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Local Distribution---
The Next Frontier

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LOCAL DISTRIBUTION -- THE NEXT FRONTIER

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The availability of diverse communications services can provide powerful leverage for greatly enhancing the nation's information-based economy. The weak link now in providing advanced communications services to business and the public is at the local distribution level. The diversity of services possible through local distribution is being inhibited by traditional views on local distribution and prevailing regulatory policies. Federal, state, and local jurisdictional boundaries need to be clarified. Broadcast and common carriage distinctions require review. Rate regulation, pricing distortion, and depreciation of common carrier services and plans must be reassessed. The emphasis in communications policy should shift from universality of service to service diversity.

Keywords: Advanced communications services, broadcasting, common carriage, communications policy, competition, deregulation, jurisdiction, local distribution, separations and settlements process.

I. INTRODUCTION

The concepts underlying communications policy as established in the 1930's are today inhibiting the nation's opportunity to acquire and use information. Significant strides have been made in the past 15 years to encourage diversity in terminal equipment and long distance transmission by removing entry barriers, promoting competition, and reducing regulation. The cost of long haul transmission and related switching, however, represents only about 20% of the total costs of the nationwide communications network. The bulk of the costs are not in the long-haul portion of the network, but in the last mile or so it takes to reach the individual customer. If, for example, competition and deregulation boosted long-haul

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efficiency by 30%, the total impact on the nation's communications bill might be only 5%. Also, innovative services developed for long haul transmission cannot necessarily be communicated through the current local distribution network due to existing technological or regulatory limitations.

The "last mile" problem has been hidden from regulators and the public to a large extent by the separations and settlements process, especially under the "Ozark Plan" now in use. Local exchange costs have been steadily increasing due to inflation, service improvements (e.g., expansion of single-party service), and other factors, while long-haul costs have been declining or at least not increasing as fast as inflation due primarily to technological advances. The separations process has transferred, in an accounting sense, an increasing fraction of local costs to long distance service, thus masking the true increases in local costs.

The current local distribution system is not only a cost impediment, it is a technological impediment as well. High speed digital local loops are generally difficult to obtain, as well as costly. Older switching equipment cannot be easily converted to give the specialized carriers local distribution services comparable to those given the established carriers. The time it takes to establish a connection with older switching equipment is incompatible with many computer applications. The use of analog grade loops for low speed data ties up an entire local loop even though the bandwidth requirement is only a fraction of that available. In addition, the regulatory distinction between common carrier and broadcast classifications may restrict our communications opportunities.

The local distribution network is now the weak link in the chain to provide advanced communications services to business and the public.

II. THE POLICY LAG - 1930 GOALS VERSUS 1980 OPPORTUNITIES

A new dimension was added to the ability to communicate with the advent of electrical communications, first the telegraph in 1850, then the telephone in 1876, and then radio broadcasting at the turn of the century. In 1934, Congress passed legislation to promote general availability of electronic communications throughout the country. By that time, two-thirds of the households had radios, but only half that many had telephone service (Figure 1). The telephone growth rate has been much slower than over-the-air broadcast services, and was much more influenced by the Great Depression. It was 1946 before the telephone reached 50% of the households. By 1970, these services, which catered to man's basic sensory communications, had attained general availability.

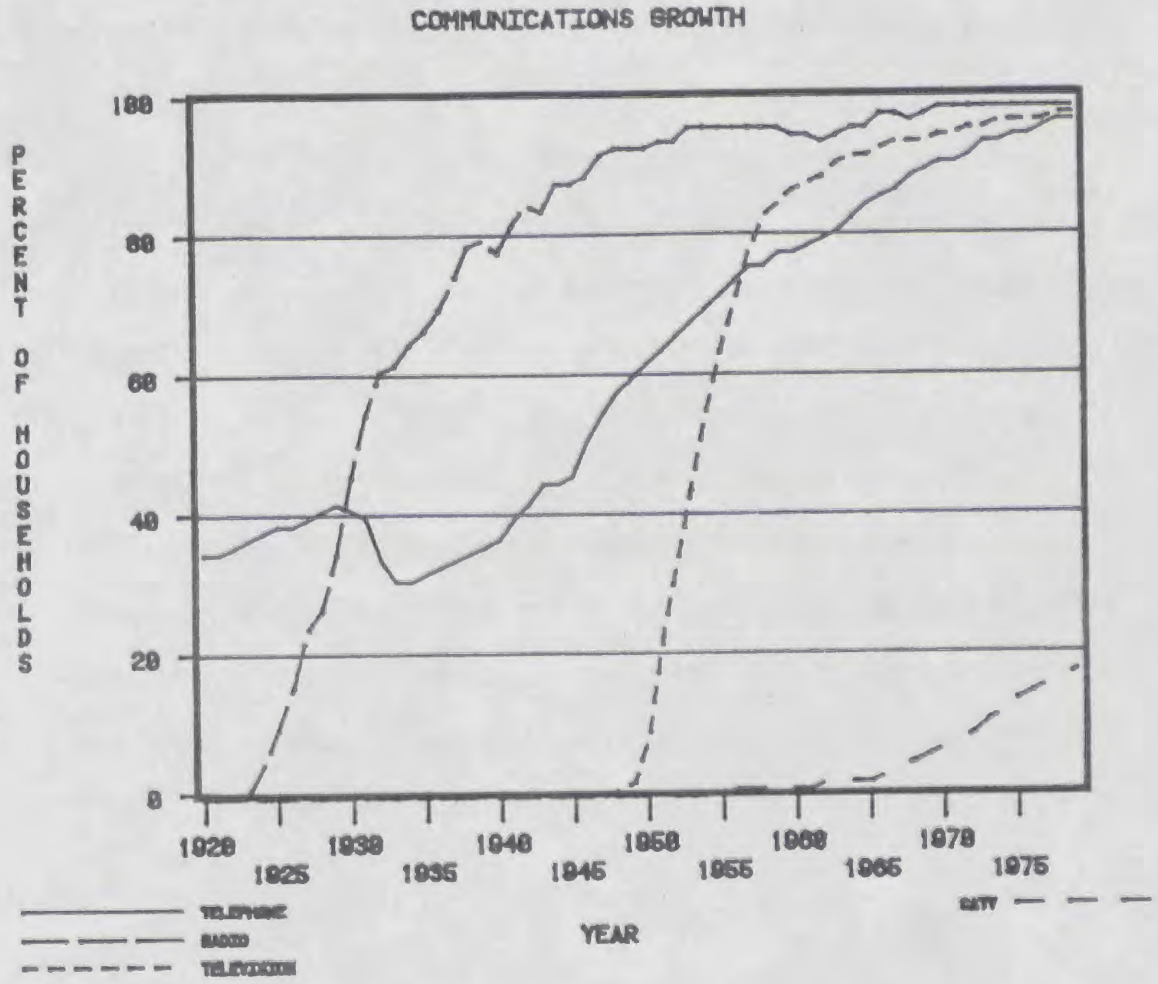

Figure 1. Development of Communications

The emphasis in national policy development in the last ten years has thus shifted from general availability of basic service toward a broader diversity of service offerings. The last Congress, for example, had before it needed legislation which would promote this diversity through marketplace interaction between consumer and producer, rather than through government approval in the regulatory process. The legislation, however, did not fully address the local distribution issue. After 50 years of strict government regulation, there are policies and procedures in place that require reexamination in light of the new opportunities. Already, customer premises (the terminal equipment through which the customer obtains service), as well as long distance transmission services are available on a competitive basis. In recent rulings, the FCC has held that carriers with no positive monopolistic influence will be allowed to offer services without strict rate-of-return regulation.

The problem is that although opportunities now exist for competitive terminal equipment and interstate transmission, regulatory and other policies constrain the diversity of services possible through local distribution. The same advanced technology of long distance transmission, such as afforded by satellite and packet switching technology, and terminal equipment technology, can provide the basis on which to build new service offerings to the customer. Such services, however, cannot necessarily be accommodated by the traditional local distribution plant; the plant that represents 80% of the $175 billion investment in communications facilities. The technological constraints and regulatory incentives of today for both common carrier and broadcast communications were derived from an emphasis on universality of service, not service diversity.

Even the structure of the Communications Act stimulated not only regulatory, but institutional separation between what 50, or even 15 years ago were the separate services of interpersonal telephone and mass media broadcasting. This distinction became an integral part of the institutional and service philosophy underlying local distribution to the public. Telephone communications were hard-wired into the home or business, whereas television and radio broadcasts were received over-the-air on a radio receiver. Now with the greater variety of broadband services to the consumer (e.g., through CATV and satellites), and with solid state electronics reducing the cost of information generation and display, the opportunity has developed for expanded diversity of communications services. Accompanying this diversity, there is the need to reconsider traditional concepts which underlie today's institutional and service policy. Today:

- Wired systems are carrying broadcast signals into the home. Telephone companies have begun to experiment with the same transmission technology to carry not only telephone conversations, but new yet undefined broadband services.

- Television stations are transmitting information for display on the individual's television set at his selection.

- Both common carriers and cable TV companies offer access to the same comprehensive data information banks.

- Communications companies are proposing new local distribution services which complement traditional voice communications with high speed data and video services which cannot be accommodated over the traditional telephone system.

- Others are proposing mobile communications that would provide alternatives to the traditional hard-wired telephone instrument.

- Common carriers are expanding message services to incorporate electronic message generation and physical or electronic local distribution. The Government-supported U.S. Postal Service has obtained approval to enter the electronic communications market.

These examples exhibit a high degree of ingenuity to force fit the opportunities of today into policies based on goals and technology of a different -- and past -- era. They point to the fact that: 1) broadcast and common carrier technology and concepts can no longer enjoy a distinct separation; 2) there is no longer a clear distinction between mass media and interpersonal information; and 3) the traditional local distribution telephone and broadcast technology will not necessarily accommodate the opportunities offered by emerging diverse information services.

The need exists to identify and rebuild a local distribution policy that provides the environment for diverse, competitive communications services, with out destroying the general availability of basic electronic communications service that has been achieved under guidance of the 1934 Communications Act.

III. TRENDS IN LOCAL DISTRIBUTION

General availability of local distribution services has been a relatively recent accomplishment, as Figure 1 illustrates. The growth in separate common carrier and broadcast services, largely since the 1960's, under the stimulus of FCC rulings and Congressional encouragement, can be seen in Figure 2. All the services and equipment illustrated are available in the market today.

	1880's	1980's
MESSAGE SERVICES	Telephone Telegraph	Telephone Radio Dispatch Mobile Telephone Paging Citizens' Band Radio Facsimile Electronic Message Information Utility Security and Alarm
	1920's	
BROADCAST SERVICES	AM Radio	MDS CATV Videotext AM/FM Radio VHF Television UHF Television Translators Satellite Television

Figure 2. Expansion of Typical Communications Services

The demand for television service caused an addition of 56 UHF channels to the original 12 VHF channels. Translators have become common for relaying television programs to areas not yet supporting regular VHF/UHF stations. MDS stations offer an outlet for pay TV programming. CATV has continued to grow. A few companies have begun offering television reception from satellites that carry national television programming. The number of public TV stations has grown substantially as has cable television.[1/]

1/ The trend illustrated in Figure 1 tends to indicate a growth pattern for CATV that is closer to that of telephone service than the faster rate which occurred for over-the-air broadcasting (and CB service). For the latter, the customer obtains service through direct capital purchase, rather than through monthly billing as with telephone and CATV service. The customer's financial involvement might substan tially affect the growth pattern as well as the impact that new services (such as video recording and special ized radio service) might have on services with standard billing where the customer has no direct financial investment.

Today, 98% of the households have conventional over-the-air television and radio sets in their homes. Although there are more transmission media, this is transparent to the customer who receives the signals on the traditional television set. The results have been greater availability of traditional television programming -- news, sports, and entertainment. The orientation of AM and FM service has primarily been toward specialization in station program format and the addition of stereo and quadraphonic signal, rather than new transmission media.

The most striking advances in service opportunity have occurred in the mobile environment with greater mobile and paging coverage, and the massive popularity of Citizens' Band radio.

The customer is also beginning to realize a few benefits of new technology and competition in common carrier services, including call forwarding, call waiting, and a limited amount of data services such as electronic mail and access to computerized data bases, both requiring additional customer data terminal devices.

The opportunity for growing numbers of suppliers to offer services is a necessary component for customer selection of quality and price in a competitive environment. Current policies have provided such encouragement. The basic concern in local distribution is the disincentives that restrain suppliers from taking advantage of the current technological advances in offering a wide diversity of services. The following basic questions must be addressed:

- The incentive required of government to stimulate diversity
- The future of the communications common carrier and broadcast concepts
- Configuration of local distribution requirements
- Definition of basic service

- The meaning of information freedom
- The function of standardization
- Scope of legal protection of programs and services.

IV. JURISDICTIONAL BARRIERS

Federal/state jurisdictional boundaries have provoked questions in the past and have, no doubt, affected the type and distribution of services offered. The extent to which jurisdictional barriers exist will depend on the type and control exerted by Federal, state, and local authorities. As discussed below, new service opportunities are already raising important issues. These may be resolved either by attempting to adapt to these changes, or by establishing a new policy framework.

One of the most significant issues in this area is where jurisdiction should lie. Possible justifications for Federal preemption of state/local regulation are: 1) need for consistent regulatory policies; 2) desirability of reduced regulation (Federal authorities have shown a much greater penchant for this than local authorities); and 3) elimination of artificial jurisdictional and regulatory distinctions that affect entry and service decisions. Arguing against Federal preemption are the following: 1) legitimate local concerns; 2) legal difficulties in justifying preemption; and 3) avoidance of Federal-state confrontations. Weighing these factors and striking the balance will require serious study of the issues and involve subjective judgments that must be supported by as much information as possible.

The Communications Act of 1934 gives the Federal Communications Commission exclusive regulatory power over interstate common carrier communications services, while authority over intrastate communications services is reserved

to the states.[2/] Usually, however, interstate and intrastate communications services use the same facilities, thus requiring jurisdictional judgments concerning the specific components of those services. The line between state/local and Federal jurisdiction is not always clear, despite court and FCC attempts at clarification. Generally, assertions of Federal jurisdiction over local services or equipment have been upheld as long as some relationship to the FCC's regulatory responsibilities existed. Thus, the customer premises equipment registration program through which the FCC effected its competitive equipment policy was upheld in the face of state challenges. This equipment is used in the provision of clearly local services as well as long-haul services. There was no way for the FCC to implement its own policies regarding interstate services without also affecting state interests, and in such instances, Federal policy prevails as long as the Federal interest is legitimate and sufficiently direct. [3/]

Jurisdictional questions have arisen over FCC attempts to assert a Federal interest over services that use radio frequencies or are ancillary to broadcasting. A brief discussion of multipoint distribution service (MDS) will serve to illuminate the magnitude of uncertainty that accompanies the establishment of artifical legal boundaries. Congress vested the FCC with exclusive jurisdiction over the allocation and assignment of radio frequencies since the energy radiated cannot be confined within state boundaries and integrated assignment/allocation policies were therefore needed. In response to claims of insufficient deference to grants of

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[2/] In some states, municipal and state authorities have concurrent common carrier regulatory responsibilities.

[3/] North Carolina Utilities Commission v. FCC, 552 F.2d 1036 (4th Cir. 1977), cert. denied, 46 U.S.L.W. 3219 (1977).

state authority in the area of multipoint distribution services, the FCC stated that its jurisdiction cannot be limited to the technical aspects of radio transmission since "frequencies are not sought as engineering exercises, but to render services."[4/]

But how much authority does this give the FCC? Although the FCC has allocated certain radio frequencies to land mobile services, it has left the economic regulation of such services to local authorities.[5/] Moreover, any reliance by the FCC on its authority over radio frequencies to justify its regulation of MDS appears to be slight. The FCC justifies its jurisdictional assertions by pointing to the potential interstate nature of the service. Thus, unlike cable systems, the FCC has labeled MDS operators common carriers, although this status is disputed and has not been confirmed in the courts.[6/] The FCC has previously defined a common carrier as one who does not transmit information of its own design and choosing. In Industrial Radio Location Service, 5 F.C.C.2d 197, 202 (1966), the FCC stated that "a carrier provides the means or ways of communication for the transmission of

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4/ Midwest Corp., 53 F.C.C.2d 294 (1975).

5/ Section 2(b)(1) of the Communications Act excludes from FCC jurisdiction the "charges, classifications, practices, services, facilities, or regulations for or in connection with intrastate communication service by ... radio of any carrier." Section 221(b) precludes the FCC from regulation "charges, classifications, practices, services, facilities, or regulations for or in connection with mobile, or point-to-point radio telephone exchange service ..., even though a portion of such exchange service constitutes interstate or foreign communication, in any case where such matters are subject to regulation by a State Commission or by local governmental authority." There are exceptions to this prohibition, however, insofar as the FCC is authorized to grant licenses for the use of radio frequencies.

6/ See, HBO v. Pay TV of Greater New York, 45 RR2d 927 (E.D.N.Y. 1979) and Orth-O-Vision v. HBO, 46 RR2d 628 (S.D.N.Y. 1979). In these cases, the courts had no difficulty considering the broadcast characteristics of MDS without addressing themselves to its common carrier status.

such intelligence as the customer may choose to have transmitted so that the choice of the specific intelligence to be transmitted is the sole responsibility or prerogative of the customer and not the carrier." (Emphasis supplied.)[7/] Yet, the FCC allowed MDS operators to own programming affiliates and to carry the offerings of those affiliates as long as such transmissions do not exceed 50% of the operator's total transmissions. Since there is no restriction as to the time of day during which the affiliated programmer's transmissions may be shown, prime time could be completely preempted by the MDS operator's own affiliate. Interestingly, the FCC asserts that whether or not the MDS operator engages in programming has no bearing on its common carrier status,[8/] which is somewhat hard to square with the FCC's own definition of common carriage.

Common carriage does not necessarily invoke the FCC's jurisdiction, however. The FCC has radio frequency licensing powers with respect to MDS, but the economic regulation of MDS imposed by the FCC is valid only if MDS operators are interstate common carriers. The interstate label was attached on the basis of a strong Federal interest in MDS. The FCC's assertion of a Federal interest in MDS in turn relied on several factors. First, some MDS stations operate close to state boundaries, with the resulting radio transmissions crossing those boundaries.[9/] Second, although the first MDS services tended to be fairly localized in nature, the

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7/ See also, NARUC v. FCC, 533 F.2d 601, 608 (D.C. Cir. 1976), cert. denied, 425 U.S. 992 (1966); FCC v. Midwest Video Corp., 440 U.S. 689, 701 (1979).

8/ Community Antenna Television Systems (CARS), 1 F.C.C.2d 897, 900 (1965).

9/ Although the specific wording of Section 221(b) of the Communications Act is inapplicable, its general thrust seems to be against assertions of jurisdiction based on the happenstance of crossing state lines.

FCC predicted that this would not be true for long -- that national service demands would eventually be substantial. Finally, the FCC found that the service characteristics of MDS "are analogous to broadcasting and cable television..." and that "[t]he relationship of MDS to these analogous services, as well as program standards for intragroup communications are among the federal regulatory issues raised by MDS service characteristics."[10/] Thus, the FCC seems to be saying that, like broadcasting, the transmission of pay programming tends to be national in scope. When the state of New York attempted to regulate the offering of pay programming services, the FCC declared that attempt unlawful with respect to MDS transmission of pay programming, but on the basis that the state's action "limits the maximum service that may be provided via the radio frequencies assigned to MDS" and "therefore conflict[s] with the Commission's determination as to the best use of radio frequencies."[11/] There was no reliance on the idea that MDS is inherently interstate because its service characteristics are analogous to broadcasting. Thus, for MDS at least, the FCC preempts state regulation sometimes on the basis of its authority with respect to radio frequencies and sometimes on the basis of its authority over interstate common carriage. That interstate label, in turn, may depend at least in part on the use of radio frequencies.

The FCC has asserted some jurisdiction in the cable area, preempting local regulation of pay programming, and imposing some regulation over the broadcast services of CATV operators, on the grounds that cable is intimately related to the broadcast field, and that the FCC cannot fulfill its regulatory responsibilities with

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10/ Midwest Corp., 53 F.C.C.2d 294, 301 (1975).

11/ Orth-O-Vision, Inc., 69 F.C.C.2d 657 (1978).

respect to broadcasting without also imposing some regulation over CATV. The courts, however, struck down the FCC's attempt to extend its jurisdictional interest to the non-video, or common carrier, aspects of cable, rejecting the argument that since the non-video services of a CATV system may influence the overall financial success of the system and its corresponding ability to offer video services, the FCC has an interest ancillary to broadcasting.[12/] Thus, once again, it appears that the attachment of a common carrier or broadcast label to a particular service may substantially influence not only the type of regulation allowed but resolution of the jurisdictional question.

Jurisdictional contests and distinctions have significant implications for local distribution. First, new firms may be reluctant to enter markets and existing firms may be reluctant to develop new services in the face of uncertainty over whether they will be regulated by local or Federal authorities or both, and whether they will be categorized as common carrier or broadcast. Second, dual regulation by local and Federal authorities may be required for some services. The cable situation discussed above is one example of this — the FCC imposes some regulation on the video aspects of cable, but jurisdiction over any common carrier services offered by a cable operator is reserved for the local authorities. Another example that may arise in the future involves digital termination systems (e.g., XTEN) that offer both long-haul and local services. A twenty-five-city network could require authorization from more than twenty different local authorities for the purely local aspect of the service; what are the implications if some authorities refuse, throwing the economic viability of the entire system into chaos? The

12/ National Association of Regulatory Utility Commissioners v. FCC, 553 F.2d 601 (D.C. Cir. 1976).

ultimate result of these jurisdictional considerations may be the artificial structuring of services to avoid whatever regulation is undesirable. For example, a cable operator may refuse to provide non-video services to avoid state common carrier regulation, or an interstate common carrier may not provide local services. What economic impacts will such non-market related decisions have? What will be the impact on the availability of services? Undoubtedly, jurisdictional questions will raise many serious questions.[13/]

The attempt by government to match new service concepts with traditional arguments of jurisdictional authority discourages even the incentive to develop these new services. When they do come forth, however, there are serious obstacles to their realization. The individual states, for example, require a certificate of public convenience and necessity before a new common carrier can commence operations. In some instances (e.g., an application to be a second telephone company), entry would be prohibited entirely; in other instances (e.g., proposed radio telephone service), the application may be opposed by existing carriers or prevented by an existing "one to a market" rule; finally, in other cases such as radio paging in certain states, entry may be relatively open. Some systems may be able to avoid state certification entirely by claiming they fall entirely under Federal jurisdiction (e.g., MDS and DTS). Certification requirements were originally established to prevent abuses (e.g., duplication of facilities and stock fraud) that may no longer be relevant and they may thwart development of high

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13/ A very significant threshold jurisdictional issue faced by both Federal and local regulators is whether a given communications service involves common or private carriage. With increased emphasis on such things as industrial park data networks, this issue could have very significant implications.

technology local systems. In some instances, a potential competitor may also need a franchise from a city or other local government entity to commence operations.

