that periodic markets with more than 900 vendors were held weekly in Chiché, Sololá, Chichicastenango, Totonicapán and Quetzaltenango. Smaller markets, of course, are more numerous and together with these large ones the 39-market sample saw more than 17,000 rural persons temporarily available to partake of goods and services in an urban center. In just this small sample of Guatemalan periodic markets the total number of vendors equalled the total population of Cobán, a level 3 central place.



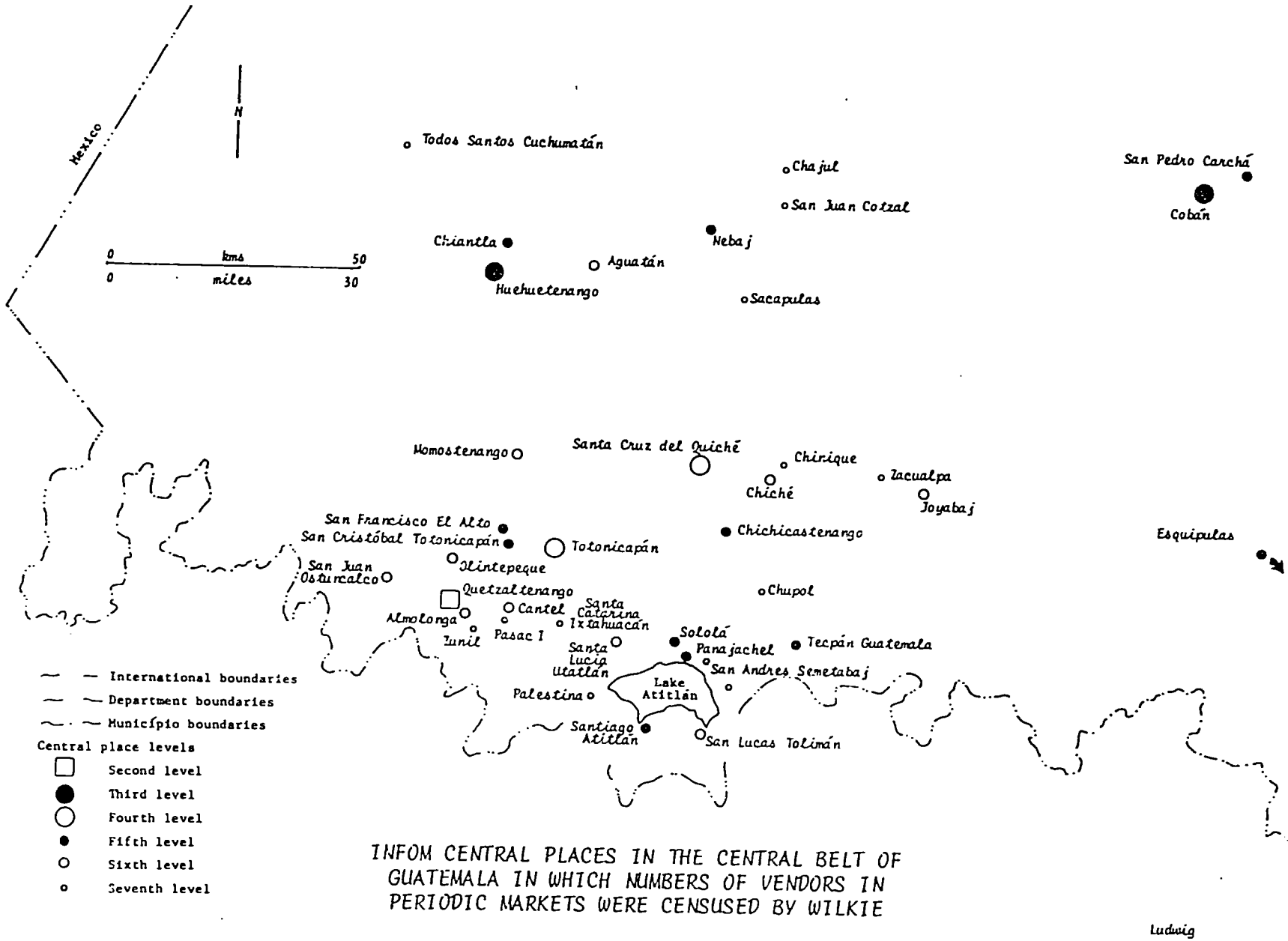
NAMES OF CENTRAL PLACES AT THE SIXTH LEVEL OF THE URBAN HIERARCHY IN THE CENTRAL BELT OF GUATEMALA

Map 6

Map 7



COMMUNITIES COMPRISING THE SEVENTH LEVEL AND ALL HIGHER LEVELS IN THE URBAN HIERARCHY OF THE CENTRAL BELT OF GUATEMALA

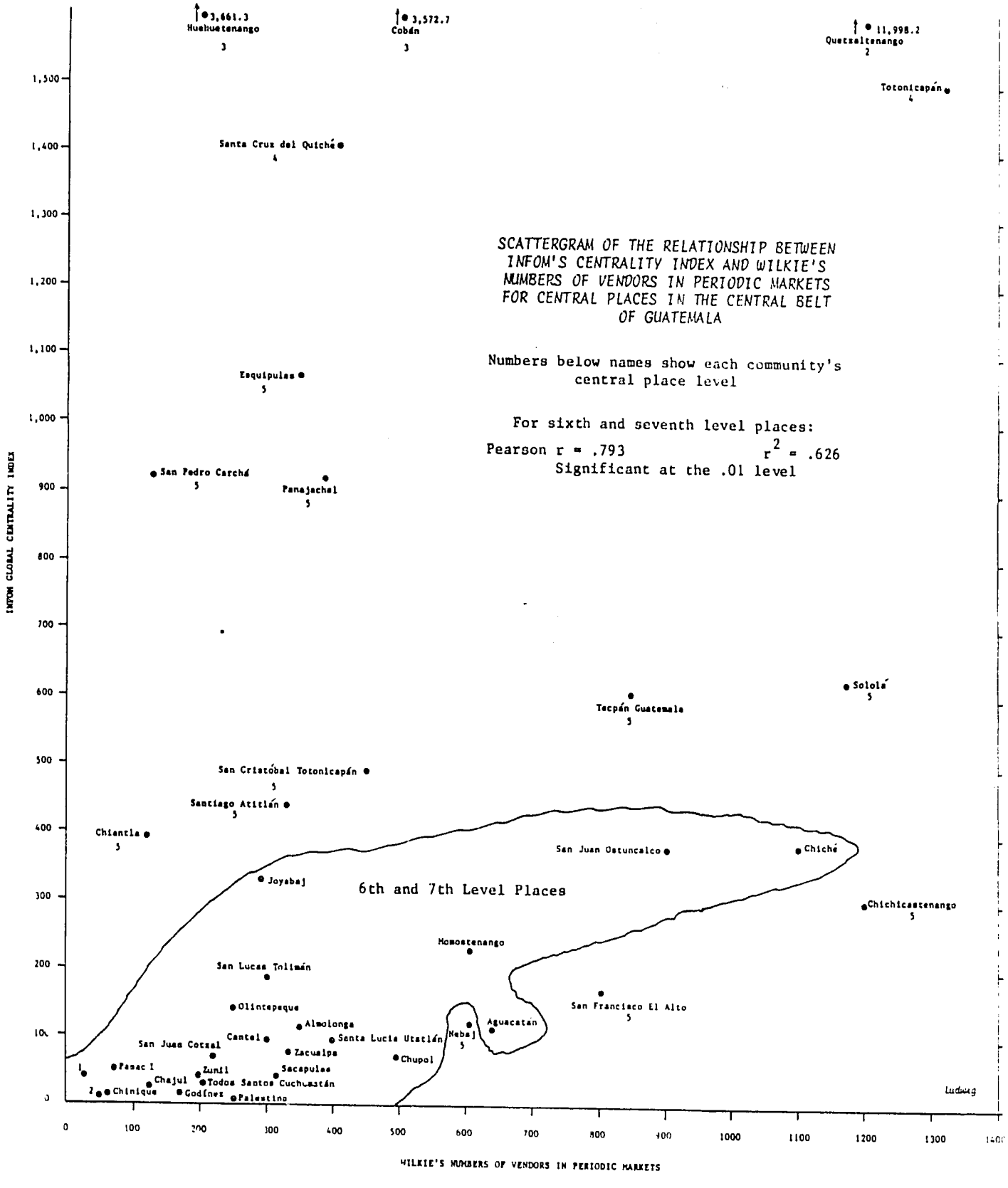


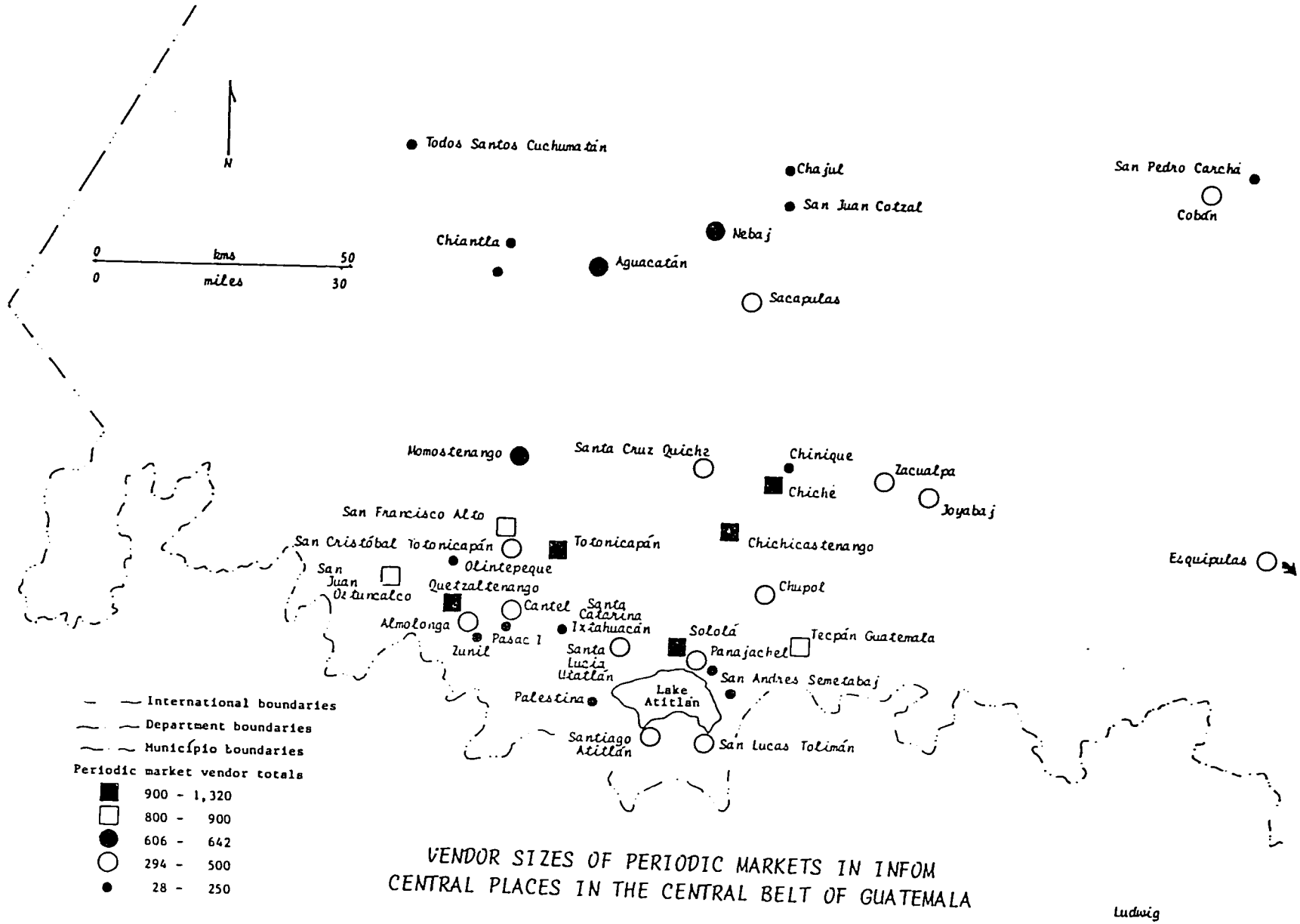
INFOM CENTRAL PLACES IN THE CENTRAL BELT OF GUATEMALA IN WHICH NUMBERS OF VENDORS IN PERIODIC MARKETS WERE CENSUSED BY WILKIE

Table 3

Hierarchical Level, Global Centrality Index and Numbers of Vendors in Periodic Markets for the 39 Central Places in the INFOM Urban Hierarchy Which Have Periodic Markets

Central Place	Level	Global Centrality Index	Numbers of Vendors in Periodic Market
Totonicapán	4	1,506.0	1,320
Quetzaltenango	2	11,998.2	1,200
Chichicastenango	5	301.1	1,100
Sololá	5	633.7	1,169
San Juan Ostuncalco	6	381.1	900
Tecpán Guatemala	5	610.1	845
San Francisco El Alto	5	167.6	800