Another entry barrier is the inability to obtain needed rights-of-way. Cities can prevent the development of competing, non-radio systems by denying them the right to cross or use city streets and alleys. Established telephone companies have the right of eminent domain while their potential competitors may not. The telephone (and power) companies' monopoly over local rights-of-way has been tempered somewhat by the pole attachment legislation. This gives cable television companies the right to use telephone poles and duct space at reasonable rates. The problem of obtaining rights-of-way, however, still provides an incentive to use radio based systems where such approval has already been authorized. These systems do not require rights-of-way or the power of eminent domain, but they do require access to the spectrum. The time and cost in trying to get access to spectrum for new services, however, causes a discouragement similar to that of obtaining rights-of-way.

V. THE STIGMA OF CLASSIFICATION

It is no longer adequate for a potential supplier to design an offering based on the market need. One must now tailor the service to the regulatory constraints the service may inspire, as well as the resultant economic viability of the service under those constraints. The regulatory tendency has been to invent a new service classification for each major new service category, and to clothe the service in the regulatory garb which fits the stream of regulatory incentives at the time of decision. Thus, in addition to the dual classification of common carriage and broadcasting (Titles II and III of the '34 Communications Act), there are now

services called "ancillary to broadcasting," and "enhanced common carriage." Although these provide the opportunity to modify or even reduce the regulatory burdens, their existence signals the need to rethink the basic institutional and policy framework.

The problems of fitting the new services within the old concepts are evident in the previous section. As discussed above, MDS carries the classification of common carriage, although it provides omni-directional broadcasting of television signals. Television stations are now broadcasting specific information that is selectively accessed by the public, the same information that can be tapped through cable TV and through telephone common carrier networks.

The nation has advanced beyond the 1934 goal of widespread availability of basic common carrier and broadcast services. The current direction toward a widespread diversity of communications services is being hampered by the incentives that grew out of a previous era.

The dilemma faced by cable television systems provides a good example. Cable television is growing at a rapid pace and, in principle at least, has the capability of providing many advanced local distribution services. Many of the advanced services have been associated with common carriage in the past. Cable operators are therefore afraid that if they offer certain interactive digital services, for example, they may inadvertently invite common carrier regulation. That poses two dangers to them. The rate-of-return regulation usually applied to common carriers could spread to their very lucrative pay-television services, or, even if common carrier, rate-of-return type regulation was applied only to the advanced service, it would limit the profit to be earned by taking the risk. It is unfortunate that a label like "common carrier" now provokes such a negative connotation.

There is absolutely no doubt that the current proliferation of cable television in major markets is being driven primarily by the revenues from pay cable, only secondarily from the carriage of broadcast signals, and hardly at all by the potential of other local distribution services. This situation is compounded by the fact that pay cable rates are unregulated while the remainder are (or at least could be) regulated. The current policy direction provides the incentive to promote pay-TV services outside the constraint of rate regulation, while discouraging the development of broadband digital service through strict regulation.

Cable systems are being optimized for one-to-many (point-to-multipoint) video services, not for interactive, multipoint-to-multipoint applications. Franchises are being awarded on a city-by-city, suburb-by-suburb basis with little or no thought to removing regulatory barriers that might allow this widespread, broadband transmission capability to offer new, innovative services such as local interconnection for video, let alone non-video uses (library access, home computer, information utility access, etc.). With such geographically fragmented and diversely owned systems, the opportunity is being diminished for technologically advanced local distribution systems which can efficiently provide other than downstream video. Advanced services like those mentioned above are being driven by the fierce competition for franchises, not by user driven market demand.

Just as strong are the disincentives for local distribution common carriers to offer broadband services. Existing cross-ownership rules prevent telephone companies in all but the smallest markets from providing cable television service in the same market. While these rules are properly regarded as pro-competitive, they also provide little incentive for telephone companies to offer <u>any</u> broadband services.

VI. PRICING DISTORTIONS

Not only is the method of service classification becoming less consistent with the service and technological opportunities, but the details of regulation that support these classifications are also inhibiting the development of services to meet our increasing information demands. This is reflected most prominently in policies that govern pricing and depreciation of common carrier services and plant.

The separations and settlements process has no doubt played a substantial role in extending universal service and improving service quality -- especially in rural areas. On the other hand, it has seriously distorted pricing signals. A potential competitor using mobile/portable radio technology, for example, sees a price for local service that may bear absolutely no relationship to cost. If local telephone prices reflected costs, competition and technological advances in local distribution would be encouraged where appropriate.

Within individual states, telephone companies -- with the approval or encouragement of the state regulatory commission -- usually price on a value-of-service basis. That is, the more people the customer can reach in the local calling area, the higher the rate. However, the relative costs of providing service may well be the opposite. Price distortions are producing rates above cost in urban areas and rates below cost in rural areas.

Any new competition in local distribution produces conflicts by driving prices toward marginal cost, thus destroying value of service pricing or statewide rate averaging. The ability to average on a statewide basis provides a limited cushion against excessive local rates due to reductions in separations and settlements or access charge payments. Once again, however, the emphasis has been on fine-tuning the regulatory process when the problem may lie in the basic policy.

In addition to the pricing distortions created by separations and settlements and value-of-service pricing, the REA provides substantial subsidies to rural telephone companies. Again, this means that a competitor does not see a cost based price.

The price seen by the potential competitor is further distorted by depreciation practices in the telephone industry. While an appropriate depreciation policy has yet to be developed, it is widely recognized that depreciation rates have been unrealistically low. This has kept local rates down, but at the expense of false price signals which decrease incentives to replace obsolete equipment, shift current costs to future ratepayers, and negatively impact economic efficiency. Not only is the local telephone company discouraged from investing in advanced local distribution plant because of unrealistic depreciation rates, it also faces rate-of-return regulation. This means, essentially, that the local carrier may not be rewarded with a commensurate rate-of-return for taking a high (or even moderate) technological or market risk. Less incentive exists to take technical and market risks (other than strictly cost reduction) in such an environment.

VII. KEY ISSUES

This paper has been a search for identification of key issues that need to be addressed in unlocking the opportunity for local distribution to accommodate the advances in technology and service diversity. Abundant examples are given of the uncertainty that exists in the industry over what they can offer, what should be regulated, by whom, and for what purposes.

The most profound issue lies not in finding a particular issue "fix," but in the basic foundation upon which the present institutional structure lies, and to which

the rules and incentives for industrial behavior are tied. The manner in which we have fulfilled our communications goals has made local distribution the umbilical cord that provides the lifeline of communications to today's society; yet it is becoming tied in knots because of the mismatch between needs of society and the incentives which govern supply.

It would be easy simply to place the blame on the industry for not being innovative, or on the government for regulatory lag. The problem, however, is too serious and widespread for such a simplistic answer. The FCC has been moving faster in the past ten years to accommodate change than ever before in its history. But, as the past FCC Chairman stated in a recent address to the press, "In our haste to develop this new technology ... we may be overlooking some much more fundamental questions."[14/] Perhaps most fundamental may be a change in goals which underlie governmental action and industrial incentive.

Obviously, it is neither desirable nor feasible to put a moratorium on our opportunities to communicate or on technology advances which are expanding this opportunity. There is an important need to accommodate the new offerings being proposed on a monthly, if not daily basis. Significant issues to this end are discussed immediately below. At the same time that we are pounding away at the issues that will shape our communications future, we need to determine whether our current policies are really leading us into the future we want, or pulling us back into facets of the past we may not want. The past fifty years have been devoted to "binding the nation together" -- this time through electronic, rather than postal

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14/ Speech for the 71st Annual Summer Conference of the Maryland-Delaware-D.C. Press Association, Ocean City, Maryland, September 13, 1980.

communications which bound our nation together in an earlier era. With over 97% penetration of both telephone and television, this goal has essentially been attained. A review of industry direction and regulatory action would indicate that the emphasis has changed toward finding new ways to access and communicate information. But yet in exploiting this new goal, we are left with trying to bend and shape fifty years of precedent oriented towards a different objective.

There can be little doubt that the most important issue is the need to determine whether current government policy and regulation is standing in the way of meeting today's communications needs. Have we attained the previous goal of universal service for all practical purposes? Must our policies now be aimed at another target, such as service diversity? What role should government have today? What rules and incentives will take us there, without destroying accomplishments of the past?

A way must be found to eliminate the need for industry to artificially structure new services to avoid some particular form of undesired regulation. The need for rate regulation in evolving competitive markets must be evaluated. Likewise, the incentives inherent in price and depreciation policy must be examined with regard to the impact on entry and innovation. The technology and service objectives regarding broadcasting and common carriage appear to be converging. Should today's policies regarding mass media and interpersonal communications force a continued separation?

Fifteen years ago, there was an increased shift in our nation's economic base from manufacturing to services. Since that time, through the persistence of industry and the foresight of regulators, the groundwork was set for opening new opportunities for competition and diversity in terminal equipment and long-

distance communications. Diverse communications services can provide powerful leverage for greatly enhancing the nation's information-based economy, for example, through raising substantial productivity gains. It is only through the extension of the opportunities for competition and diversity into the "last mile," however, that the nation can take full advantage of this leverage.

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15. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

The availability of diverse communications services can provide powerful leverage for greatly enhancing the nation's information-based economy. The weak link now in providing advanced communications services to business and the public is at the local distribution level. The diversity of services possible through local distribution is being inhibited by traditional views on local distribution and prevailing regulatory policies. Federal, state, and local jurisdictional boundaries need to be clarified. Broadcast and common carriage distinctions require review. Rate regulation, pricing distortion, and depreciation of common carrier services and plans must be reassessed. The emphasis in communications policy should shift from universality of service to service diversity.

16. Key Words *(Alphabetical order, separated by semicolons)*
Advanced communications services; broadcasting; common carriage; communications policy; competition; deregulation; jurisdiction; local distribution; separations and settlements process.

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NTIA Report 82-97

Telephone Areas Serviced by Bell and Independent Companies in the United States

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Telephone Areas Serviced by Bell and Independent Companies in the United States

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U.S. DEPARTMENT OF COMMERCE
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Bernard J. Wunder, Jr., Assistant Secretary
for Communications and Information

February 1982

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TELEPHONE AREAS SERVICED BY BELL AND INDEPENDENT COMPANIES IN THE UNITED STATES

Burgette A. Hart, Ann M. Nave,
Anthony W. Raskob, Jr., and John C. Thomason*

The geographic coverage of all telephone companies in the United States is presented in a series of maps depicting the operating areas served by Bell and each of the various independent telephone companies. Tables are also presented of state-by-state listings of (1) almost 1500 telephone companies and their headquarters, and (2) the land areas of each state's major telephone companies. In the future, this updated version of telephone company areas should be more useful than the original 1973 report, since it was plotted with an interactive computer system, which has the capability of updating boundary changes with minimal effort.

Key words: telephone company areas; independent telephone companies; telephone company maps; interactive computer graphic system

1. INTRODUCTION

The geographic coverage of all telephone companies in the United States was previously presented in a series of state maps (Hart, 1973). An unusually large number of these reports have been and are still being sold by the National Technical Information Service and the Government Printing Office. In the past few years, however, many firms and individuals have indicated that they would be interested in purchasing an update of this publication. In response to these requests, the telephone company area maps have been revised, and a new listing (as of January 1, 1981) of independent telephone companies operating in each of the

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fifty states has been prepared. In addition, because the telephone company boundaries were digitized with an interactive computer graphic system, area computations of the eight largest companies in each state were made and are listed in this report.

2. DISCUSSION OF DATA

2.1 Statistical

There were 180,424,023 telephones in the United States at the beginning of 1981. The principal subsidiaries of the American Telephone and Telegraph Company* (more commonly called the Bell System) service 81 percent of these phones. (See Table 1.) The remainder is serviced by 1,483 non-Bell companies, which are usually called the "independents." These independent companies service 44 percent of the area of the United States, while Bell services 31 percent. A list of the top fifteen independents (with their number of telephones) is given in Table 2. The large area of the United States that is labeled as "undesignated" in Table 1 represents unfranchised or unassigned territory. It includes natural features such as lakes, deserts, swamps, and mountainous terrain. It may also include special bounded areas, such as military reservations or very sparsely populated areas of national parks and forests.

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* The January 8, 1982, settlement of the antitrust suit brought by the United States against the American Telephone and Telegraph Company (AT&T) requires AT&T to divest itself of ownership of 21 operating companies (excluding Cincinnati Bell and Southern New England Telephone) 18 months after the settlement is approved. That approval is pending in the U.S. District Court for the District of Columbia.

TABLE 1
Summary of U.S. Telephone Coverage

TELEPHONE COMPANY	AREA TOTAL SQ. MILES	AREA % OF TOTAL	TELEPHONES TOTAL NUMBER	TELEPHONES % OF TOTAL	DENSITY (PHONES/ SQ. MI.)
BELL	1,134,619	31.36	145,876,350*	80.85	128.57
GENERAL TEL. & ELECTRONICS	250,774	6.93	15,756,400	8.73	62.83
UNITED	116,674	3.22	4,697,468	2.60	40.26
CONTINENTAL	237,681	6.57	3,125,800	1.73	13.15
CENTRAL	30,549	0.84	1,806,600	1.00	59.14
MID-CONTINENTAL	25,966	0.72	1,094,850	0.61	42.16
OTHER INDEPENDENTS	940,383	25.99	8,066,555	4.47	8.58
UNDESIGNATED AREAS (inc. water)	881,759	24.37	0	.00	.00
TOTAL	3,618,405	100.00	180,424,023	100.00	49.86

TABLE 2
Top 15 Independent Telephone Companies or Groups**
December 31, 1980

	NAME	HEADQUARTERS	TELEPHONES
1.	General Tel. & Elec. Corp.	Stamford, CT	15,756,400
2.	United Telephone System, Inc.	Kansas City, MO	4,697,500
3.	Continental Telephone Corp.	Atlanta, GA	3,125,800
4.	Central Tel. & Utilities Corp.	Chicago, IL	1,806,600
5.	Mid-Continent Tel. Corp.	Hudson, OH	1,094,900
6.	Puerto Rico Tel. Co.	San Juan, PR	631,500
7.	Rochester Tel. Corp.	Rochester, NY	621,900
8.	Lincoln Tel. & Tel. Co.	Lincoln, NE	330,600
9.	Century Tel. Enterprises, Inc.	Monroe, LA	265,600
10.	Tel. & Data Systems, Inc.	Chicago, IL	236,500
11.	Commonwealth Tel.Co.	Dallas, PA	235,800
12.	Telephone Utilities, Inc.	Portland, OR	205,000
13.	Allied Telephone Co.	Little Rock, AR	201,600
14.	Anchorage Telephone Utilities	Anchorage, AK	142,200
15.	Illinois Consolidated Tel. Co.	Mattoon, IL	126,400

* From Telephony's Directory (1981), p. 632.

** From USITA (1981b), p. 13.

Among the independents, General Telephone and Electronics serves the largest area (6.9 percent of the United States) followed closely by Continental (6.6 percent). Other independents (than the top five) service 26 percent of the United States area, but only 4.5 percent of the telephones. These area data from Table 1 are a summary of the detailed data given in Table 3. This latter table gives the state areas served by Bell, any of the top five independent holding companies (shown in Table 1) that serve the state, and the two "additional" independents (designated as #1 and #2) that have the larger number of telephones within that particular state. The percentages do not always equal 100 percent because of rounding errors. Rounding errors also explain why the total square miles in each state do not always agree with totals given in the Statistical Abstract (1980).

Appendix A lists all the telephone companies in each state that are not a part of Bell or the top five independent holding companies. Those companies that are affiliates or associates of a larger independent are (indented and) listed under the "parent" company. Each company has at least one telephone service area in the state under which it is listed. Two states, Iowa and Wisconsin, contain more than 100 independent telephone companies. This Appendix also gives the number of telephones (as of the beginning of 1981) for the additional (#1 and #2) top independents within each state. These two companies are marked with asterisks. We used information from four sources: Telephony's Directory (1981), Telephone Engineer and Management Directory (1981), Rural Electrification Administration (1981), and USITA (1981a), for these data. If small discrepancies appeared, the latter reference was used, but, in the case of large discrepancies, individual telephone companies were contacted for their number of telephones. It can be noted that companies 7-9 and 11-15 in Table 2 are also the #1 companies in those states where each is headquartered.