Aguatán	6	113.1	642
Nebaj	5	121.1	606
Momostenango	6	228.9	606
Cobán	3	3,572.7	500
Chupol	7	70.3	494
San Cristóbal Totonicapán	5	490.7	450
Santa Cruz del Quiché	4	1,409.8	405
Santa Lucia Utatlán	6	97.5	400
Panajachel	5	920.6	387
Almolonga	6	125.4	350
Esquipulas	5	1,072.8	350
Zacualpa	7	66.6	333
Santiago Atitlán	5	440.6	327
Sacapulas	7	42.9	312
Cantel	6	96.2	300
San Lucas Tolimán	6	88.4	300
Joyabaj	6	330.9	294
Olintepeque	6	139.7	250
Palestina	7	5.0	250
San Juan Cotzal	7	69.7	221
Todos Santos Cuchumatán	7	28.6	204
Zunil	7	37.2	200
Huehuetanango	3	3,661.3	200
Godinez	7	14.9	169
San Pedro Carchá	5	923.9	130
Chiantla	5	392.3	120
Chajul	7	25.8	123
Pasac I	7	49.8	72
Chinique	7	13.8	62
San Andres Semetabaj	7	9.7	50
Santa Catarina Ixtahuacán (Ixtahuacán)	7	40.6	28
Total	-	-	17,669


SCATTERGRAM OF THE RELATIONSHIP BETWEEN INFOM'S CENTRALITY INDEX AND WILKIE'S NUMBERS OF VENDORS IN PERIODIC MARKETS FOR CENTRAL PLACES IN THE CENTRAL BELT OF GUATEMALA
Numbers below names show each community's central place level
For sixth and seventh level places:
Pearson r = .793
r2 = .626
Significant at the .01 level
6th and 7th Level Places
INFOM GLOBAL CENTRALITY INDEX
WILKIE'S NUMBERS OF VENDORS IN PERIODIC MARKETS
3,661.3
Huehuetenango
3
3,572.7
Cobán
3
11,998.2
Quetzaltenango
2
Totonicapán
4
Santa Cruz del Quiché
4
Esquipulas
5
San Pedro Carchá
5
Panajachel
5
Sololá
5
Tecpán Guatemala
5
San Cristóbal Totonicapán
5
Santiago Atitlán
5
Chiantla
5
San Juan Ostuncalco
Chiché
Joyabaj
Chichicastenango
5
Momostenango
San Lucas Tolimán
San Francisco El Alto
5
Olintepeque
Almolonga
Aguacatán
Santa Lucía Utatlán
Nebaj
5
Cantel
San Juan Cotzal
Zacualpa
Chupol
Pasac I
Zunil
Sacapulas
Chajul
Todos Santos Cuchumatán
Chinique
Godínez
Palestina
Ludwig