TABLE 3
Telephone Company Land Areas by State

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
ALABAMA				
		BELL	27,067	52.4
		GTE	5,775	11.2
		CONTINENTAL	7,193	13.9
		MID-CONTINENT	708	1.4
	#1	GULF TEL. CO.	643	1.2
	#2	FARMERS TEL. COOP., INC.	669	1.3
		OTHER	9,555	18.5
		TOTAL	51,610	
ALASKA				
		GTE	15,547	2.6
		CONTINENTAL	12,145	2.1
	#1	ANCHORAGE TEL. UTIL.	1,212	0.2
	#2	FAIRBANKS MUNICIPAL UTIL. SYSTEMS	3,727	0.6
		OTHER	97,088	16.5
		UNDESIGNATED	460,037	78.0
		TOTAL	589,756	
ARIZONA				
		BELL	27,105	23.8
		CONTINENTAL	9,746	8.6
	#1	CITIZEN'S UTIL. CO.	8,313	7.3
	#2	GREAT SOUTHWEST TEL. CORP.	13,280	11.7
		OTHER	15,790	13.9
		UNDESIGNATED	39,674	34.8
		TOTAL	113,908	
ARKANSAS				
		BELL	18,620	35.1
		GTE	6,086	11.5
		UNITED	801	1.5
		CONTINENTAL	5,541	10.4
	#1	ALLIED TEL. CO., INC.	7,846	14.8
	#2	CENTURY TEL. ENTERPRISES	2,226	4.2
		OTHER	9,603	18.1
		UNDESIGNATED	2,262	4.3
		LARGE WATER AREAS	119	0.2
		TOTAL	53,104	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
CALIFORNIA				
		BELL	51,142	32.2
		GTE	10,916	6.9
		UNITED	237	0.1
		CONTINENTAL	19,049	12.0
	#1	ROSEVILLE TEL. CO	78	0.0
	#2	CITIZENS UTIL. CO.	3,780	2.4
		OTHER	8,154	5.1
		UNDESIGNATED	64,754	40.8
		LARGE WATER AREAS	584	0.4
		TOTAL	158,694	
COLORADO				
		BELL	75,486	72.4
		CONTINENTAL	1,533	1.5
	#1	DELTA COUNTY TEL. CO.	1,489	1.4
	#2	EASTERN SLOPE RURAL TEL. ASSN.	5,326	5.1
		OTHER	17,637	16.9
		UNDESIGNATED	2,776	2.7
		TOTAL	104,247	
CONNECTICUT				
		BELL	4,938	98.6
	#1	WOODBURY TEL. CO.	71	1.4
		TOTAL	5,009	
DELAWARE				
		BELL	2,057	100.0
		TOTAL	2,057	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
FLORIDA				
		BELL	20,905	35.7
		GTE	5,164	8.8
		UNITED	16,139	27.6
		CONTINENTAL	1,687	2.9
		CENTRAL	4,448	7.6
		MIDCONTINENT	3,791	6.5
	#1	ST. JOSEPH TEL. & TELEGRAPH CO.	2,790	4.8
	#2	GULF TEL. CO.	1,033	1.8
		OTHER	1,422	2.4
		LARGE WATER AREAS	1,181	2.0
		TOTAL	58,560	
GEORGIA				
		BELL	27,248	46.3
		GTE	8,800	14.9
		UNITED	62	0.1
		CONTINENTAL	6,299	10.7
		MID-CONTINENT	1,837	3.1
	#1	STANDARD TEL. CO.	1,599	2.7
	#2	COASTAL UTIL., INC.	974	1.7
		OTHER	12,058	20.5
		TOTAL	58,877	
HAWAII				
		GTE	5,765	89.4
		UNDESIGNATED	685	10.6
		TOTAL	6,450	
IDAHO				
		BELL	20,676	24.7
		GTE	6,824	8.2
		CONTINENTAL	5,329	6.4
	#1	PROJECT MUTUAL TEL. COOP. ASSN.	1,003	1.2
	#2	CENTURY TEL. ENTERPRISES, INC.	1,976	2.4
		OTHER	16,674	20.0
		UNDESIGNATED	30,860	36.9
		LARGE WATER AREAS	215	0.3
		TOTAL	83,557	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
ILLINOIS				
		BELL	12,009	21.3
		GTE	20,203	35.8
		CONTINENTAL	9,216	16.3
		CENTRAL	1,400	2.5
		MID-CONTINENT	2,228	4.0
	#1	ILLINOIS CONSOLIDATED TEL. CO.	2,882	5.1
	#2	HARRISONVILLE TEL. CO.	480	0.9
		OTHER	7,981	14.2
		TOTAL	56,399	
INDIANA				
		BELL	10,377	28.6
		GTE	7,473	20.6
		UNITED	6,102	16.8
		CONTINENTAL	5,324	14.7
		MID-CONTINENT	397	1.1
	#1	SMITHVILLE TEL. CO. INC.	1,073	3.0
	#2	PRINCETON TEL. CO.	467	1.3
		OTHER	5,077	14.0
		TOTAL	36,290	
IOWA				
		BELL	12,773	22.7
		GTE	9,252	16.4
		UNITED	3,364	6.0
		CONTINENTAL	8,171	14.5
		CENTRAL	2,853	5.1
	#1	CLEAR LAKE INDEPENDENT TEL. CO.	151	0.3
	#2	GRAND RIVER MUTUAL TEL. CORP.	1,209	2.1
		OTHER	18,517	32.9
		TOTAL	56,290	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
KANSAS				
		BELL	29,200	35.5
		GTE	141	0.2
		UNITED	7,988	9.7
		CONTINENTAL	9,506	11.6
	#1	PIONEER TEL. ASSN., INC.	4,610	5.6
	#2	CRAW-KAN. TEL. COOP. ASSN., INC.	1,904	2.3
		OTHER	28,423	34.6
		UNDESIGNATED	492	0.6
		TOTAL	82,264	
KENTUCKY				
		BELL	19,227	47.6
		GTE	6,920	17.1
		CONTINENTAL	4,298	10.6
	#1	SO. CENTRAL RURAL TEL. COOP.	1,521	3.8
	#2	BRANDENBURG TEL. CO., INC.	518	1.3
		OTHER	7,576	18.8
		LARGE WATER AREAS	335	0.8
		TOTAL	40,395	
LOUISIANA				
		BELL	33,735	69.5
	#1	CENTURY TEL. ENTERPRISES, INC.	6,668	13.7
	#2	EAST ASCENSION TEL. CO.	479	1.0
		OTHER	6,884	14.2
		LARGE WATER AREAS	757	1.6
		TOTAL	48,523	
MAINE				
		BELL	12,908	38.9
		CONTINENTAL	3,868	11.6
	#1	TEL. AND DATA SYSTEMS, INC.	2,060	6.2
	#2	COMMUNITY SERVICE TEL. CO.	285	0.9
		OTHER	1,751	5.3
		UNDESIGNATED	12,343	37.2
		TOTAL	33,215	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
MARYLAND				
		BELL	10,418	98.5
		GTE	14	0.1
	#1	ARMSTRONG TEL. CO.	145	1.4
		TOTAL	10,577	
MASSACHUSETTS				
		BELL	8,140	98.6
	#1	GRANBY TEL. & TELEGRAPH CO.	29	0.3
	#2	RICHMOND TEL. CO.	18	0.2
		OTHER	31	0.4
		LARGE WATER AREAS	40	0.5
		TOTAL	8,258	
MICHIGAN				
		BELL	25,084	43.1
		GTE	17,450	30.0
		CONTINENTAL	2,908	5.0
		MID-CONTINENT	1,603	2.8
	#1	CENTURY TEL. ENTERPRISES, INC.	886	1.5
	#2	CC&S SYSTEMS, INC.	642	1.1
		OTHER	8,159	14.0
		UNDESIGNATED	1,485	2.6
		TOTAL	58,217	
MINNESOTA				
		BELL	23,882	28.4
		GTE	474	0.6
		UNITED	4,005	4.8
		CONTINENTAL	11,432	13.6
		CENTRAL	3,502	4.2
	#1	MANKATO CITIZENS TEL. CO.	754	0.9
	#2	GARDEN VALLEY TEL. CO.	3,441	4.1
		OTHER	29,884	35.5
		UNDESIGNATED	5,366	6.4
		LARGE WATER AREAS	1,327	1.6
		TOTAL	84,067	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
MISSISSIPPI				
		BELL	39,212	82.2
		MID-CONTINENT	529	1.1
	#1	TELEPHONE ELECTRONICS CORP.	1,311	2.7
	#2	CENTURY TEL. ENTERPRISES, INC.	516	1.1
		OTHER	6,148	12.9
		TOTAL	47,716	
MISSOURI				
		BELL	19,475	27.9
		GTE	4,215	6.0
		UNITED	7,876	11.3
		CONTINENTAL	14,469	20.8
		CENTRAL	3,303	4.7
	#1	ALLIED TEL. CO.	4,019	5.8
	#2	GRAND RIVER MUTUAL TEL. CORP.	784	1.1
		OTHER	14,916	21.4
		UNDESIGNATED	155	0.2
		LARGE WATER AREAS	475	0.7
		TOTAL	69,687	
MONTANA				
		BELL	34,384	23.4
		GTE	3,427	2.3
	#1	TEL. UTILITIES, INC.	2,445	1.7
	#2	TRIANGLE TEL. COOP. ASSN., INC.	13,924	9.5
		OTHER	57,455	39.0
		UNDESIGNATED	35,503	24.1
		TOTAL	147,138	
NEBRASKA				
		BELL	21,114	27.3
		GTE	4,422	5.7
		UNITED	3,707	4.8
		CONTINENTAL	3,172	4.1
	#1	LINCOLN TEL. & TELEGRAPH CO.	10,167	13.2
	#2	UNITEL OF NEBRASKA	6,302	8.2
		OTHER	24,744	32.0
		UNDESIGNATED	3,599	4.7
		TOTAL	77,227	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
NEVADA				
		BELL	5,987	5.4
		CONTINENTAL	1,643	1.5
		CENTRAL	1,636	1.5
	#1	CALIF-PACIFIC NATIONAL CORP.	5,095	4.6
	#2	COUNTY OF CHURCHILL	5,168	4.7
		OTHER	5,094	4.6
		UNDESIGNATED	85,292	77.2
		LARGE WATER AREAS	625	0.6
		TOTAL	110,540	
NEW HAMPSHIRE				
		BELL	8,183	87.9
		CONTINENTAL	235	2.5
	#1	TEL. & DATA SYSTEMS, INC.	169	1.8
	#2	MERRIMACK COUNTY TEL. CO.	202	2.2
		OTHER	515	5.5
		TOTAL	9,304	
NEW JERSEY				
		BELL	6,675	85.2
		UNITED	956	12.2
		CONTINENTAL	155	2.0
	#1	WARWICK VALLEY TEL. CO.	50	0.6
		TOTAL	7,836	
NEW MEXICO				
		BELL	61,404	50.5
		GTE	2,589	2.1
		CONTINENTAL	12,381	10.2
	#1	GREAT SOUTHWEST TEL. CORP.	5,432	4.5
	#2	E.N.M.R. TEL. COOP.	5,461	4.5
		OTHER	25,691	21.1
		UNDESIGNATED	8,709	7.2
		TOTAL	121,667	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
NEW YORK				
		BELL	28,126	56.7
		CONTINENTAL	11,190	22.6
		MID-CONTINENT	1,368	2.8
	#1	ROCHESTER TEL. CORP.	2,454	5.0
	#2	TOCONIC TEL. CORP.	638	1.3
		OTHER	5,752	11.6
		LARGE WATER AREAS	48	0.1
		TOTAL	49,576	
NORTH CAROLINA				
		BELL	12,789	24.3
		GTE	862	1.6
		UNITED	20,811	39.6
		CONTINENTAL	4,339	8.3
		CENTRAL	3,470	6.6
		MID-CONTINENT	2,101	4.0
	#1	NORTH STATE TEL. CO.	350	0.7
	#2	CONCORD TEL. CO.	741	1.4
		OTHER	7,123	13.5
		TOTAL	52,586	
NORTH DAKOTA				
		BELL	28,430	40.2
		CONTINENTAL	2,720	3.8
	#1	NORTHERN STATES POWER CO.	198	0.3
	#2	SOURIS RIVER TEL. MUTUAL AID CORP.	5,076	7.2
		OTHER	33,989	48.1
		UNDESIGNATED	252	0.4
		TOTAL	70,665	
OHIO				
		BELL	11,513	27.9
		GTE	15,174	36.8
		UNITED	8,762	21.3
		CENTRAL	175	0.4
		MID-CONTINENT	2,781	6.7
	#1	CHILLICOTHE TEL. CO.	720	1.7
	#2	CHAMPAIGN TEL. CO.	160	0.4
		OTHER	1,938	4.7
		TOTAL	41,223	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
OKLAHOMA				
		BELL	30,322	43.4
		GTE	6,814	9.7
		CONTINENTAL	165	0.2
	#1	PIONEER TEL. COOP, INC.	7,378	10.6
	#2	ALLIED TEL. CO.	5,061	7.2
		OTHER	20,178	28.9
		TOTAL	69,918	
OREGON				
		BELL	26,069	26.9
		GTE	4,097	4.2
		UNITED	5,237	5.4
		CONTINENTAL	1,822	1.9
	#1	TEL. UTIL., INC.	9,218	9.5
	#2	CALIF-PACIFIC NATIONAL CORP.	1,406	1.4
		OTHER	8,720	9.0
		UNDESIGNATED	40,228	41.5
		LARGE WATER AREAS	184	0.2
		TOTAL	96,981	
PENNSYLVANIA				
		BELL	18,230	40.2
		GTE	4,787	10.6
		UNITED	5,809	12.8
		CONTINENTAL	1,925	4.2
		MID-CONTINENT	5,543	12.2
	#1	COMMONWEALTH TEL. CO.	4,926	10.9
	#2	DENVER & EPHRATA TEL. & TELEGRAPH	183	0.4
		OTHER	3,930	8.7
		TOTAL	45,333	
RHODE ISLAND				
		BELL	1,206	99.4
		LARGE WATER AREAS	8	0.6
		TOTAL	1,214	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
SOUTH CAROLINA				
		BELL	14,183	45.7
		GTE	2,292	7.4
		UNITED	2,517	8.1
		CONTINENTAL	328	1.1
		MID-CONTINENT	423	1.4
	#1	ROCK HILL TEL. CO.	215	0.7
	#2	FARMERS TEL. COOP., INC.	2,512	8.1
		OTHER	8,066	26.0
		UNDESIGNATED	28	0.1
		LARGE WATER AREAS	492	1.6
		TOTAL	31,056	
SOUTH DAKOTA				
		BELL	33,070	42.9
		CONTINENTAL	2,884	3.7
	#1	CITY OF BROOKINGS MUNICIPAL TEL.	547	0.7
	#2	GOLDEN WEST TEL. COOP., INC.	12,897	16.7
		OTHER	27,409	35.6
		UNDESIGNATED	240	0.3
		TOTAL	77,047	
TENNESSEE				
		BELL	25,131	59.5
		GTE	1,333	3.2
		UNITED	2,279	5.4
	#1	TEL. & DATA SYSTEMS, INC.	2,255	5.3
	#2	TWIN LAKES TEL. COOP.	1,890	4.5
		OTHER	9,356	22.1
		TOTAL	42,244	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
TEXAS				
		BELL	78,930	29.5
		GTE	43,845	16.4
		UNITED	8,656	3.2
		CONTINENTAL	27,561	10.3
		CENTRAL	3,064	1.1
	#1	LUFKIN-CONROE COMM. CO.	1,359	0.5
	#2	SUGAR LAND TEL. CO.	146	0.1
		OTHER	80,913	30.3
		UNDESIGNATED	22,791	8.5
		LARGE WATER AREAS	74	0.0
		TOTAL	267,339	
UTAH				
		BELL	32,464	38.2
		CONTINENTAL	11,977	14.1
	#1	EMERY CO. FARMERS UNION TEL.	2,700	3.2
	#2	UNITAH BASIN TEL. ASSN., INC.	4,905	5.8
		OTHER	16,140	19.0
		UNDESIGNATED	14,598	17.2
		LARGE WATER AREAS	2,132	2.5
		TOTAL	84,916	
VERMONT				
		BELL	7,232	75.3
		CONTINENTAL	1,653	17.2
	#1	TEL. & DATA SYSTEMS, INC.	204	2.1
	#2	WAITSFIELD-FAYSTON TEL. CO.	115	1.2
		OTHER	405	4.2
		TOTAL	9,609	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
VIRGINIA				
		BELL	15,348	37.6
		GTE	979	2.4
		UNITED	3,197	7.8
		CONTINENTAL	9,712	23.8
		CENTRAL	6,698	16.4
	#1	CLIFTON FORGE-WAYNESBORO TEL.	661	1.6
	#2	SHENANDOAH TEL. CO.	592	1.5
		OTHER	3,401	8.3
		UNDESIGNATED	230	0.6
		TOTAL	40,818	
WASHINGTON				
		BELL	20,444	30.0
		GTE	7,788	11.4
		UNITED	6,279	9.2
		CONTINENTAL	3,631	5.3
	#1	TEL. UTIL., INC.	5,693	8.3
	#2	ELLENSBURG TEL. CO.	1,382	2.0
		OTHER	3,501	5.1
		UNDESIGNATED	19,473	28.6
		TOTAL	68,191	
WEST VIRGINIA				
		BELL	15,143	62.6
		GTE	2,247	9.3
		CONTINENTAL	2,476	10.2
		MID-CONTINENT	2,657	11.0
	#1	ARMSTRONG UTIL., INC.	543	2.2
	#2	CENTURY TEL. ENTERPRISES, INC.	54	0.2
		OTHER	670	2.8
		UNDESIGNATED	390	1.6
		TOTAL	24,180	

TABLE 3
Telephone Company Land Areas by State (Continued)

STATE		COMPANY	LAND AREA (SQ. MI)	% OF STATE AREA
WISCONSIN				
		BELL	8,449	15.0
		GTE	19,100	34.0
	#1	NORTH-WEST TEL. CO.	2,060	3.7
	#2	TEL. & DATA SYSTEMS, INC.	3,388	6.0
		OTHER	21,683	38.6
		UNDESIGNATED	1,284	2.3
		LARGE WATER AREAS	191	0.3
		TOTAL	56,155	
WYOMING				
		BELL	58,013	59.2
		UNITED	1,868	1.9
	#1	WYOMING TEL. CO., INC.	3,820	3.9
	#2	UNION TEL. CO.	1,874	1.9
		OTHER	12,754	13.0
		UNDESIGNATED	19,586	20.0
		TOTAL	97,915	

NOTE: Washington, D.C. is not included in either Maryland or Virginia. This district covers 67 sq. mi. and is serviced by a private telephone company, Potomac Telecommunications, Ltd.

2.2 Maps

The maps in the first telephone map report (Hart, 1973) were hand-drafted figures. However, telephone area boundaries change from year to year due to company mergers, purchases, and new exchange acquisitions or trades; therefore, it seemed desirable to seek some method that would permit easy alteration of telephone map boundaries. If this method also included a way to calculate telephone company areas, that would be a bonus. Computer graphics met both of these needs; therefore, it was used. (See Appendix B for a discussion of how a computer graphic system was used to create the telephone area maps.)

Maps were prepared of the telephone company operating areas for each of the 50 states (Figures 1-50). Two states with a very large number of area polygons were placed on more than one page in order to retain detail. Texas, with 511 polygons, is shown as Figures 43a, 43b, and 43c, while California, with 196 polygons, became Figures 5a and 5b. The shaded inset on each of these figures shows which state portion is depicted.

The key to the shading found on the maps is given on the code sheet preceding the state maps. Each of the state maps was divided into eleven arbitrary telephone areas: (1) Bell System companies, (2-6) the five independent companies with the largest number of telephones in the United States, (7-8) the two independent companies (exclusive of the five listed in 2-6) with the largest number of telephones within that state, (9) all other independent telephone companies in that state, (10) undesignated, and (11) large water areas. The last category is somewhat misleading, because it only includes those large water areas that were indicated on the telephone maps sent to us by the state commissions. Other water areas are either disguised as undesignated or included within the boundaries of a telephone company.

Almost half of the source maps of telephone service areas were based on updated versions of telephone boundary areas obtained from the state public service and utility commissions, the state independent telephone associations, or various Bell headquarters. Fifteen states were updated from telephone maps that were four to eight years old. Fourteen states were "hand-drawn," using the latest information obtained from the larger telephone holding companies and data contained in USITA (1981b), Telephone Engineer and Management Directory (1981), and Telephony's Directory (1981). Every attempt was made to insure that the company operating areas within each state were updated accurately through the early months of 1981. Some errors are inevitable because boundaries can fluctuate from month to month; however, this revised report contains a great many corrections updating the original 1973 report. It should be very useful to any group or individual who has a need for telephone company area data.

3. ACKNOWLEDGMENTS

The authors wish to express appreciation to Dale Hatfield who, first of all, suggested that this update should be written, and, second, gave encouragement whenever needed. They also wish to credit Roger Salaman and Jeffrey Close with assisting with the solving of computer hardware and software problems.

4. REFERENCES

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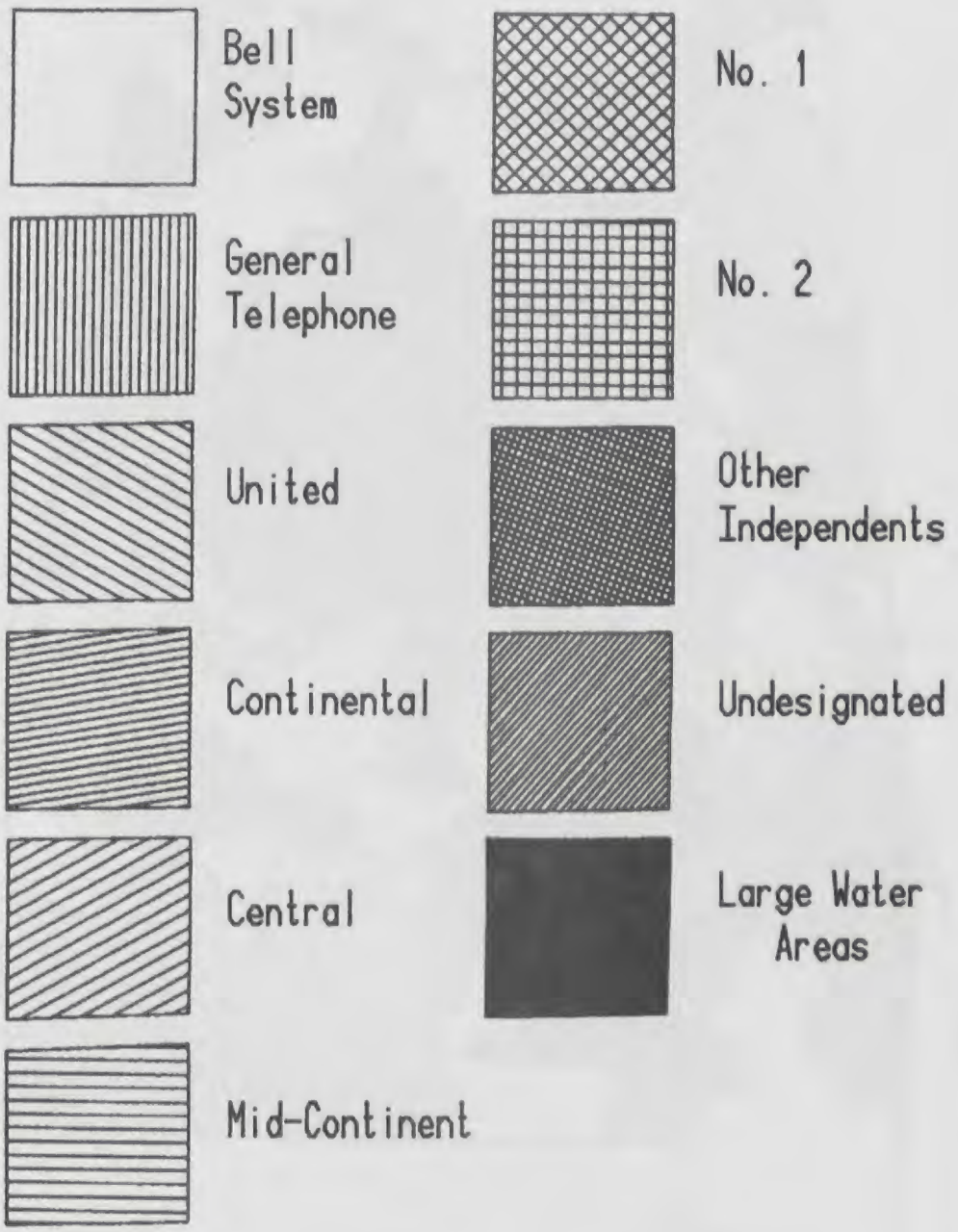
USITA (1981b), Holding Company Report, United States Independent Telephone Association, Washington, D.C. 20006.