VENDOR SIZES OF PERIODIC MARKETS IN INFOM CENTRAL PLACES IN THE CENTRAL BELT OF GUATEMALA

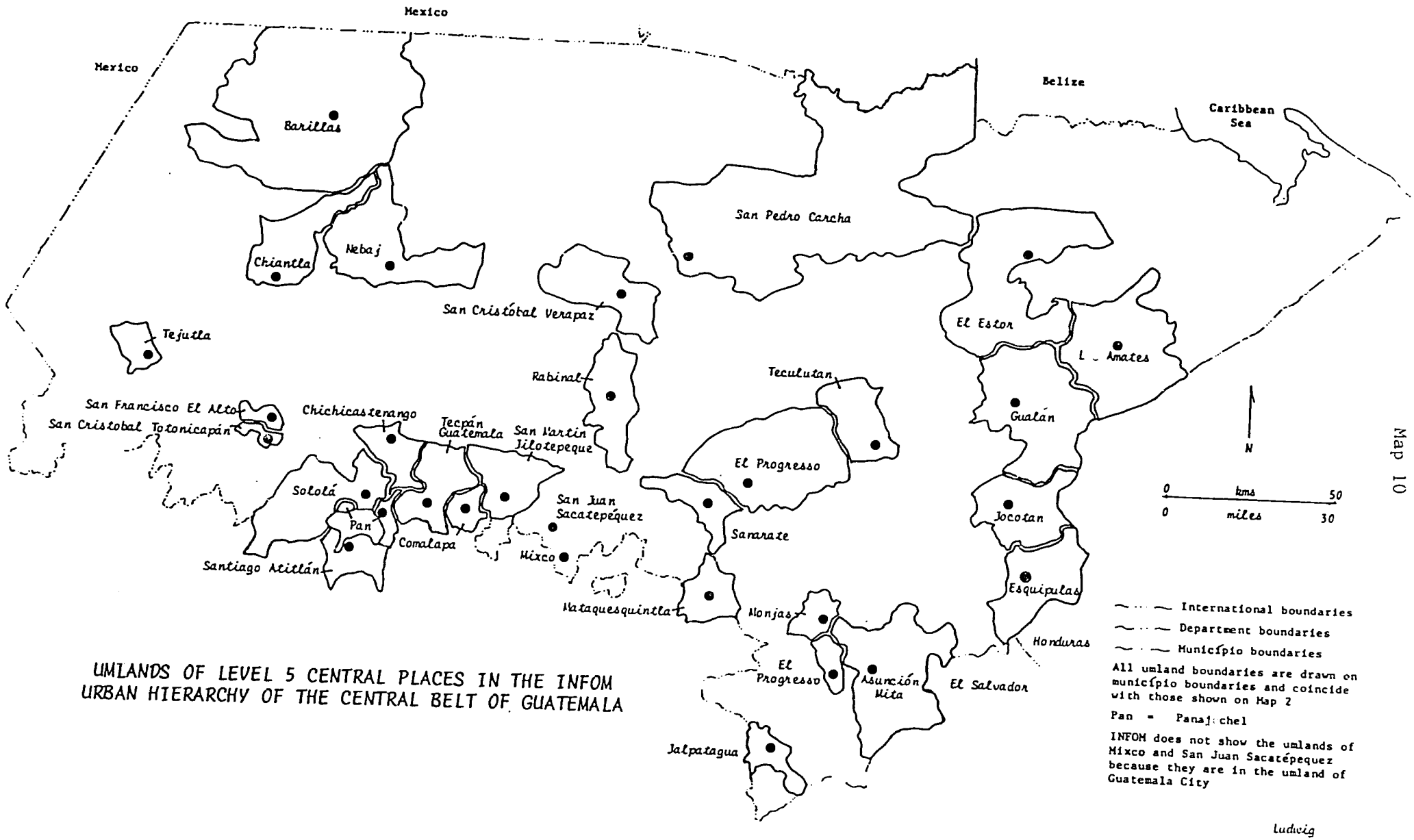
Ludwig

Umlands or Tributary Areas of Central Places at Levels Five Through Two in the Urban Hierarchy

Maps 10 through 13 present INFOM's estimates of the umlands or tributary areas of each central place at levels five through two. INFOM prepared elaborate working maps showing straight line linkages between a given central place as the site where such items as soap and coffee were purchased and hospital facilities used, and other places where those who came to the central place to do these things resided. In this way the researchers built a picture of the service umlands of each central place. When these umlands were drawn, the município was used as the building block. None was divided, so an entire município had to go in one or another umland.

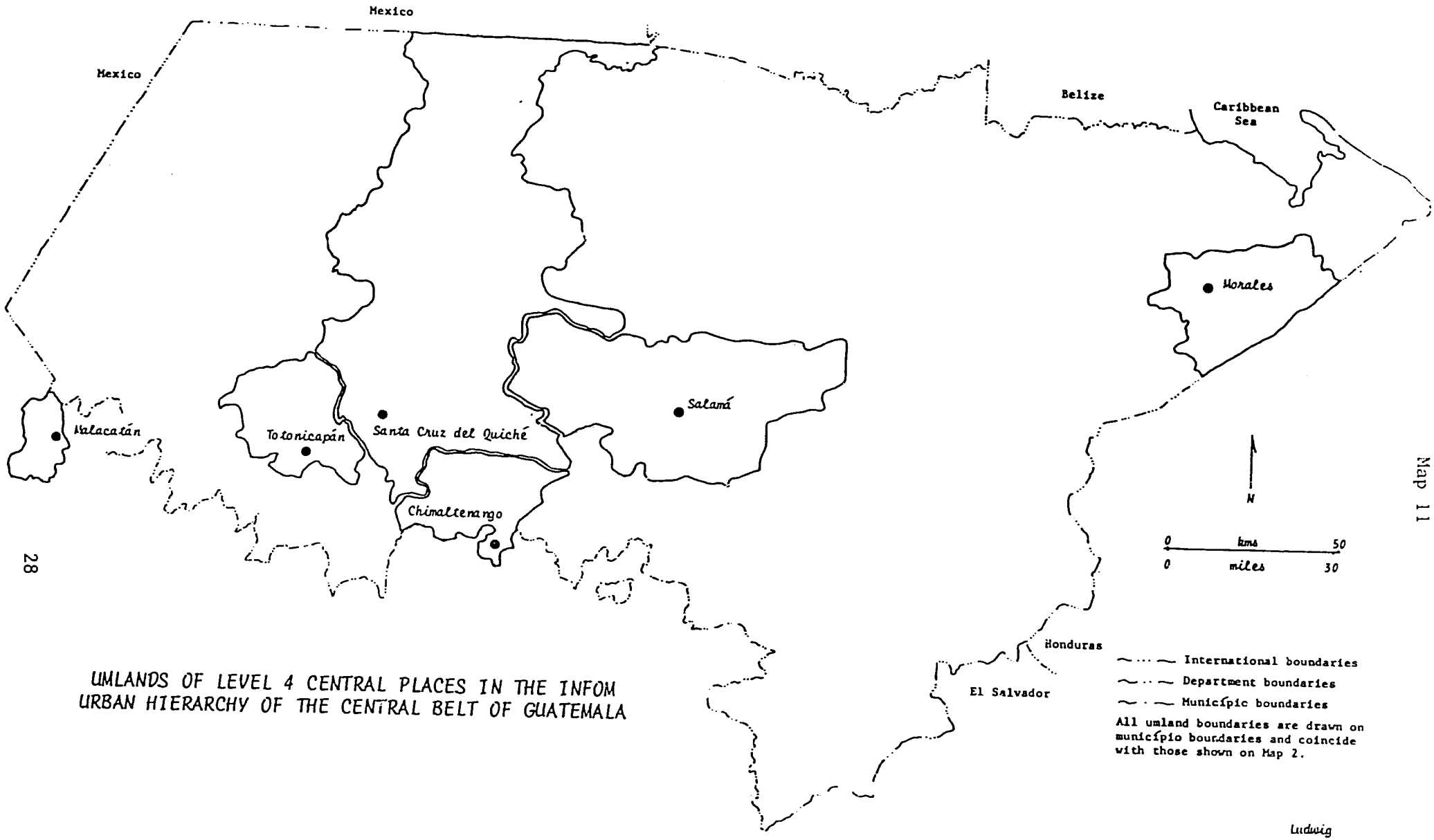
Not one of the linkages defined, however, appears to have been empirically based. To explain on what basis these linkages were established the INFOM study uses such phrases as "....entre los lugares poblados que evidenciaron tener relación...." in referring to the straight line linkages "....between the population centers which evidence having an economic tie between them." The evidence used appears to have been the calculation of the "reach" of a good or service (how far individuals could be expected to come for them), then the application of this distance from the central place outward in all directions to see what places in which municípios were within the circle so scribed. A composite of "reaches" of various goods and services was the final determinant of the umland in which a given município fell. Apparently each umland was altered by extending it along main transportation routes and shortening where there were no such routes. The methodology notwithstanding, these estimates did allow the creation of umlands which INFOM took as expressions of reality.