CODING KEY FOR TELEPHONE COMPANY STATE MAPS



ALABAMA

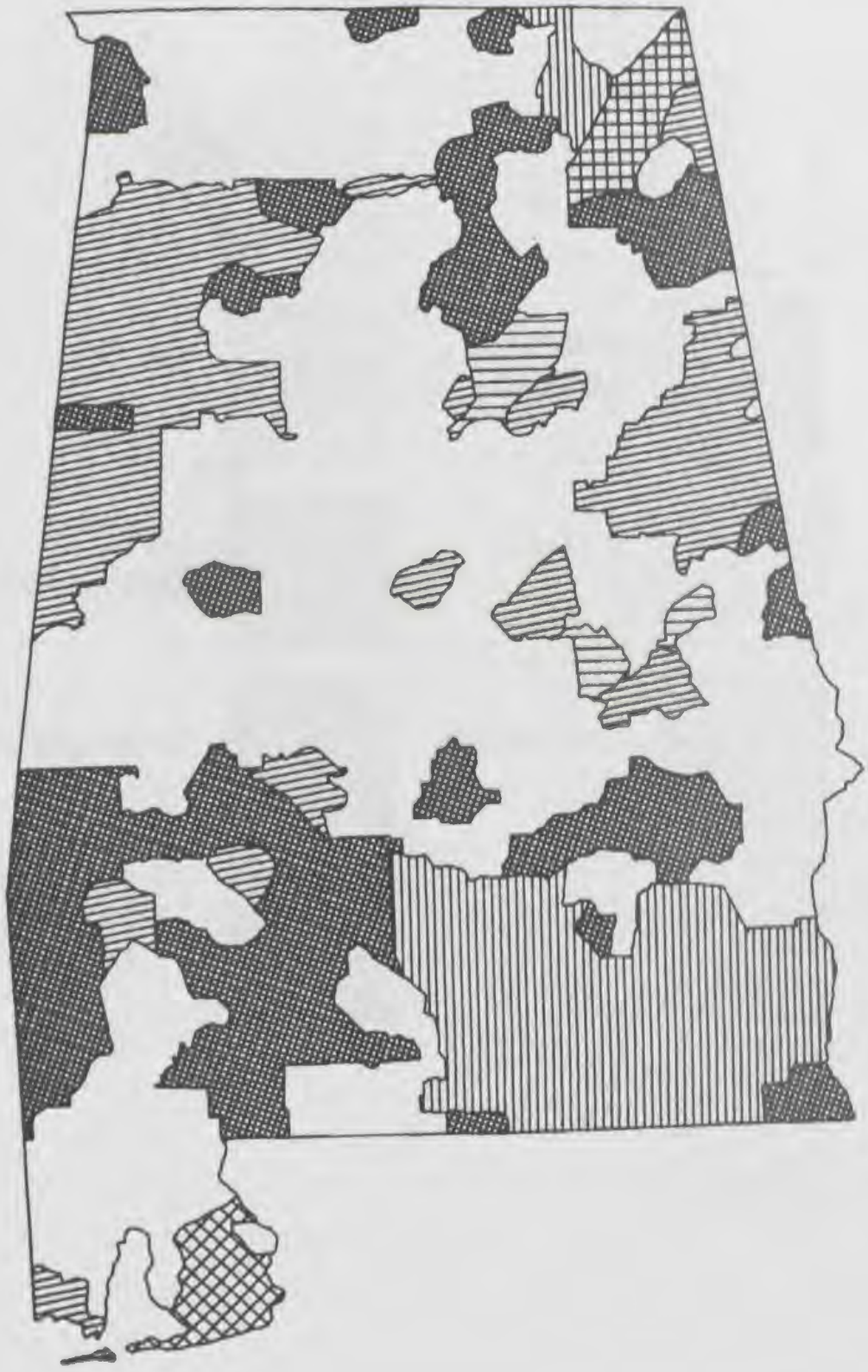


FIGURE 1

ALASKA

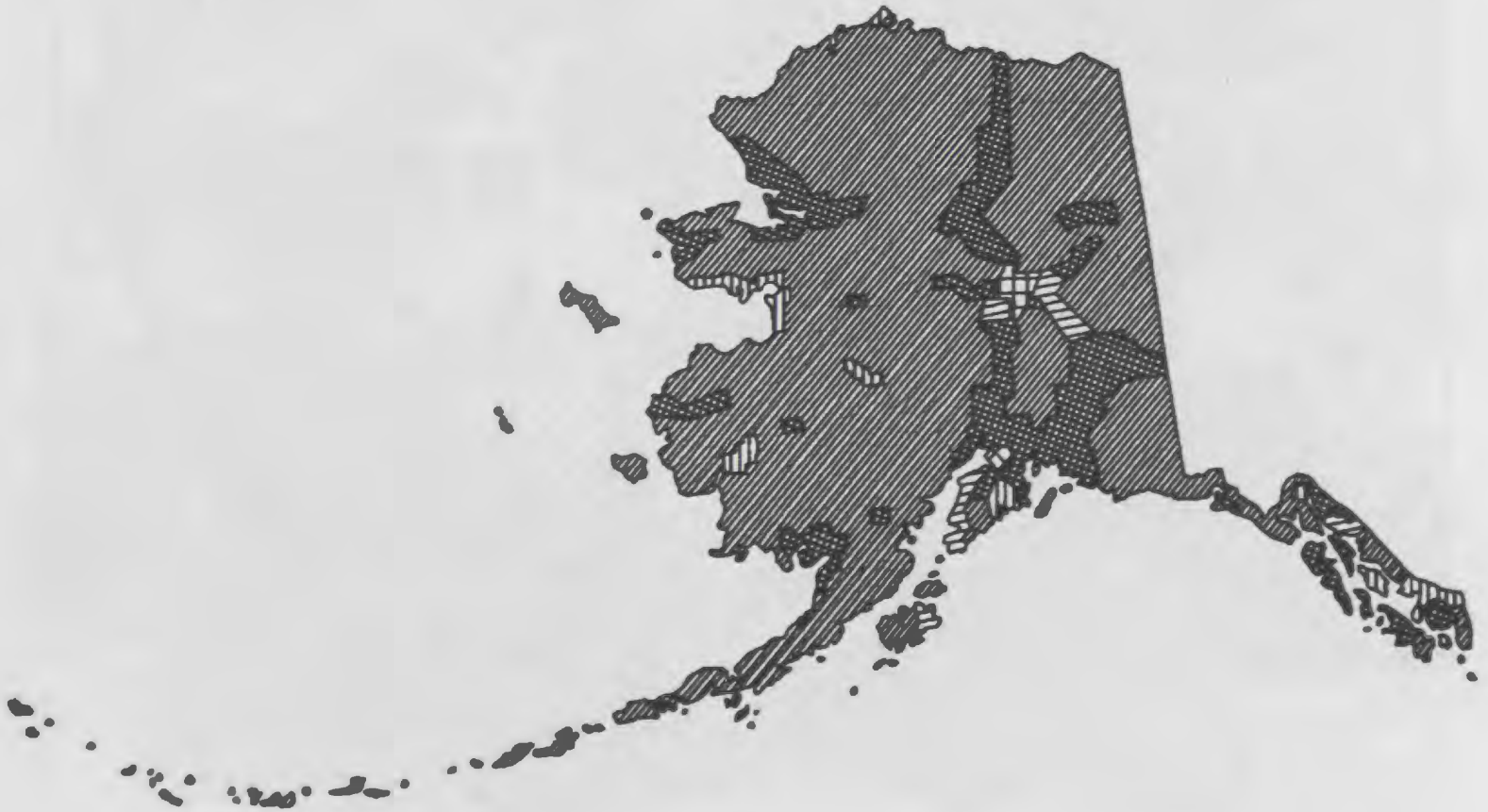


FIGURE 2

ARIZONA

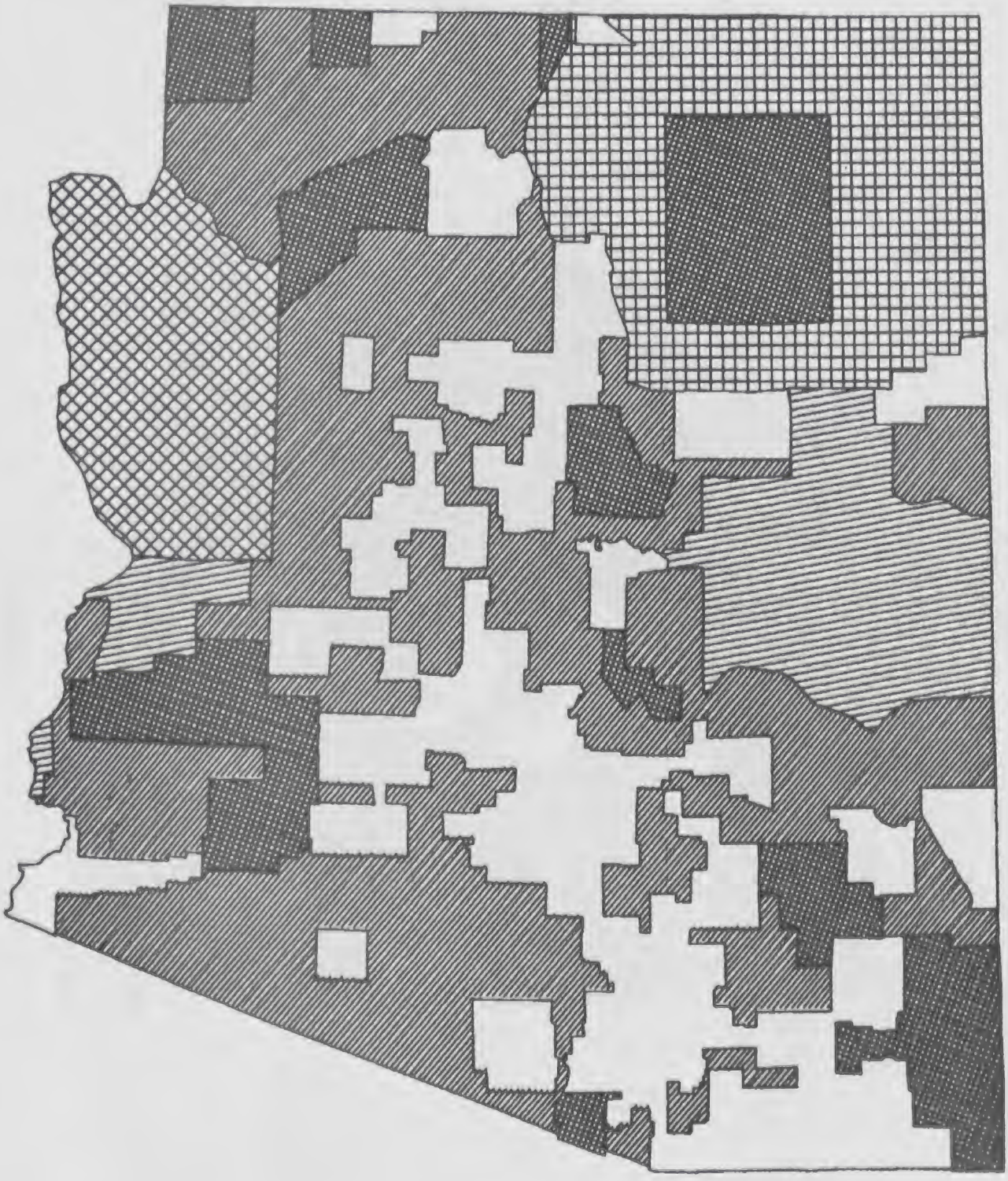


FIGURE 3

ARKANSAS

FIGURE 4

CALIFORNIA (UPPER)

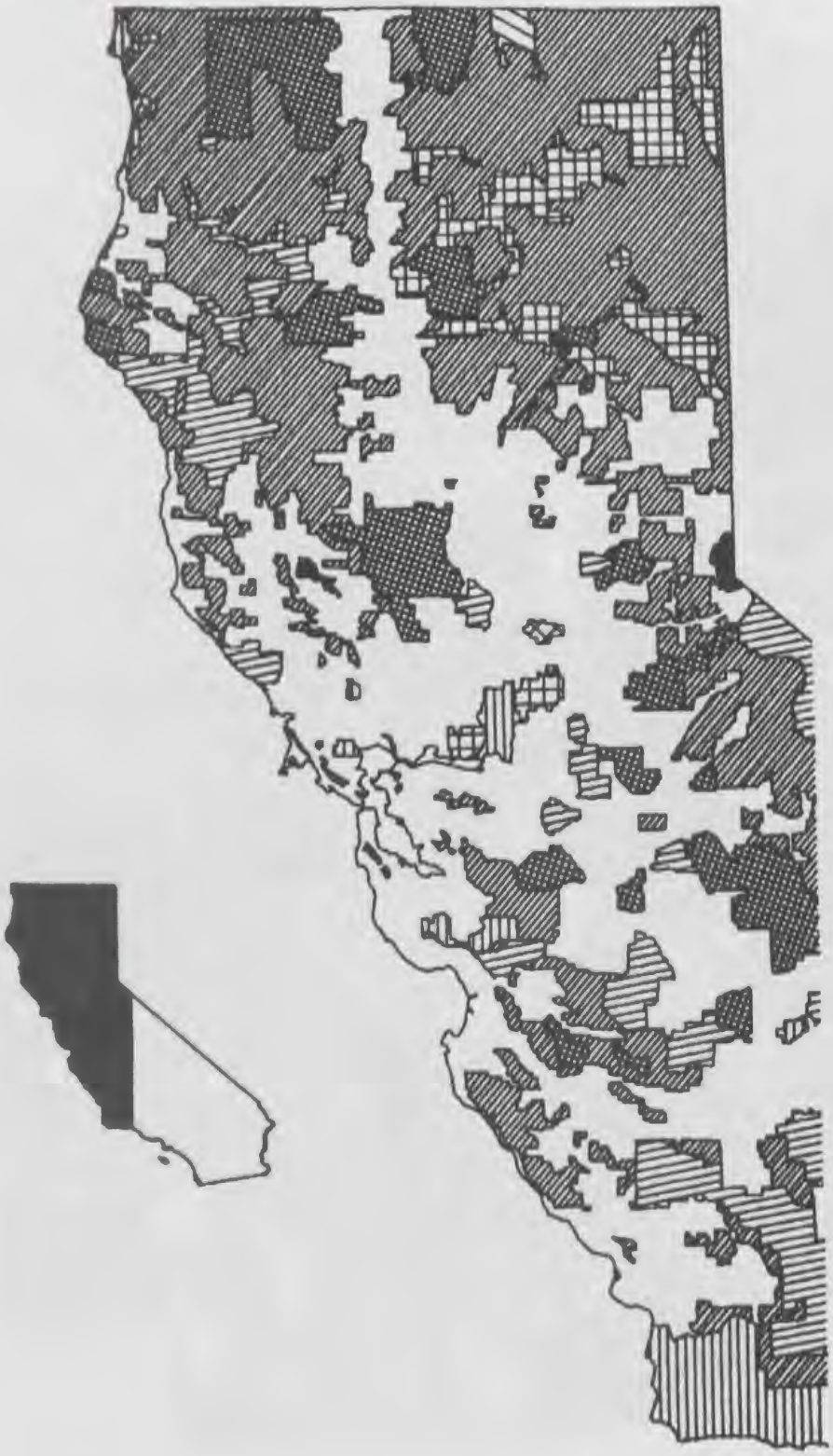


FIGURE 5a

CALIFORNIA (LOWER)

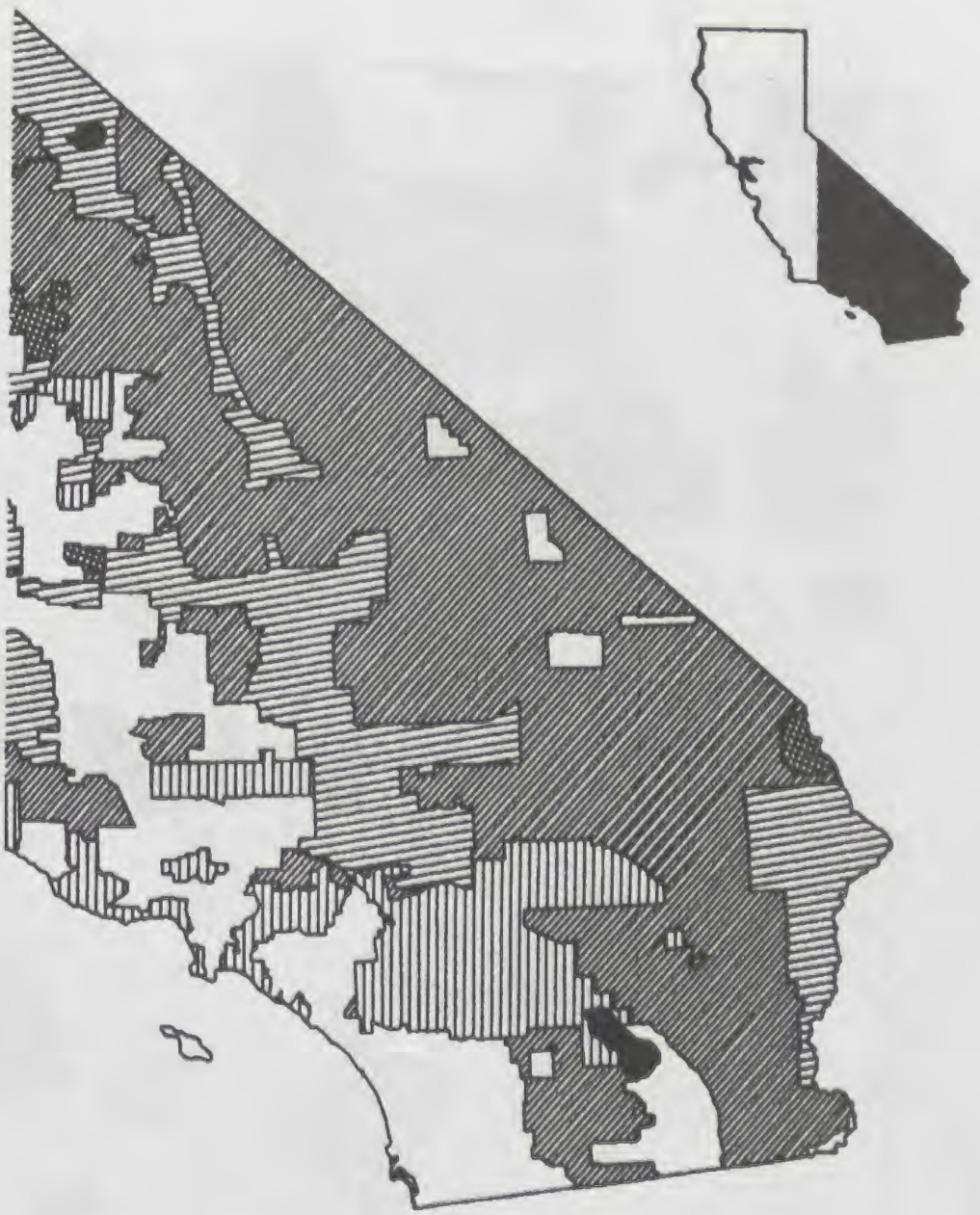


FIGURE 5b

COLORADO

FIGURE 6

CONNECTICUT

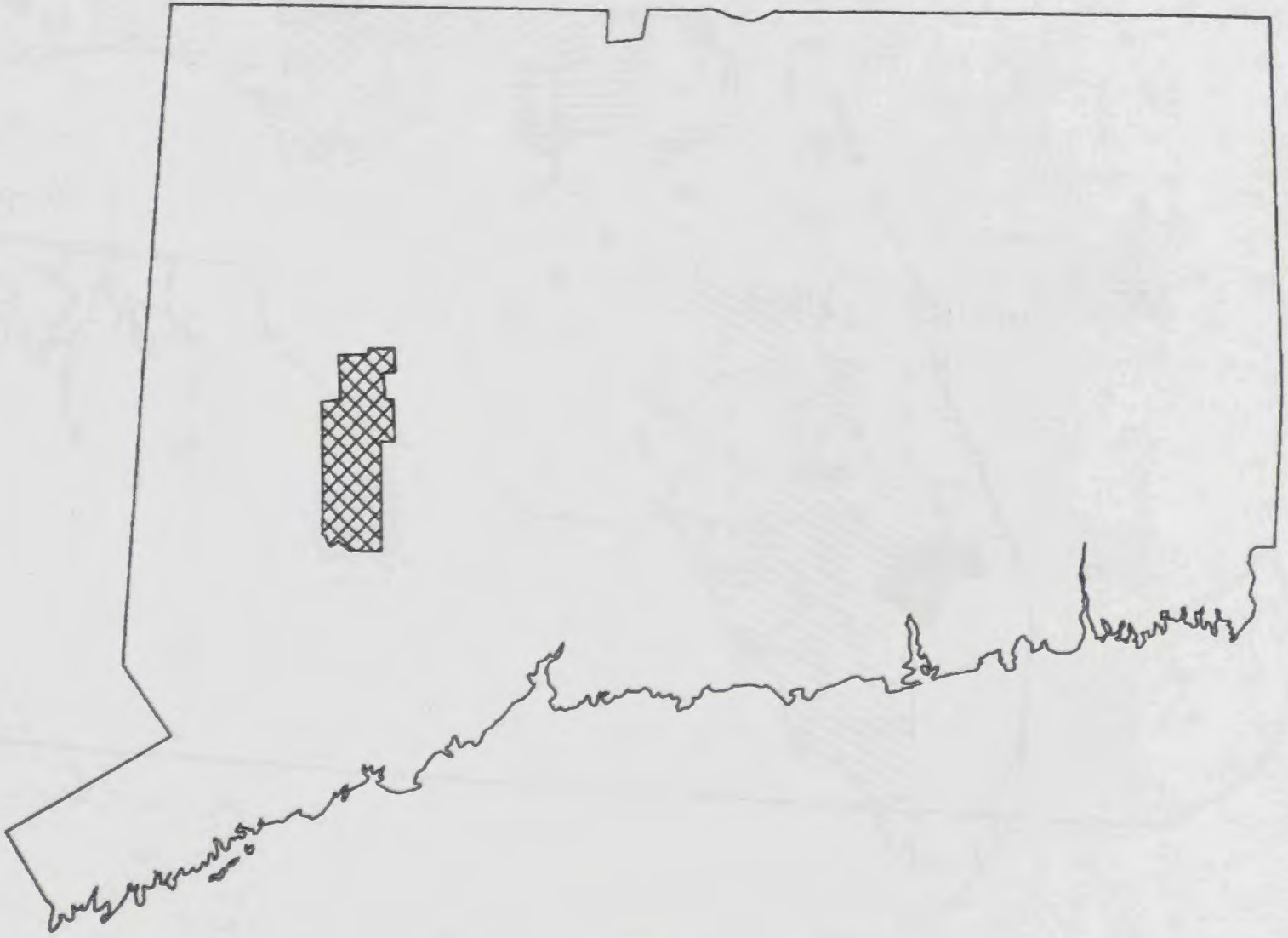


FIGURE 7

DELAWARE

FIGURE 8

FLORIDA

FIGURE 9

GEORGIA

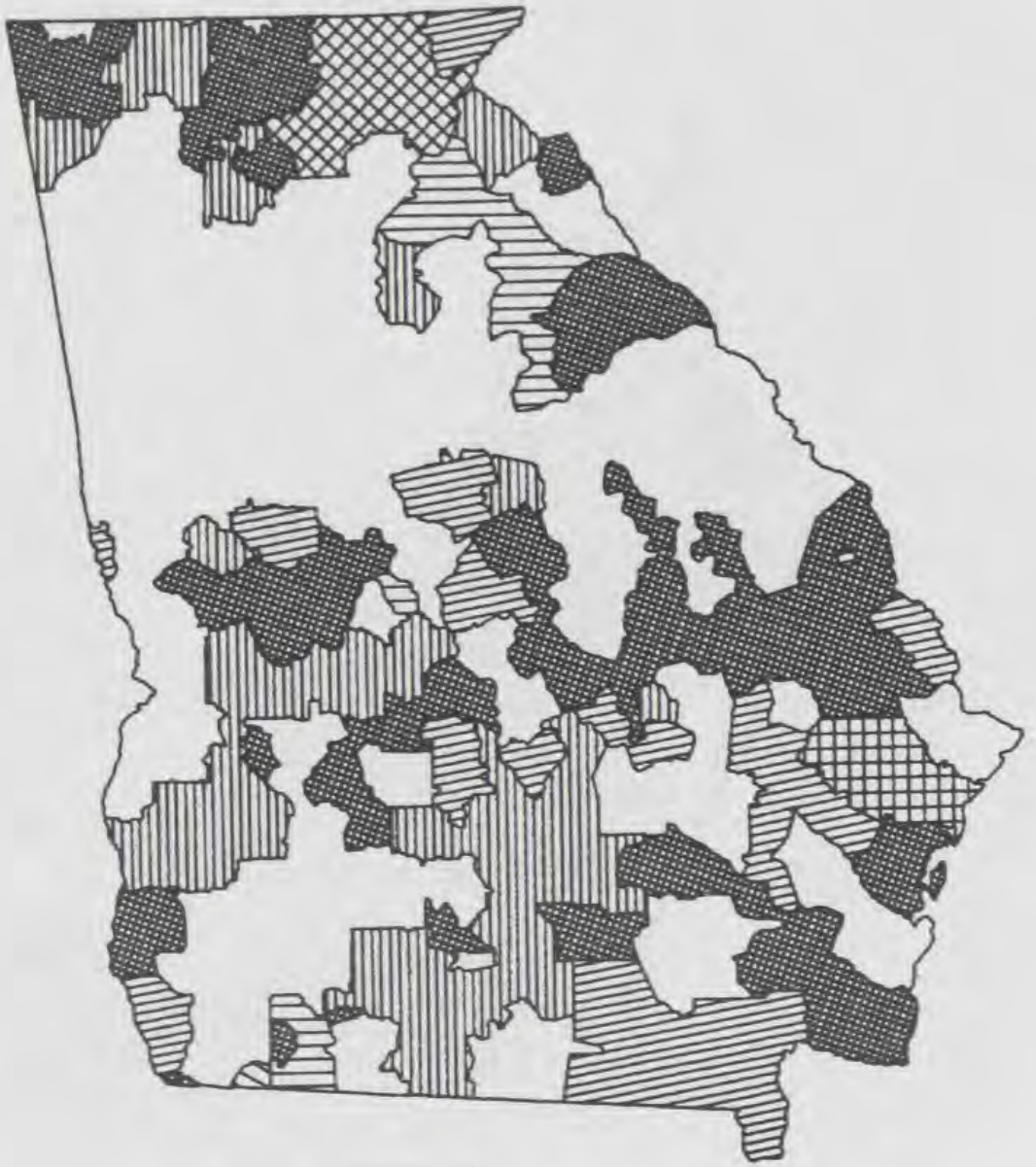


FIGURE 10

HAWAII

FIGURE 11

IDAHO

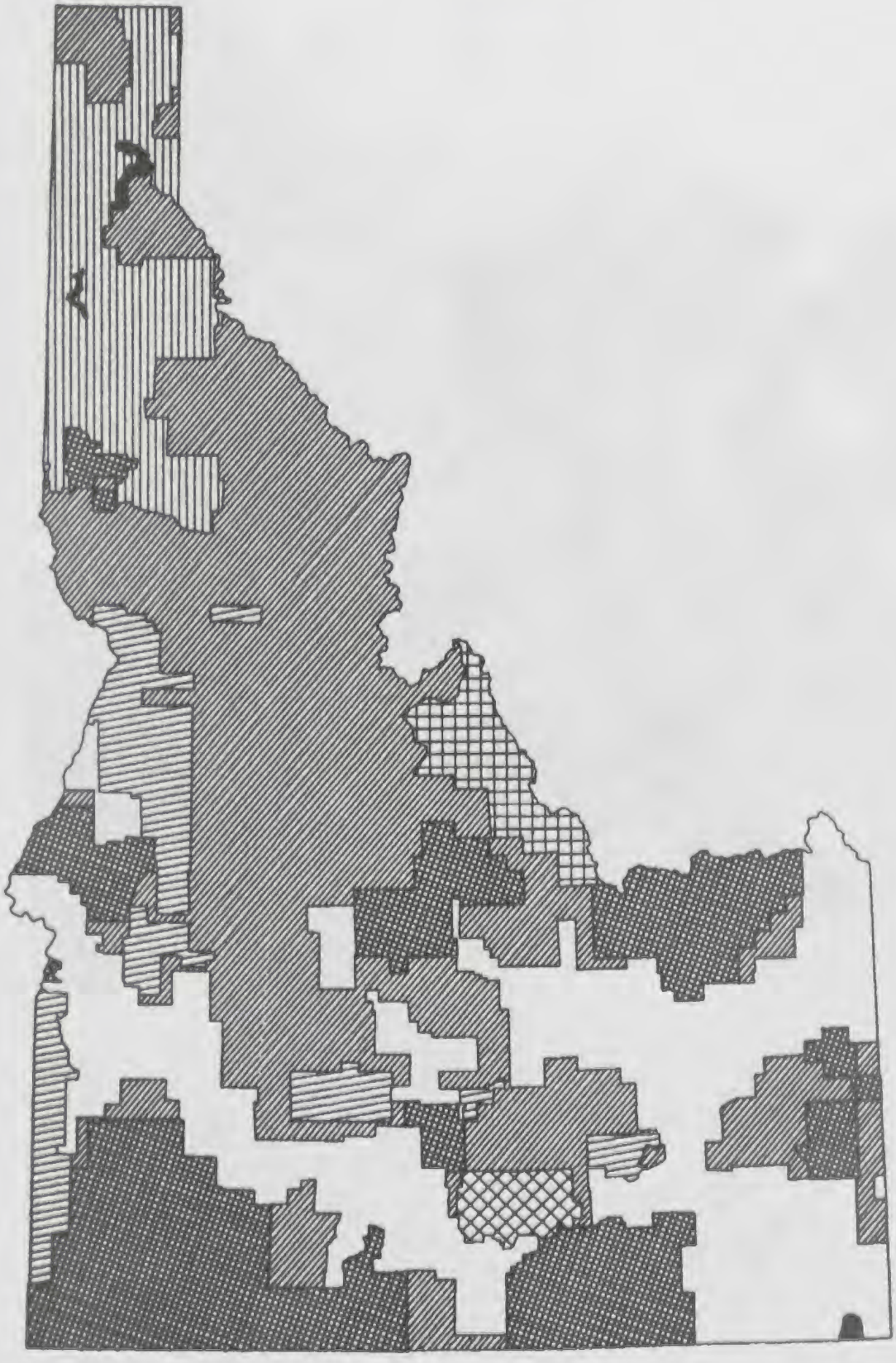


FIGURE 12

ILLINOIS

FIGURE 13

INDIANA

FIGURE 14

IOWA

FIGURE 15

KANSAS

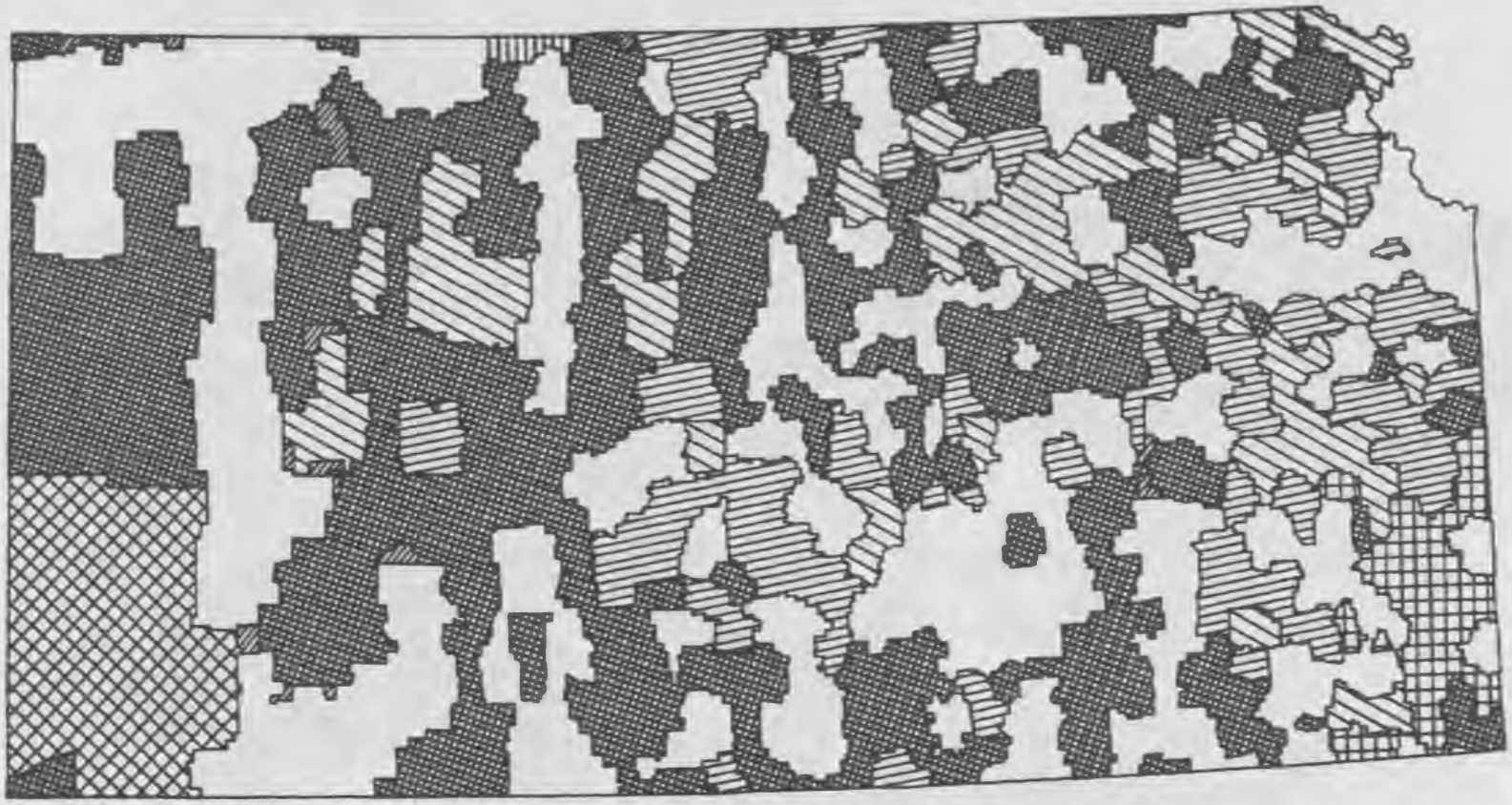


FIGURE 16

KENTUCKY

FIGURE 17

LOUISIANA

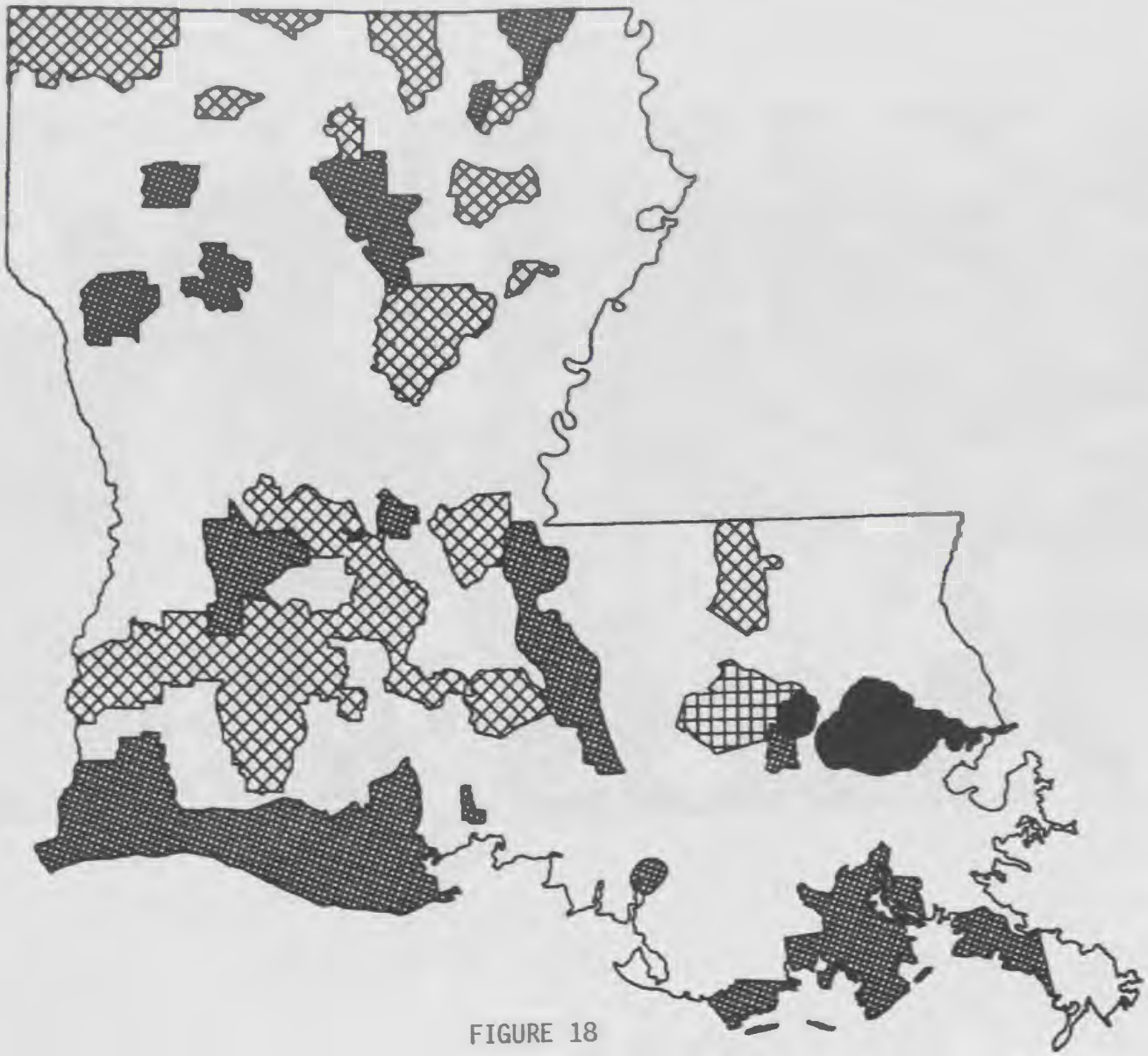


FIGURE 18

MAINE

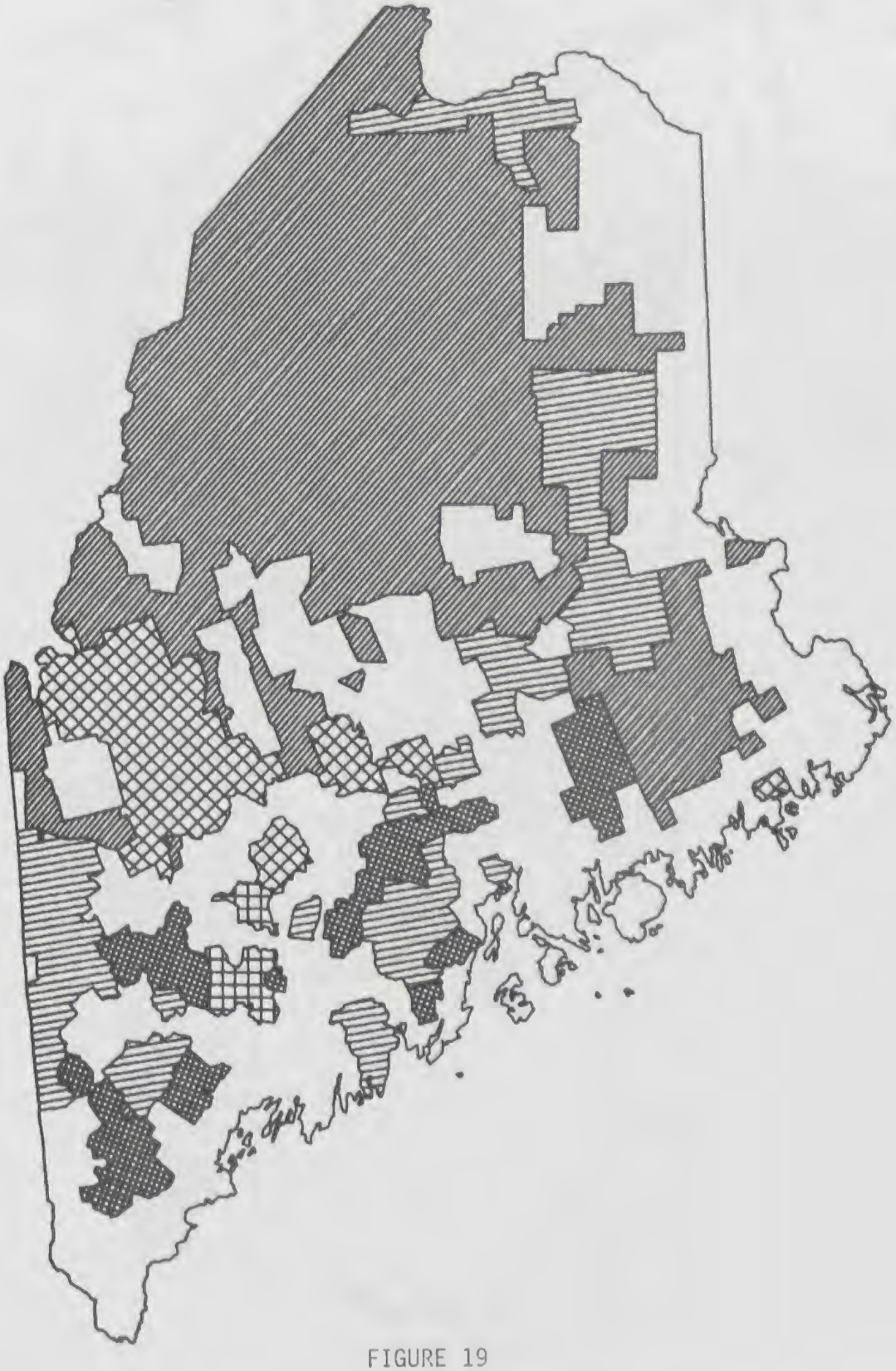


FIGURE 19

MARYLAND

FIGURE 20