At level 5 (Map 10) the 31 umlands defined include only 63 municípios. Seventeen of these umlands are comprised of only one município, while Sololá's umland contains 11 municípios and Barilla's 6. If these level 5 central places were ideally distributed, the fact that only 63 municípios of a total of 209 in the study area were proximal to level 5 services would indicate a serious lack of access to goods and services for rural peoples. But because so many of the higher order centers are mal-distributed relative to the ideal they are probably filling in these gaps and providing rural residents and residents of smaller central places access to 5 level or higher central places.



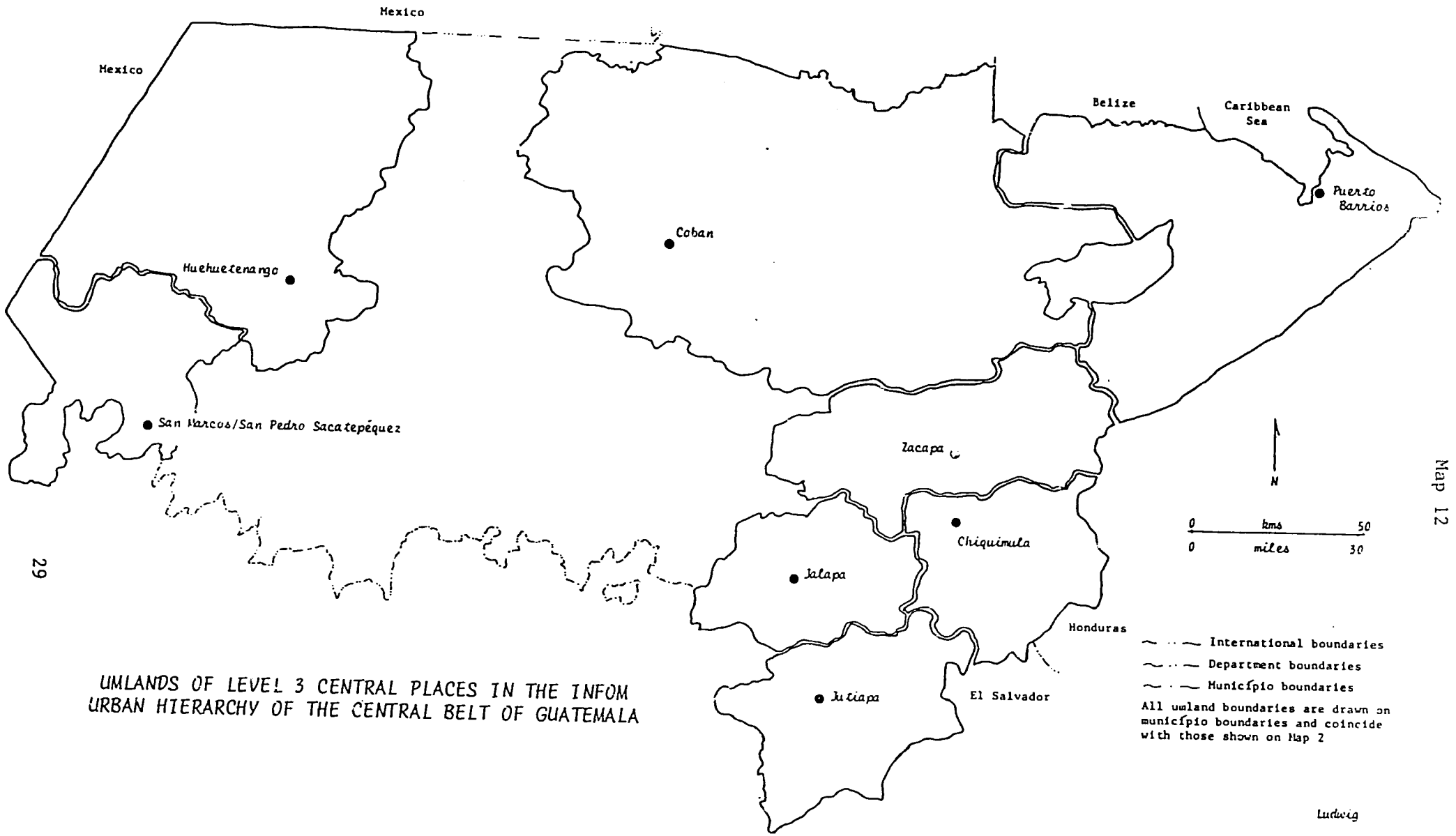
UMLANDS OF LEVEL 5 CENTRAL PLACES IN THE INFOM URBAN HIERARCHY OF THE CENTRAL BELT OF GUATEMALA

Map 10



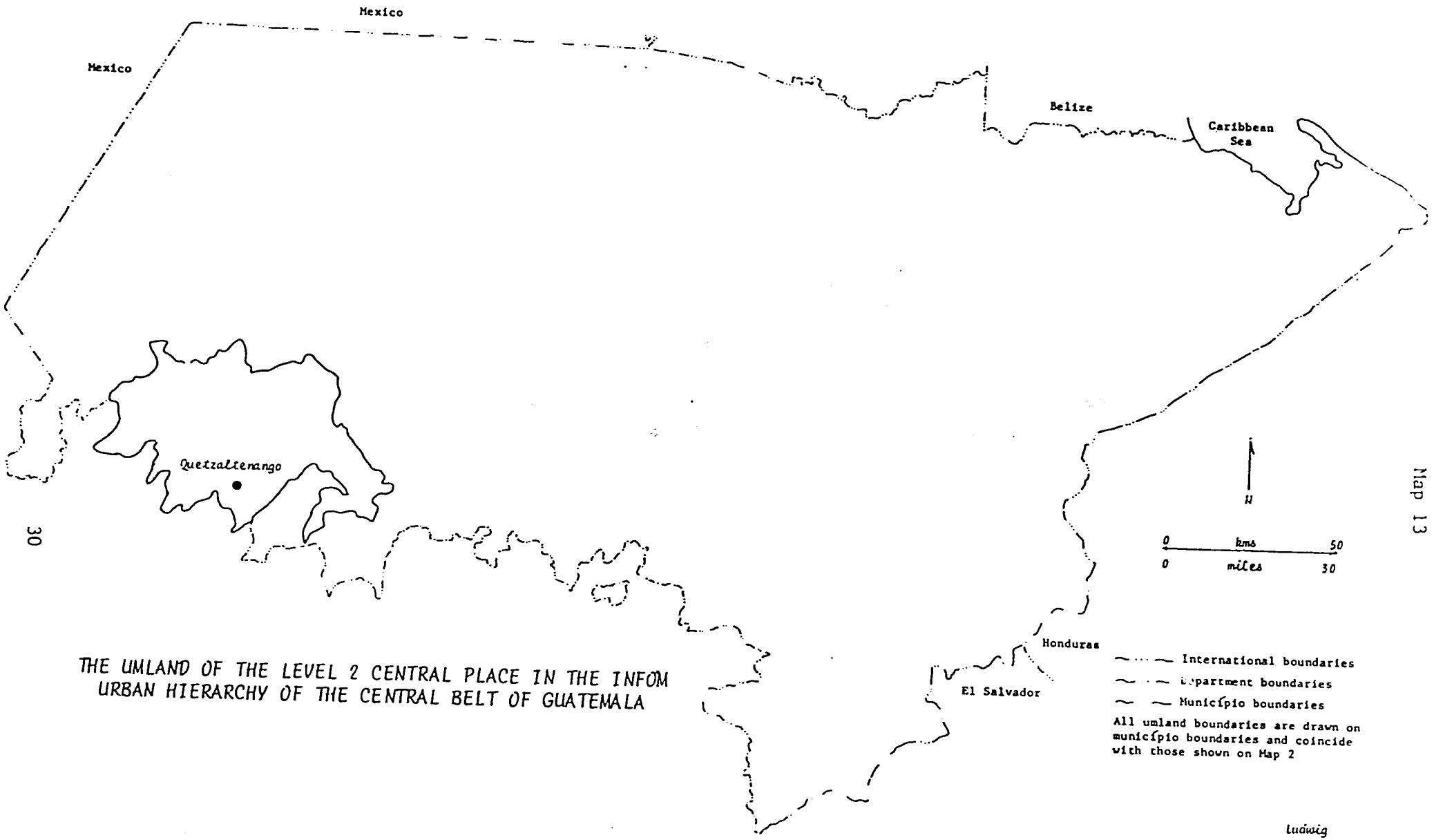
UMLANDS OF LEVEL 4 CENTRAL PLACES IN THE INFOM URBAN HIERARCHY OF THE CENTRAL BELT OF GUATEMALA