MASSACHUSETTS

FIGURE 21

MICHIGAN

FIGURE 22

MINNESOTA

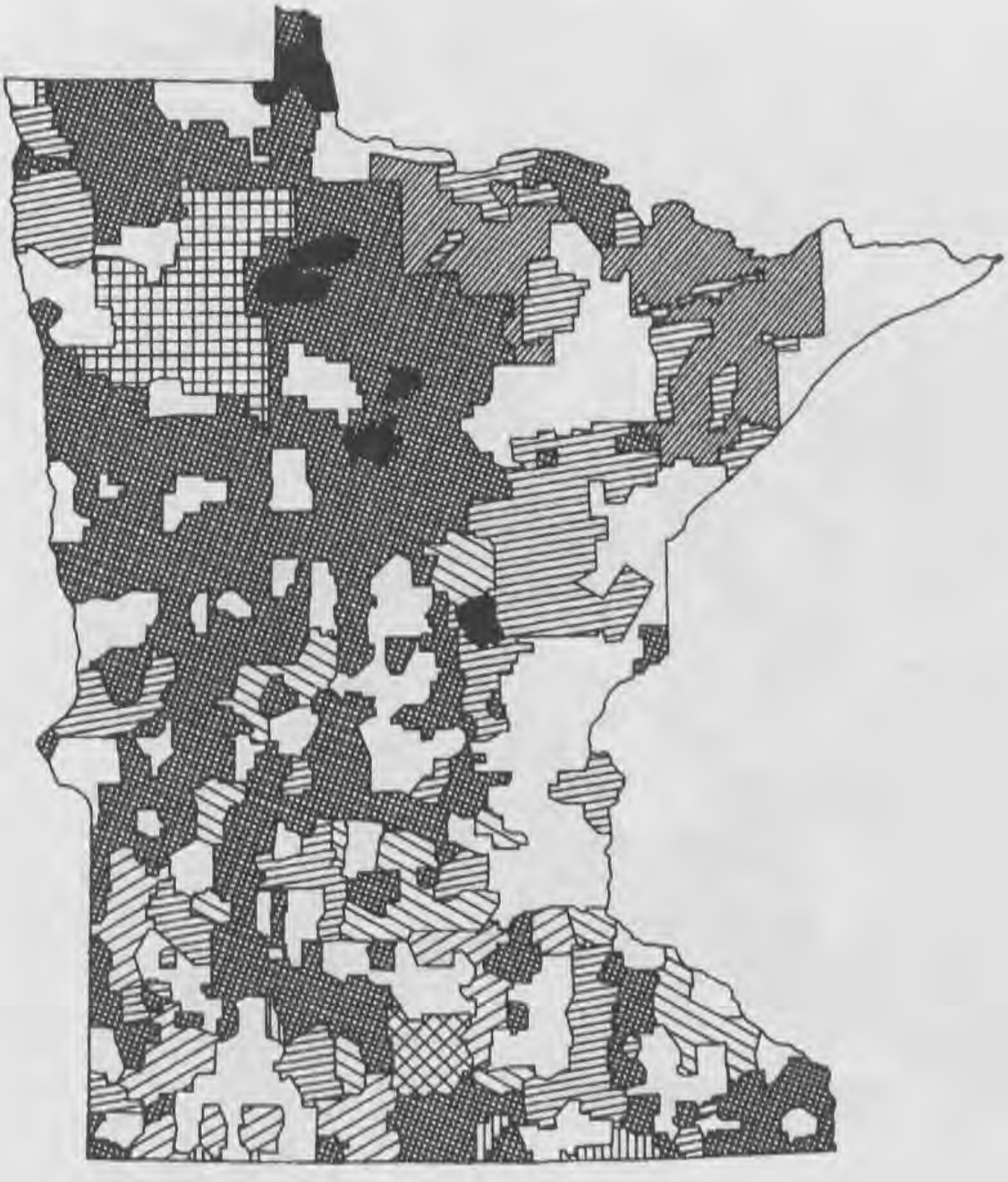


FIGURE 23

MISSISSIPPI

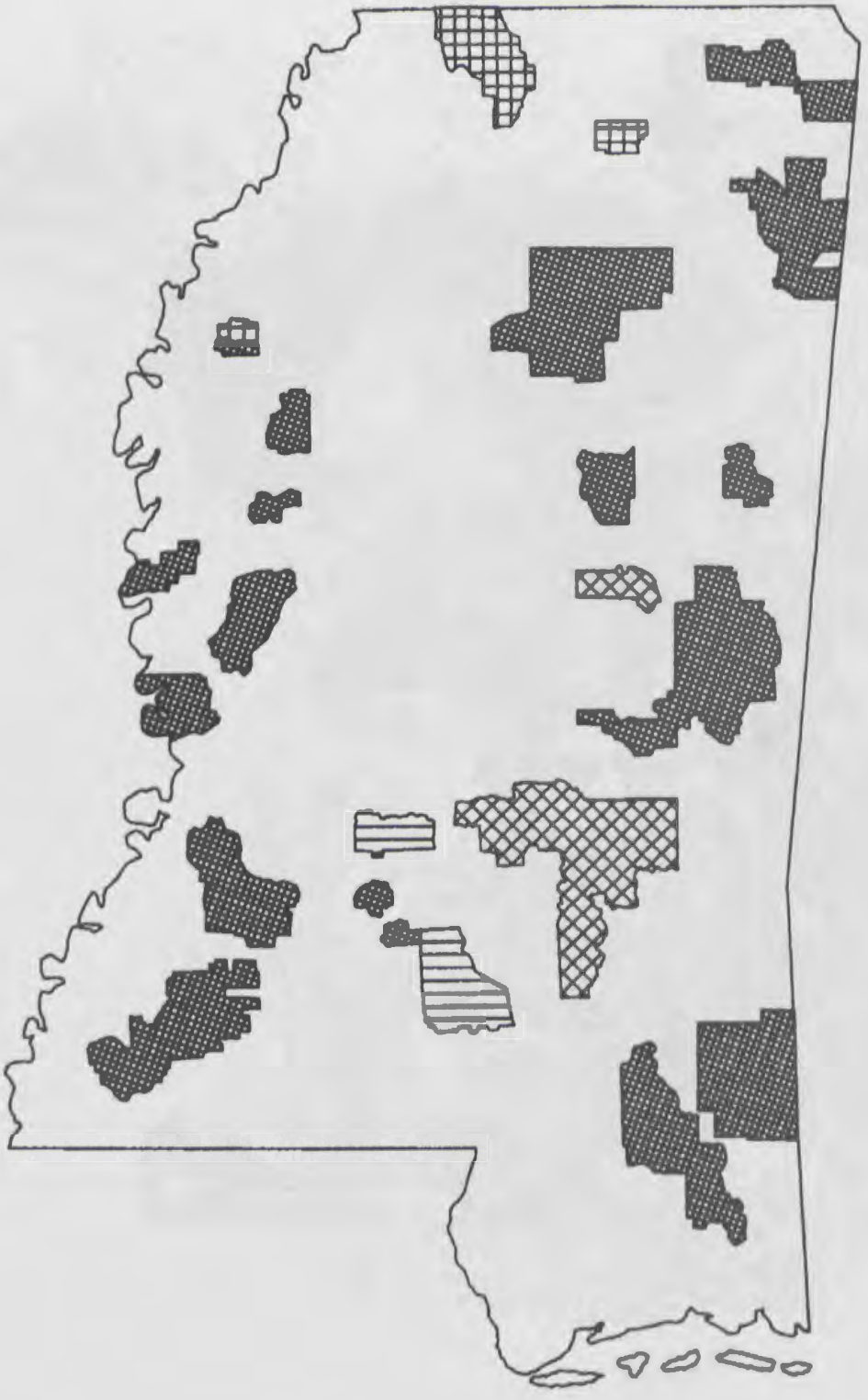


FIGURE 24

MISSOURI

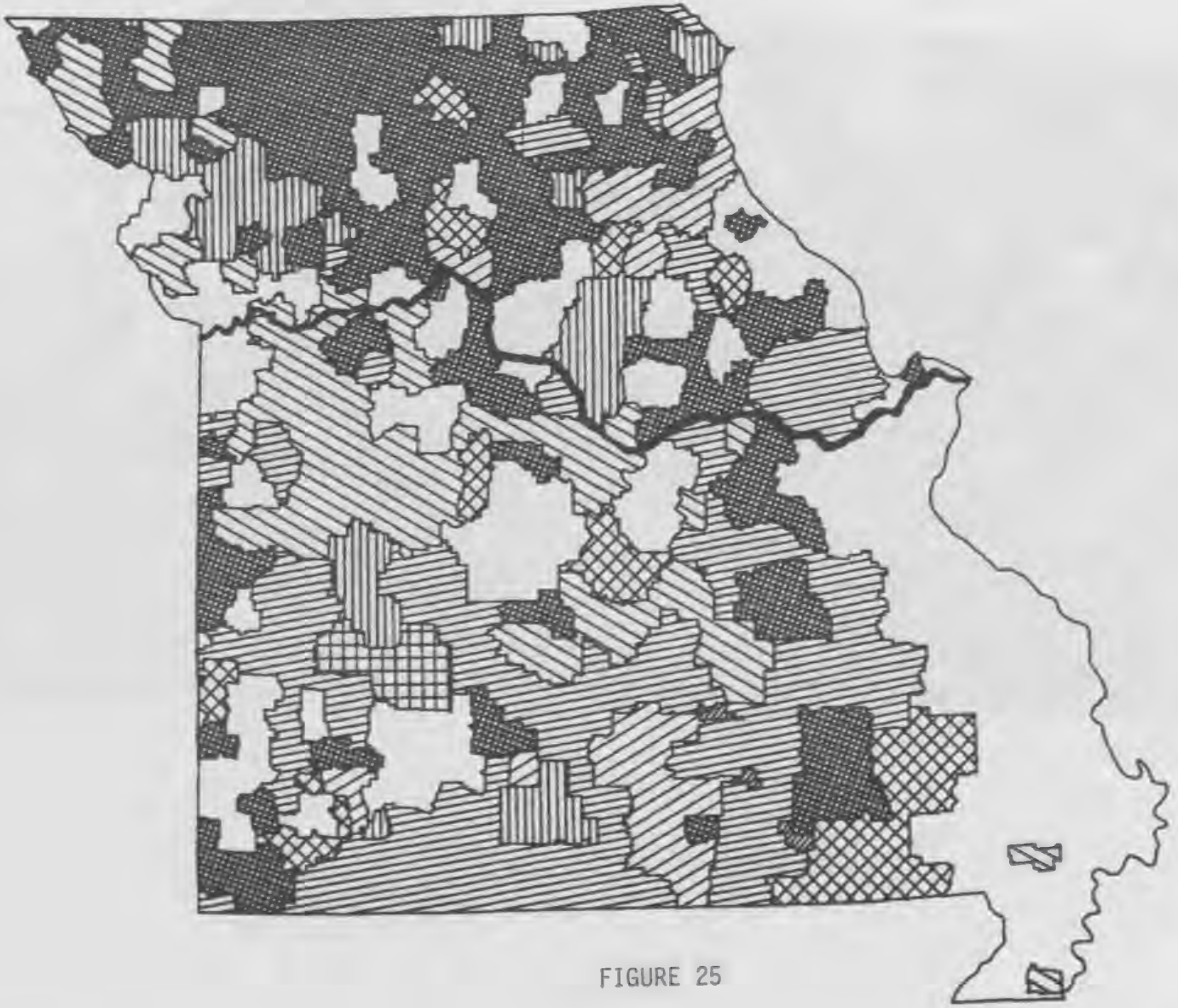


FIGURE 25

MONTANA

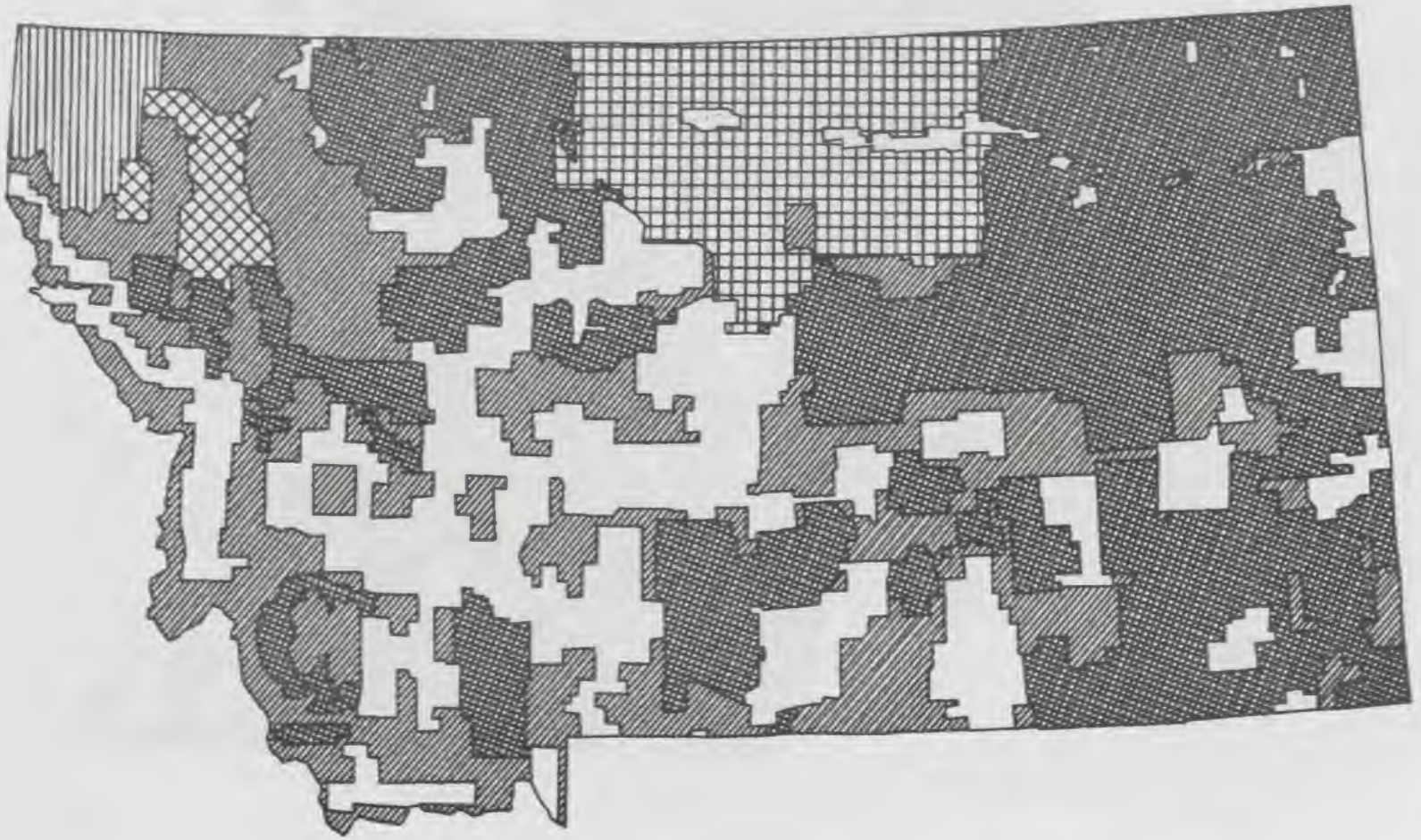


FIGURE 26

NEBRASKA

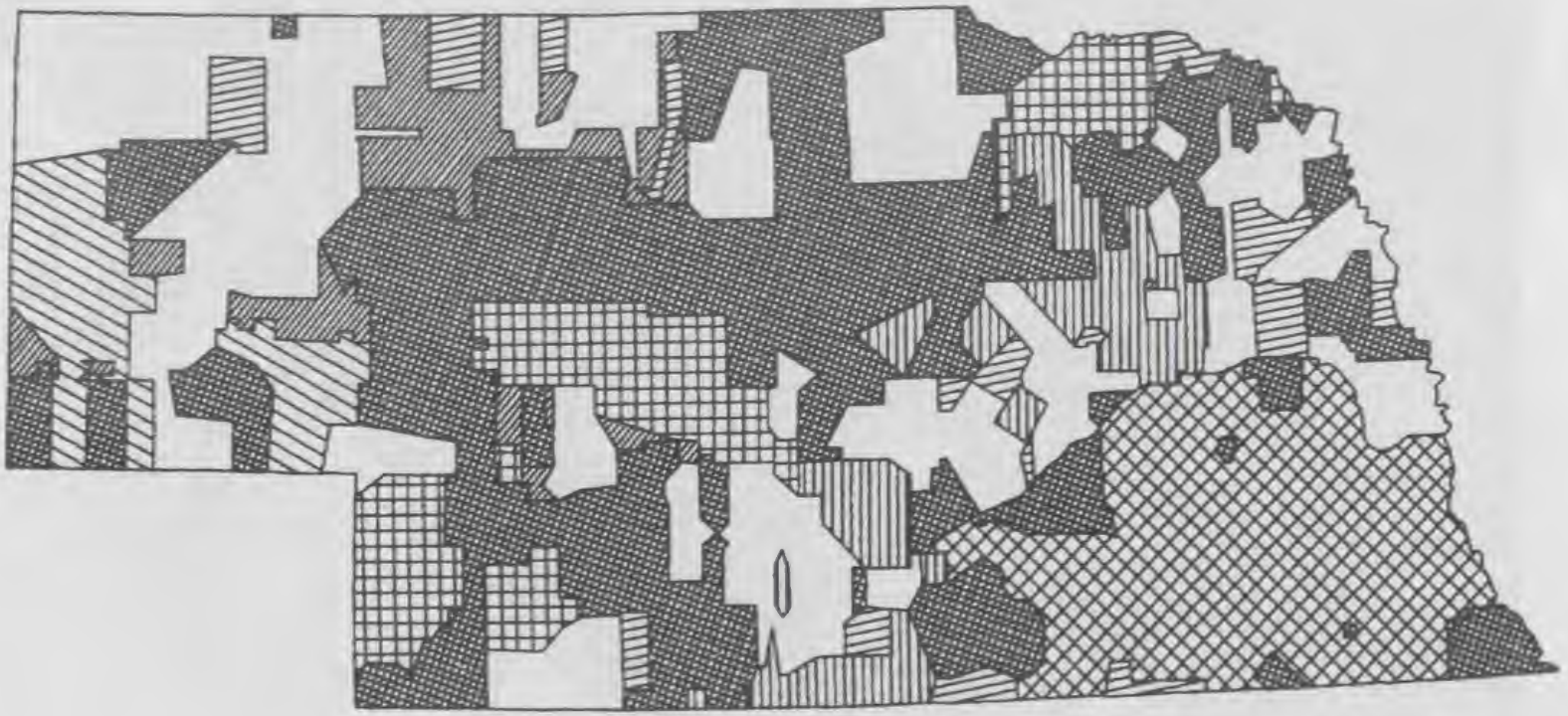


FIGURE 27

NEVADA

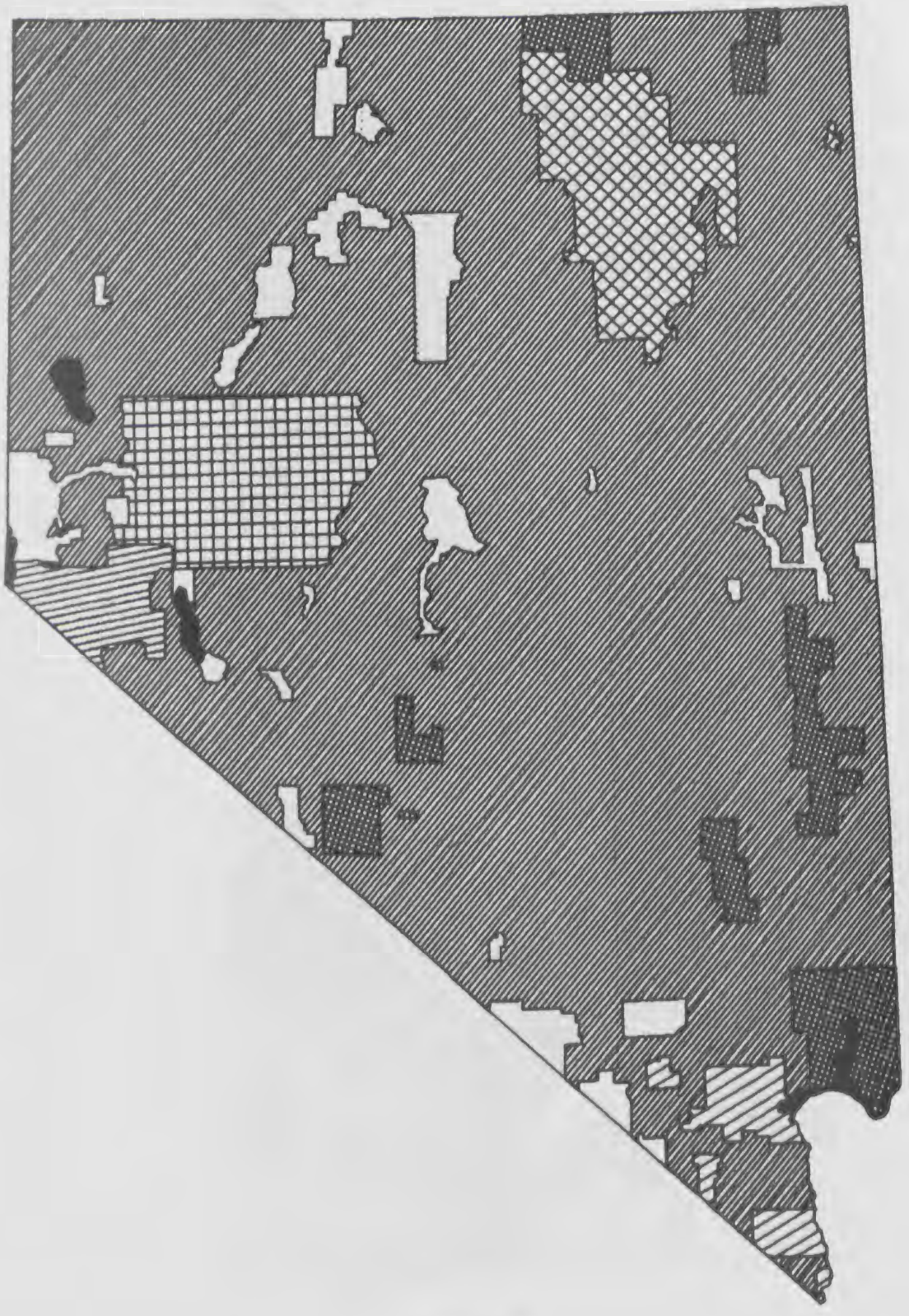


FIGURE 28

NEW HAMPSHIRE

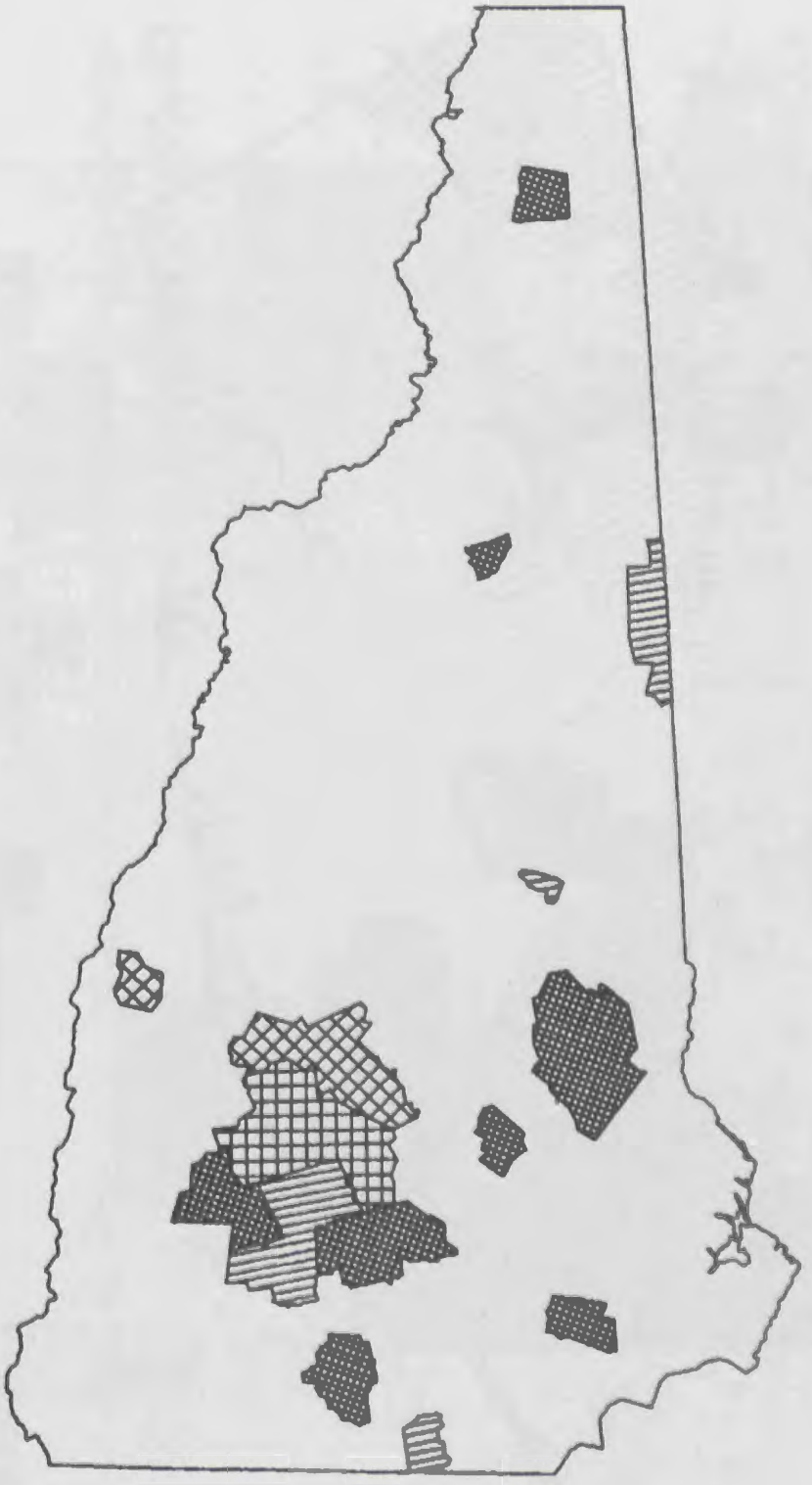


FIGURE 29

NEW JERSEY

FIGURE 30

NEW MEXICO

FIGURE 31

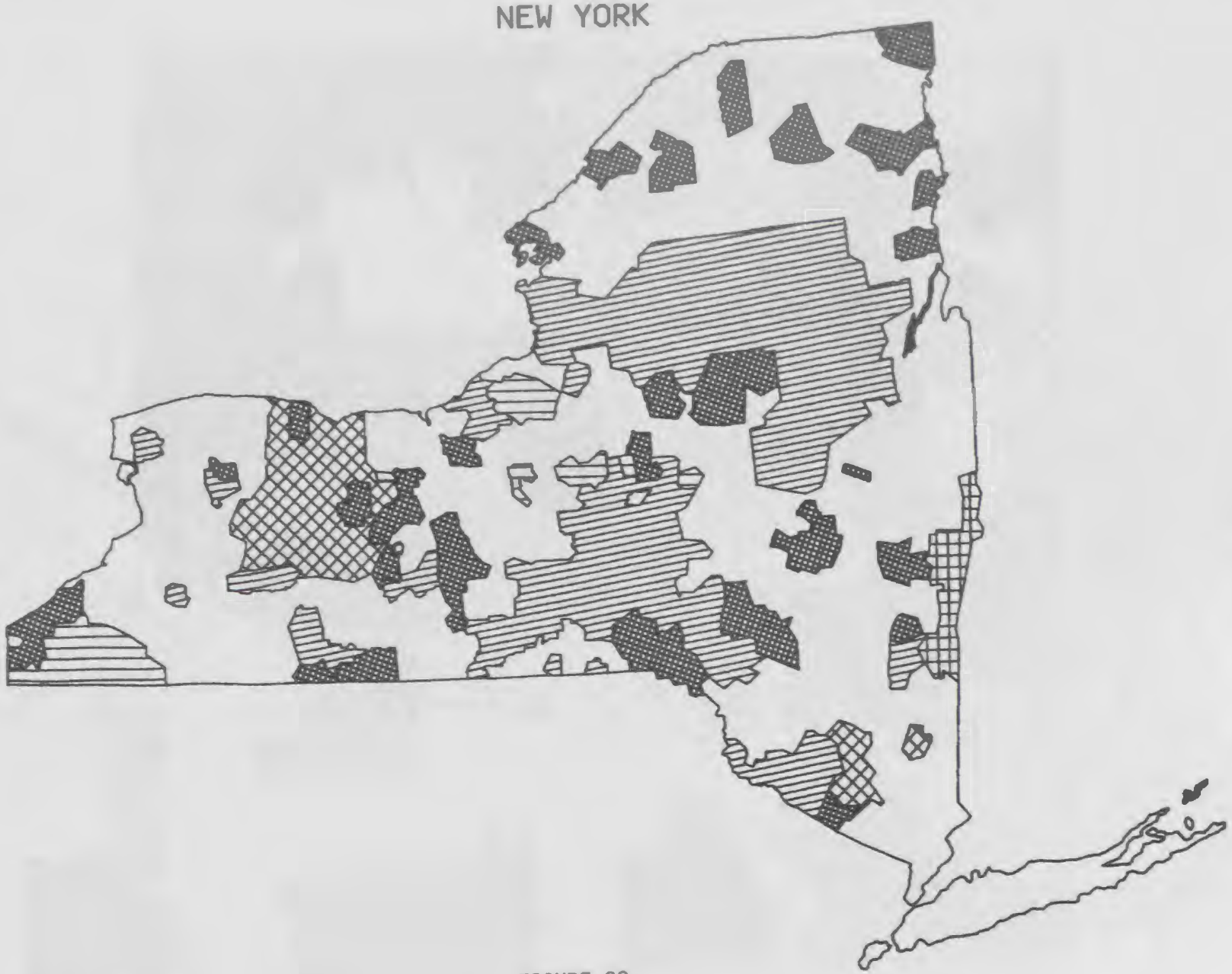


FIGURE 32