Map 11



UMLANDS OF LEVEL 3 CENTRAL PLACES IN THE INFOM URBAN HIERARCHY OF THE CENTRAL BELT OF GUATEMALA

Map 12



THE UMLAND OF THE LEVEL 2 CENTRAL PLACE IN THE INFOM URBAN HIERARCHY OF THE CENTRAL BELT OF GUATEMALA

Map 13

Sololá had links only to the northern parts of Nahualá and Santa Catarina Ixtahuacán (Ixtahuacán) while the southern parts of these municípios were oriented to Suchitepéquez to the south, out of the Central Belt. In keeping with rule not to split municípios, the entire areas of both of these municípios are included in Sololá's umland. San Pedro Carchá has a very large umland based on a strong set of functions that compete well with Cobán, a nearby level 3 central place. INFOM sees this condition as an incipient form of healthy decentralization at work.

At level 4 INFOM notes how Santa Cruz del Quiche's umland spreads beyond the Department of the same name to include the município of Santa Lucia La Reforma in Totonicapán Department. The 'reach' of Morales, owing to the highway and rail systems in the Rio Motágua route zone, extends northeast into Livingston município, but apparently it is not sufficient to allow inclusion of this latter município in Morales' umland. In the same manner Malacatán's 'reach' extends northward into Tajumulco município, which is not included in the former's umland.

At level 3 INFOM calls Puerto Barrios and Zacapa very similar places that are located along a major route zone. It sees the strength and consistency of linkages and the clustering of the four centers, Chiquimula, Jutiapa, Jalapa and Zacapa, in relative proximity as the keys to their having large and well-developed umlands.

At level 2, Quetzaltenango's umland would probably spread to the south if this area were added to the Central Belt study area. No explanation is given for the exclusion from Quetzaltenango's umland of the municípios of Santa Catarina Ixtahuacán (Ixtahuacán) and Nahualá in Sololá Department. They are in Sololá's level 3 umland and Sololá is in Quetzaltenango's level 2 umland. Their inclusion should follow.

Conclusions

Despite the methodological crudity of some parts of the central place hierarchy study it does provide a basis for analysis of the Guatemalan system and can lead to a better understanding of the country's urban spatial structure. The redrawing of the hierarchical levels would depend upon recalculating the Global Centrality Indices which are in turn dependent upon whether establishments or functions are used as the building blocks. All this might not really sharpen a picture of Guatemala's central place structure, since these structures, wherever they are developed, tend to present rather hazy pictures of reality.

What was said about central place hierarchies does not apply to umlands. These can be sharp and useful planning tools at the meso and micro levels if they are adequately and accurately done. The umland picture of Guatemala should be clarified in the future. Perhaps the INFOM estimates completed to date will stimulate further research in this area.

Periodic markets may be seen as but a single element to be considered in multi-variable planning proposals. On the other hand, if their roles are given some thought and further analysis, they may become critical factors in the delivery of goods and services to rural dwellers by urban persons who are not likely to reside in Maya farming communities.

Citations

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3. John U. Marshall, The Location of Service Centers, An Approach to the Analysis of Central Place Systems, (Toronto: University of Toronto Press, 1969, pp. 169-170).