NORTH CAROLINA

FIGURE 33

NORTH DAKOTA

FIGURE 34

OHIO

FIGURE 35

OKLAHOMA

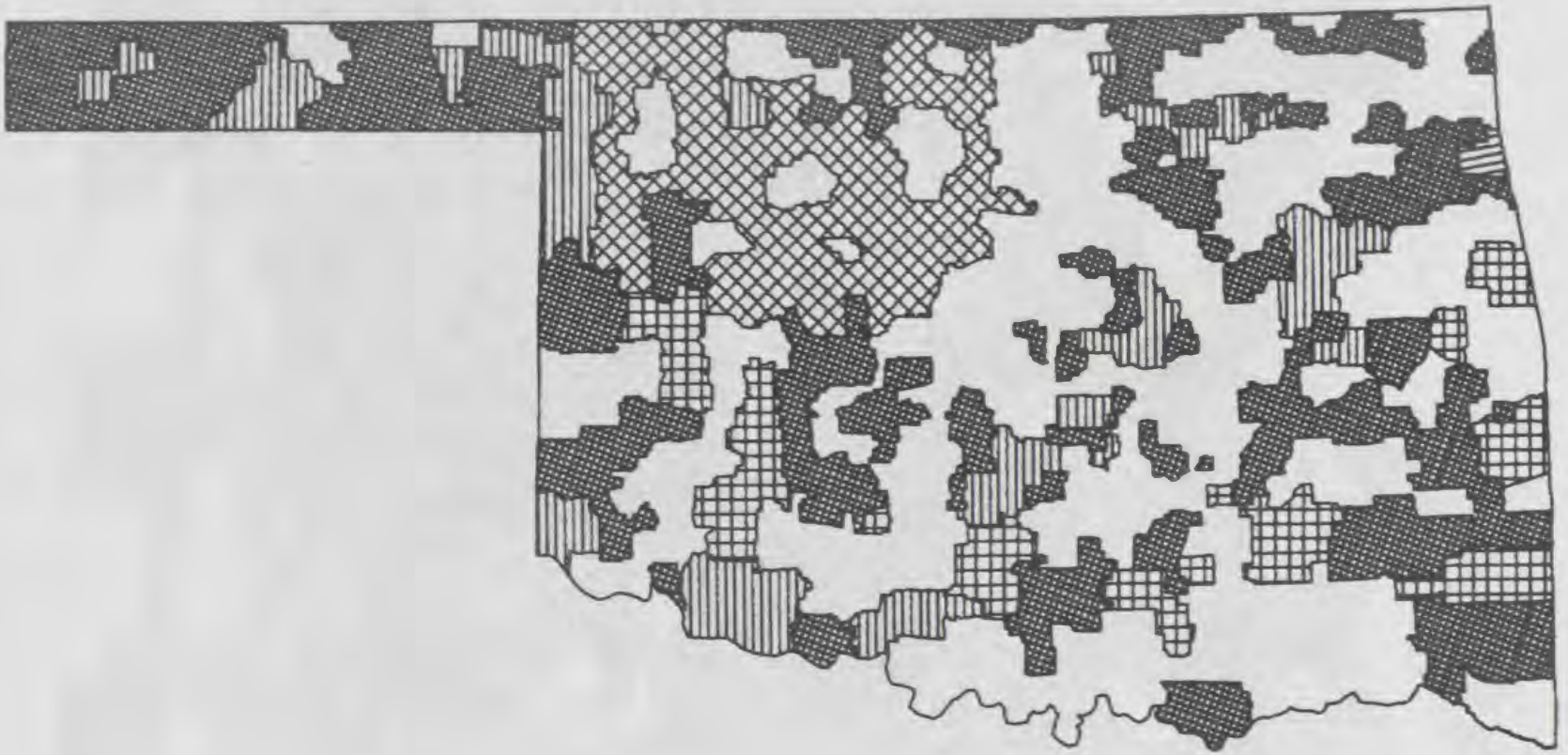


FIGURE 36

OREGON

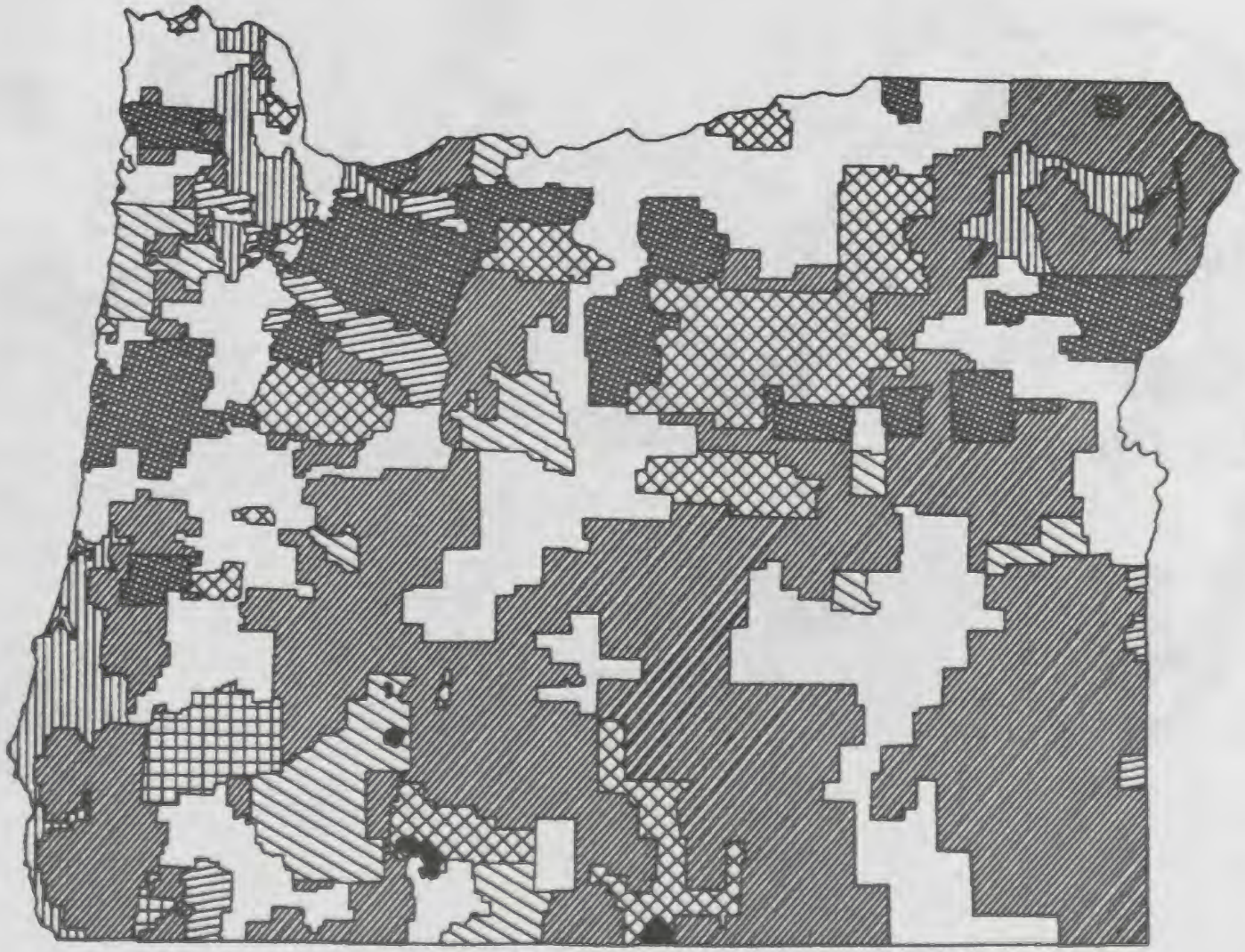


FIGURE 37

PENNSYLVANIA

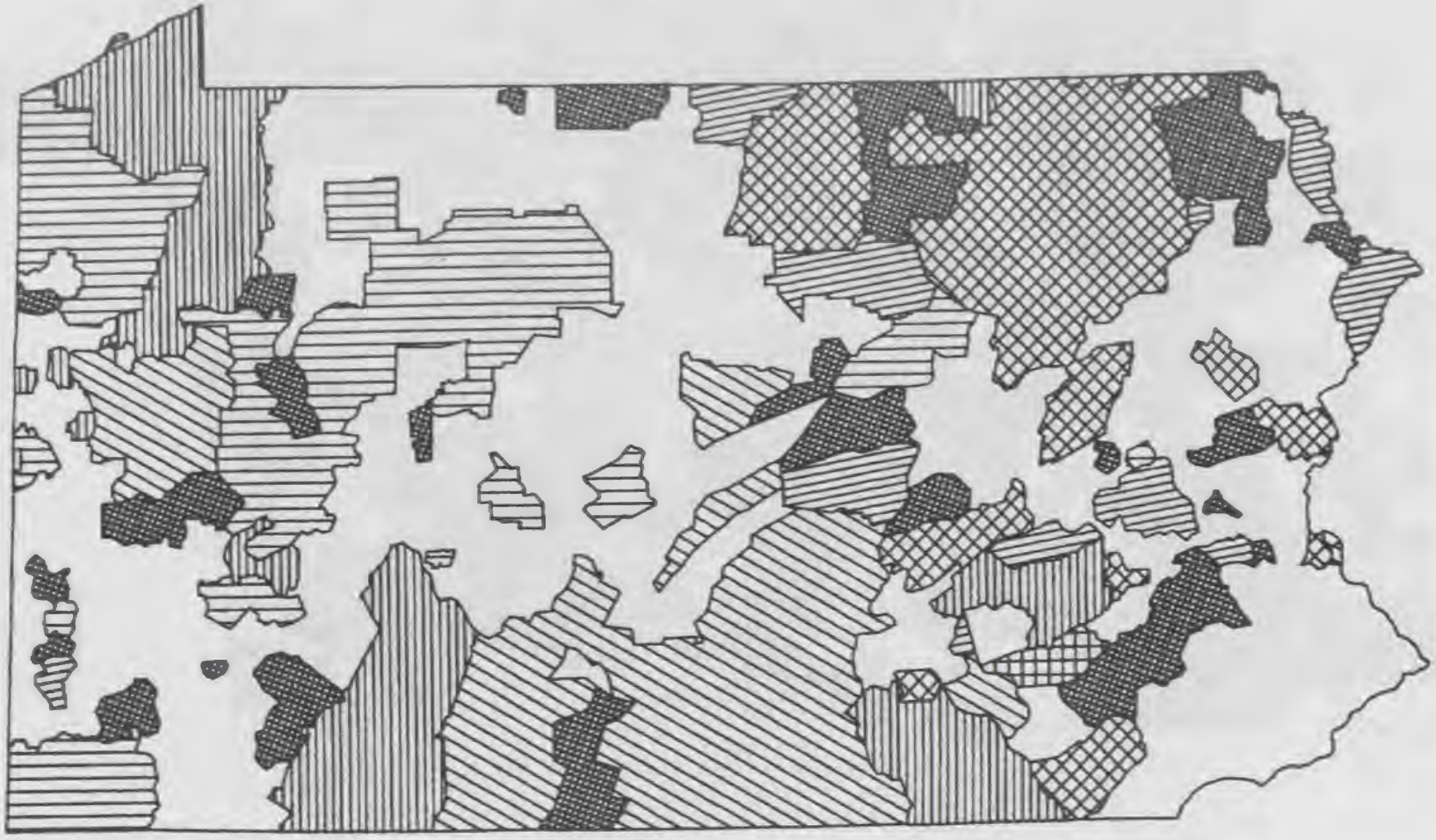


FIGURE 38

RHODE ISLAND

FIGURE 39

SOUTH CAROLINA

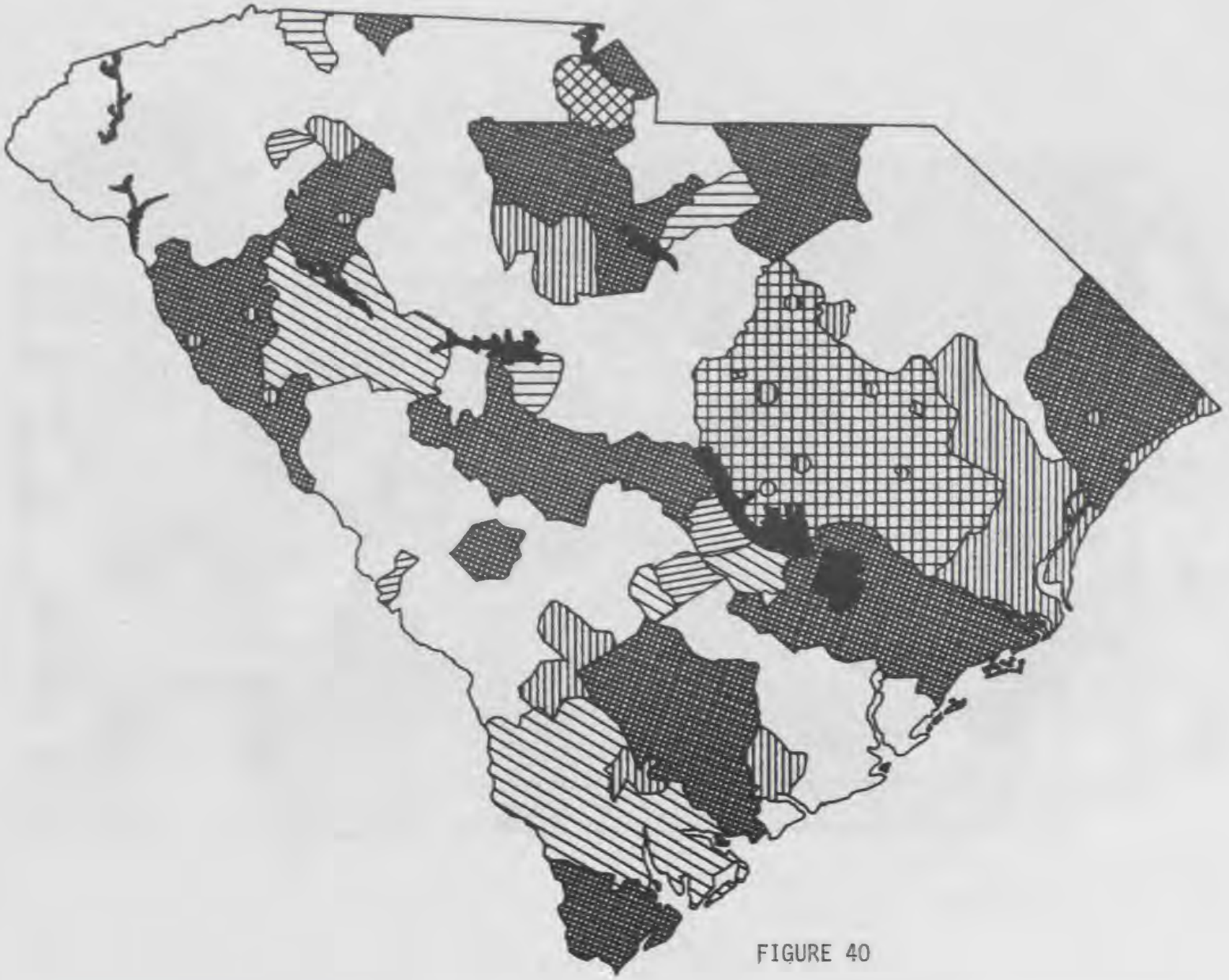


FIGURE 40

SOUTH DAKOTA

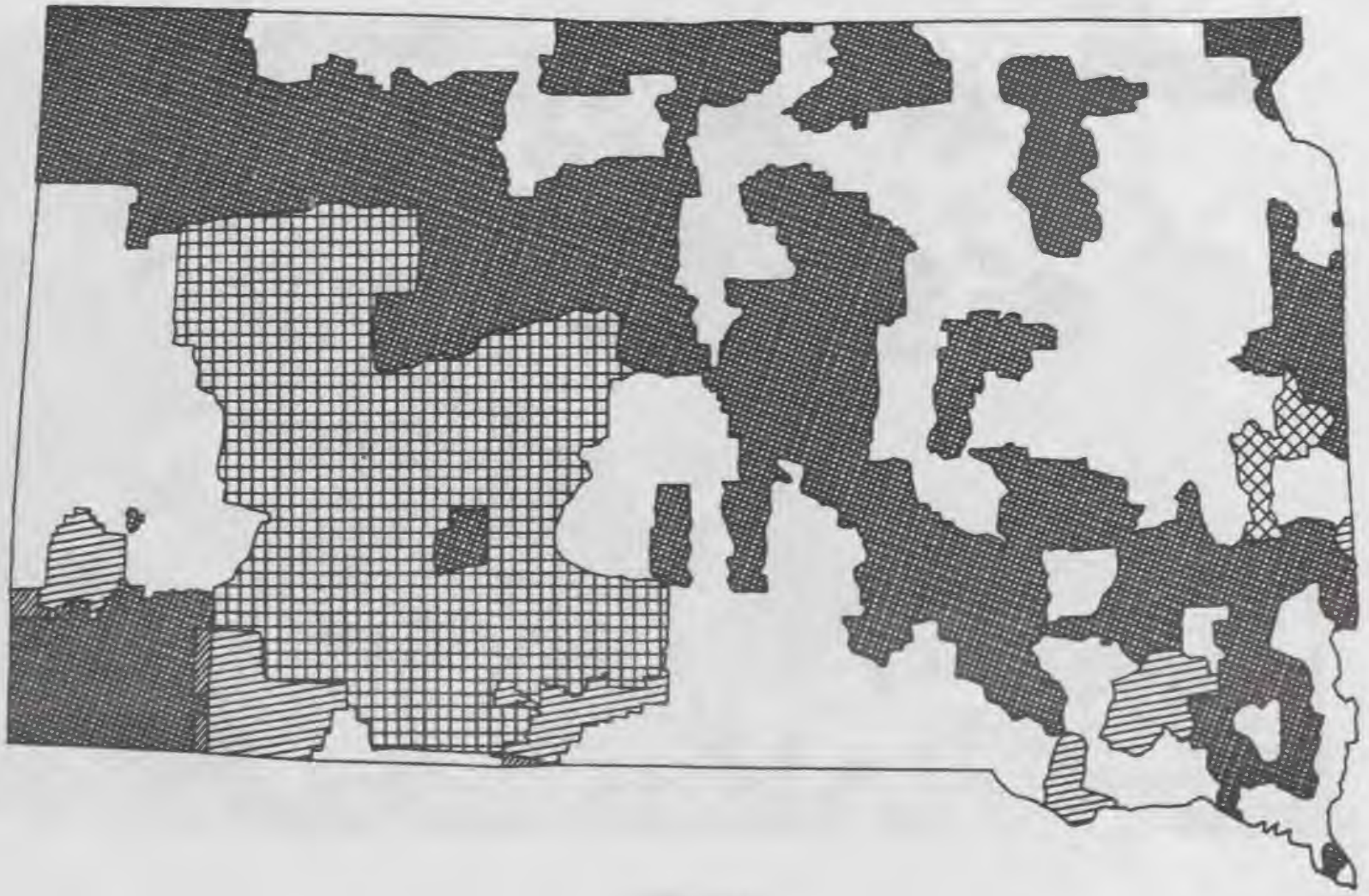


FIGURE 41

TENNESSEE

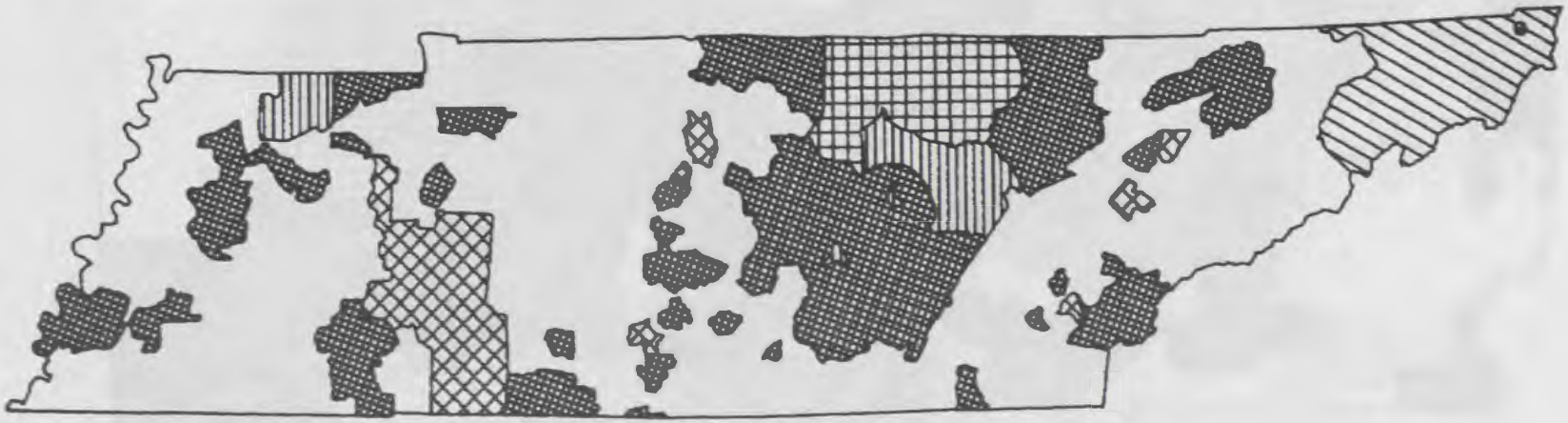


FIGURE 42

TEXAS (UPPER)

FIGURE 43a

TEXAS (LOWER LEFT)

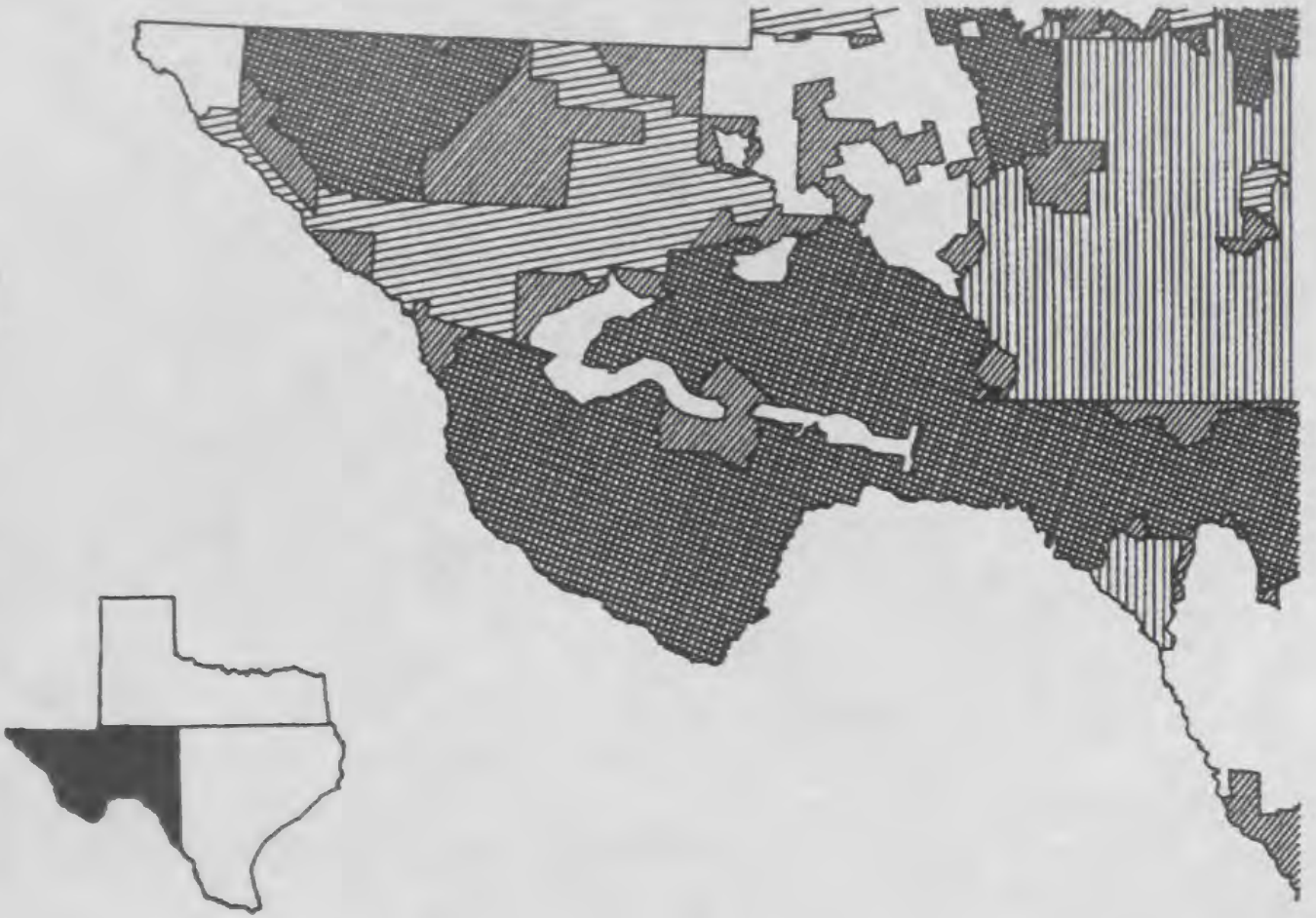


FIGURE 43b

TEXAS (LOWER RIGHT)

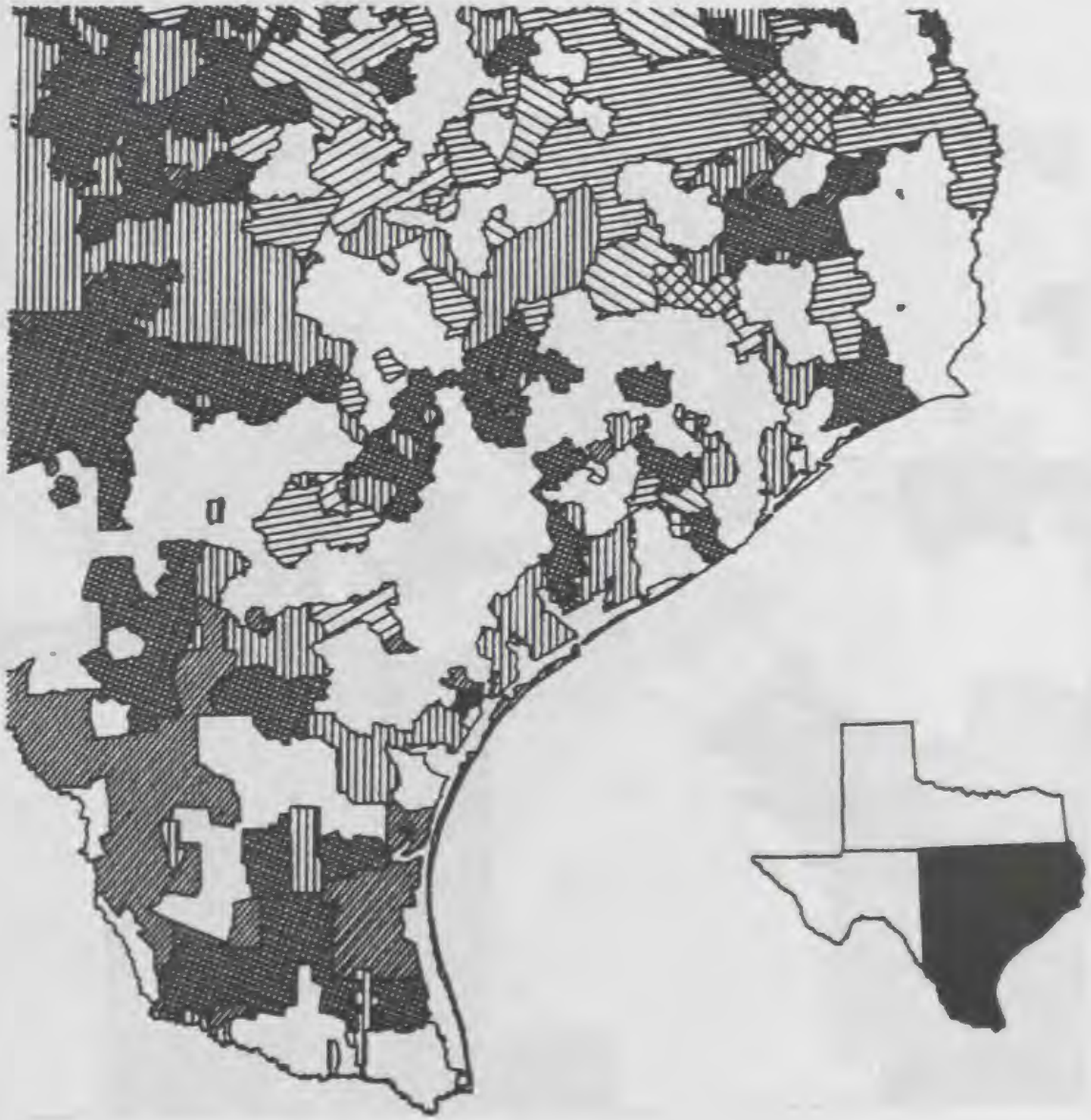


FIGURE 43c

UTAH

FIGURE 44

VERMONT

FIGURE 45

VIRGINIA

FIGURE 46

WASHINGTON

FIGURE 47

WEST VIRGINIA

FIGURE 48

WISCONSIN

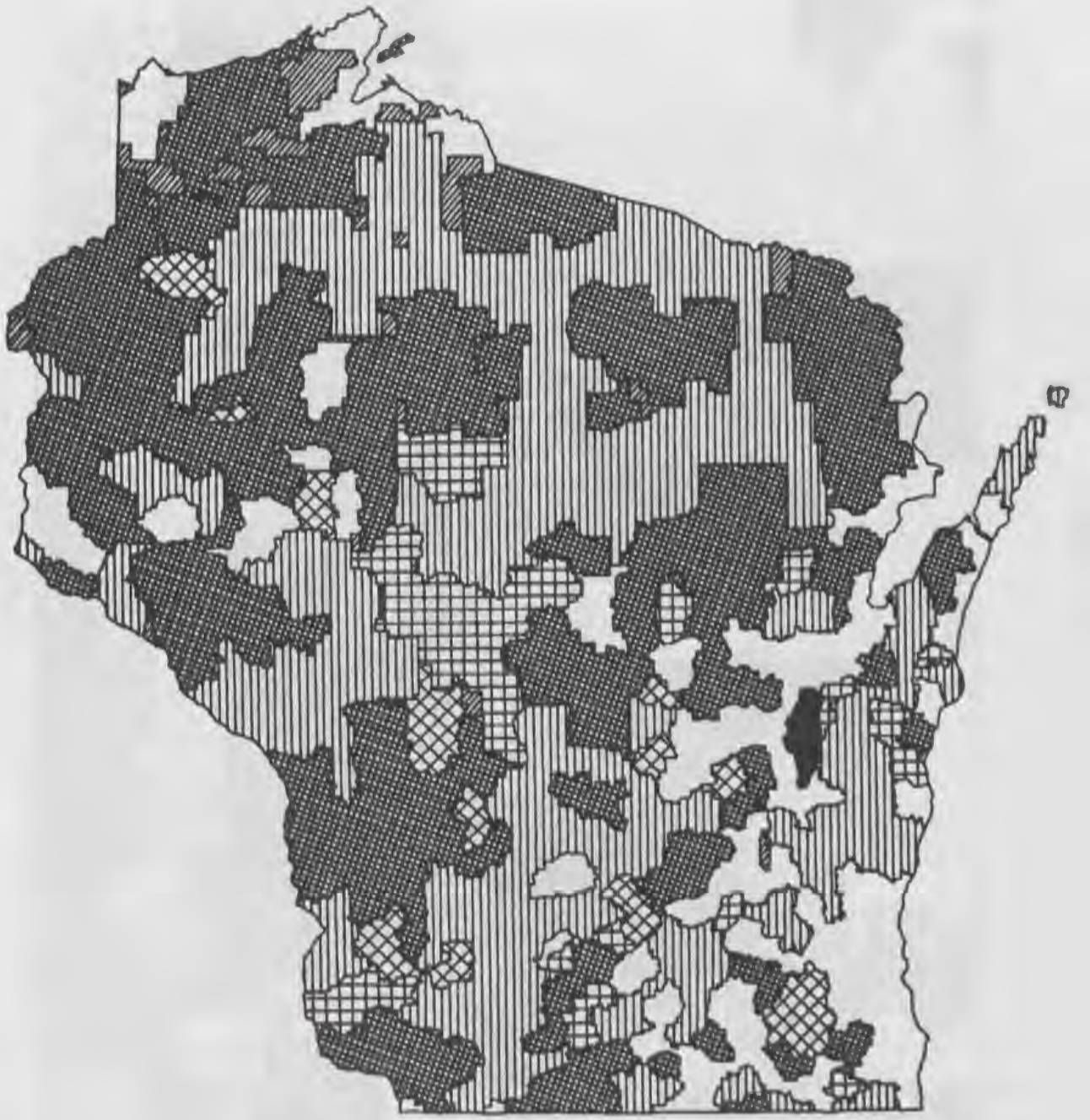


FIGURE 49

WYOMING

FIGURE 50

APPENDIX A:
LISTING OF INDEPENDENT TELEPHONE COMPANIES IN EACH STATE THAT ARE NOT A PART OF THE TOP FIVE HOLDING COMPANIES

ALABAMA

Ardmore Tel. Co., Inc., Ardmore
Blountsville Tel. Co., Blountsville
Brindlee Mountain Tel. Co., Arab
Castleberry Tel. Co., Castleberry
Century Tel. Enterprises, Inc., Monroe, LA
    Butler Tel. Co., Inc., Butler
*Farmers Tel. Co-op., Inc., Rainsville (17,537)
Florala Tel. Co., Inc., Florala
Goshen Tel. Co., Goshen
Gra-Ceba Tel. Total Communications, Ashford
*Gulf Tel. Co., Foley (19,091)
Hayneville Tel. Co., Hayneville
Hopper Tel. Co., Altoona
Interstate Tel. Co., Westpoint, GA
Mid-South Tel. Co., Inc., Baton Rouge, LA
    Lamar County Tel. Co., Millport
Millry Tel. Co., Millry
Mississippi Tel. Corp., Leakesville, MS
    Fruitdale Tel. Co., Inc., Fruitdale
Mon-Cre Tel. Co-op. Inc., Ramer
Monroeville Tel. Co., Monroeville
Moundville Tel. Co., Inc., Moundville
New Hope Tel. Co-op., New Hope
Oakman Tel. Co., Inc., Oakman
Oneonta Tel. Co., Inc., Oneonta
Pine Belt Tel. Co., Inc., Arlington
Ragland Tel. Co., Ragland
Roanoke Tel. Co., Roanoke
Southland Tel. Co., Atmore
Telephone and Data Systems, Inc., Chicago, IL
    Peoples Tel. Co., Inc., Leesburg
Telephone Electronics Corporation, Bay Springs, MS
    Grove Hill Tel. Corp., Grove Hill
    National Telephone Co. of Alabama, Inc., Cherokee
Tri-County Tel. Co., Everton
Union Springs, Tel. Co., Inc., Union Springs

---

* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

ALASKA

Alaska Power & Telephone Co.
    National Utilities Inc., Skagway
*Anchorage Telephone Utility, Anchorage (144,563)
Bettles Tel. Co., Inc., Bettles
Bristol Bay Tel. Communications Co-op., Inc., Naknek
Bush Tel. Inc., Aniak
Circle Tel., Circle
Copper Valley Tel. Co-op., Valdez
Cordova Public Utilities, Cordova
*Fairbanks Municipal Utilities Systems, Fairbanks (35,128)
GAB Telecommunications Co., Inc., Girdwood
Great Land Tel. Anchorage
Interior Tel. Co., Anchorage
Ketchikan Public Utilities Co., Ketchikan
Manley Utility Co., Manley Hot Springs
Matanuska Tel. Assn., Inc., Palmer
Mukluk Tel. Co., Teller
Nushagak Tel. Co-op., Inc., Dillingham
OTZ Tel. Co-op., Inc., Kotzebue
Summit Tel., Summit
Telephone Utilities, Inc., Portland, OR
    Sitka Tel. Co., Sitka
    Telephone Utilities of Alaska, Inc., Ft. Wainwright
United Utilities, Inc., Anchorage
Whittier Tel. Co., Anchorage
Yukon Tel. Co., Tanana

ARIZONA

Arizona Tel. Co., Phoenix
*Citizens Utilities Co., Stamford, CT (37,828)
    Citizens Utilities Co. & Citizens Utilities Rural Co., Kingman
*Great Southwest Tel. Corp., Grandview, TX (13,376)
    Navajo Communications Co., Inc., Window Rock
Rio Virgin Tel. Co., Mesquite, NV
South Central Utah Tel. Assn., Inc., Escalante, UT
Southwestern Tel. Co., Salome
Universal Tel., Inc., Milwaukee, WI
    Universal Tel. Co., of Arizona, Keams Canyon
Valley Tel. Co-op., Inc., Willcox

---

* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

ARKANSAS

*Allied Tel. Co., Inc., Little Rock (91,225)
Allied Tel. Co., of Arkansas, Inc., Little Rock
Allied Utilities Corp., Crossett
Boone County Tel. Co., Harrison
Doniphan Tel. Co., Doniphan, MO
White River Tel. Co., Elkins
Wickes Tel. Co., Inc., Wickes
Arkansas Tel. Co., Inc., Clinton
Central Arkansas Tel. Co-op. Inc., Donaldson
*Century Tel. Enterprises, Monroe, LA (34,148)
Liberty Tel. & Comm., Inc., Hardy
Liberty Tel. Co., Calico Rock
Mountain Home Tel. Co., Inc., Mountain Home
Union Tel. Co., Plain Dealing, LA
Cleveland County Tel. Co., Inc., Rison
Decatur Tel. Co., Inc., Decatur
Lavaca Tel. Exch., Lavaca
Madison County Tel. Co., Inc., Huntsville
Magazine Tel. Co., Magazine
Mountain View Tel. Co., Mountain View
Northern Arkansas Tel. Co., Flippin
Perco Tel. Co., Perryville
Prairie Grove Tel. Co., Prairie Grove
Redfield Tel. Co., Inc., Redfield
Rice Belt Tel. Co., Inc., Weiner
E. Ritter Tel. Co., Marked Tree
South Arkansas Tel. Co., Hampton
Southwest Arkansas Tel. Co-op., Inc., Texarkana
Walnut Hill Tel. Co., Lewisville
Yelcot Tel. Co., Mountain Home
Yell County Tel. Co., Inc., Danville

CALIFORNIA

Calaveras Tel. Co., Copperopolis
Calif-Pacific National Corp., Concord
Capay Valley Tel. Co., Guinda
*Citizens Utilities Co., Stamford, Conn. (63,275)
Citizens Utilities Co. of California, Redding
Dorris Tel. Co., Dorris
Ducor Tel. Co., Ducor
Evans Tel. Co., Patterson
Livingston Tel. Co., Livingston

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

CALIFORNIA (cont.)

Foresthill Tel. Co., Inc., Foresthill
Happy Valley Tel. Co., Anderson
Hornitos Tel. Co., Hornitos
Kerman Tel. Co., Kerman
Pinnacles Tel. Co, Paicines
Ponderosa Tel. Co., O'Neals
*Roseville Tel. Co., Roseville (72,473)
Sierra Tel. Co., Inc., Oakhurst
Mariposa County Tel. Co., Inc., Oakhurst
Siskiyou Tel. Co., The, Fort Jones
Volcano Tel. Co., The, Pine Grove

COLORADO

Agate Mutual Tel. Co., Agate
Big Sandy Tel. Co., Simla
Bijou Tel. Co-op., Byers
Blanca Tel. System, Blanca
Columbine Tel. Co., Billings, MT
*Delta County Tel. Co, Paonia (8,017)
Eagle Valley Tel. Co., The, Eagle
*Eastern Slope Rural Tel. Assn. Inc., Hugo (5,345)
El Paso County Tel. Co., El Paso
Farmers Mutual Tel. Co., Pleasant View
Nucla-Naturita Tel. Co., Nucla
Nunn Tel. Co., Nunn
Peetz Co-op. Tel., Peetz
Phillips County Tel. Co., Holyoke
Pine Drive Tel. Co., Beulah
Pioneer Tel. Assn., Inc., Ulysses, KS
Plains Cooperative Tel. Assn., Inc., Joes
Rico Tel. Co., Rico
Roggen Tel. Co-op. Co., Roggen
Rye Tel. Co., Inc., Colorado City
S&T Tel. Co-op. Assn., Brewster, KS
Stoneham Co-op. Tel. Co., Stoneham
Strasburg Tel. Co., Strasburg
Sunflower Tel. Co., Inc., Dodge City, KS
Union Tel. Co., Mountainview, WY
Universal Tel. Inc., Milwaukee, WI
Universal Tel. Co. of Colorado, Pagosa Springs
Valley Tel. Co., Baggs, WY
Wiggins Tel. Assn., Wiggins
Willard Tel. Co., Willard

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CONNECTICUT

*The Woodbury Tel. Co., Woodbury (20,684)

DELAWARE

No "other" independents

FLORIDA

*Gulf Tel. Co., Perry (8,602)
Florala Tel. Co., Florala, Al.
Indiantown Tel. Co., Indiantown
Northeast Florida Tel. Co., Inc., MacClenny
*St. Joseph Tel. & Telegraph Co., Port St. Joe (26,101)
Southland Tel. Co., Atmore, AL

GEORGIA

Alma Tel. Co., Inc., Alma
Blue Ridge Tel. Co., Blue Ridge
Brantley Tel. Co., Nahunta
Bulloch Tel. Co-op. Inc., Statesboro
Camden Tel. & Telegraph Co., Inc., St. Mary's
Chickamauga Tel. Corp., Chickamauga
Citizens Tel. Co., Inc., Leslie
*Coastal Utilities, Inc., Hinesville (17,782)
Darien Tel. Co., Darien
Ellijay Tel. Co., Ellijay
Fairmount Tel. Co., Inc., Fairmount
Georgia Tel. Corp., Blakely
Glenwood Tel. Co., Glenwood
Hart County Tel. Co., Hartwell
Hawkinsville Tel. Co., Hawkinsville
Interstate Tel. Co., West Point
Valley Tel. Co., Inc., West Point
Nelson-Ball Ground Tel. Co, Nelson
Pembroke Tel. Co., Inc., Pembroke
Pineland Tel. Co-op. Inc., Metter
Planters Rural Tel. Co-op. Inc, Newington
Plant Tel. & Power Co., Inc., Tifton
Progressive Rural Tel. Co-op., Rentz
Public Service Tel. Co., Reynolds

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GEORGIA (cont.)

Ringgold Tel. Co., Ringgold
St. Joseph Tel. And Telegraph Co., Port St. Joe, FL
*Standard Tel. Co., Cornelia (37,956)
Statesboro Tel. Co., Statesboro
Trenton Tel. Co., Trenton
Utelwico Inc., The, Talbotton
Walker County Tel. Co., LaFayette
Waverly Hall Tel. Co., Waverly Hall
Wilkes Tel. & Electric Co., Washington
Wilkinson County Tel. Co., Irwinton

HAWAII

No "other" independents

IDAHO

Albion Tel. Co., Inc., Albion
Cambridge Tel. Co., Inc., Cambridge
Custer Tel. Co-op., Challis
Farmers Mutual Tel. Co., Fruitland
Filer Mutual Tel. Co., Filer
Inland Tel. Co., Uniontown, WA
*Century Tel. Enterprises, Inc., Monroe, LA (5,525)
    Lemhi Tel. Co., Salmon
Midvale Tel. Exch., Midvale
Mud Lake Tel. Co-op. Assn., Dubois
Potlatch Tel. Co., Kendrick
*Project Mutual Tel. Co-op. Assn., Inc., Rupert (11,556)
Rockland Tel. Co., Rockland
Rural Tel. Co., Three Creek
Silver Star Tel. Co., Inc., Freedom, WY
Telephone and Data Systems, Inc., Chicago, IL
    Troy Tel. Co., Inc., Troy
Telephone Utilities, Ilwaco, WA
    Gem State Utilities Corp., Grandview

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ILLINOIS

Adams Tel. Co-op., Golden
Alhambra-Grantfork Tel. Co., Alhambra
Bergen Tel. Co., Sharon, WI
Cambridge Tel. Co., Geneseo
Cass Tel. Co., Virginia
Chandlerville Tel. Co., Chandlerville
C-R Tel. Co., Ransom
Clarksville Mutual Tel. Co., Clarksville
Crossville Tel. Co., Crossville
Depue Tel. Co., Depue
Egyptian Tel. Co-op. Assn., Steeleville
El Paso Tel. Co., El Paso
Equality Tel. Co., Inc., Equality
Flat Rock Mutual Tel. Co., Flat Rock
Geneseo Tel. Co., Geneseo
Glasford Tel. Co., Glasford
Grafton Tel. Co., Grafton
Grandview Mutual Tel., Grandview
Gridley Tel. Co., Gridley
Hamilton County Tel. Co-op., Dahlgren
Hardin County Tel. Co., Rosiclare
*Harrisonville Tel. Co., Waterloo (17,990)
Henry County Tel. Co., Geneseo
Home Tel. Co., St. Jacob
*Illinois Consolidated Tel. Co., Mattoon (126,468)
Inland Tel. Co., Champaign
Kinsman Mutual Tel. Co., Kinsman
LaHarpe Tel. Co., Inc., LaHarpe
Lakeside Tel. Co., Champaign
Leaf River Valley Tel. Co., Leaf River
Leonore Mutual Tel. Co., Leonore
McDonough Tel. Co-op., Colchester
McNabb Tel. Co., McNabb
Madison Tel. Co., Hamel
Marseilles Tel. Co., Marseilles
Metamora Tel. Co., Metamora
Mid Century Tel. Co-op., Inc., Canton
Midland Tel. Co., Champaign
Montrose Mutual Tel. Co. Inc., Dietrich
Moultrie Independent Tel. Co., Lovington
Mt. Pulaski Tel. & Electric Co., Lincoln
New Windsor Tel. Co., New Windsor
Odin Tel. Exch., Odin

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ILLINOIS (cont.)

Oneida Tel. Exch., Oneida
Orion Tel. Exch., Orion
Prairie Tel. Co., Champaign
Reynolds Tel. Co., Inc., Reynolds
Schuyler Tel. Co., Rushville
Sharon Tel. Co., Sharon, WI
Timewell Tel. Exch., Timewell
Tonica Tel. Co., Tonica
Viola Home Tel. Co., Viola
Wabash Tel. Co-op., Inc., Louisville
Woodhull Community Tel. Co., Woodhull
Yates City Tel. Co., Yates City

INDIANA

Bloomingdale Home Tel. Co., Inc., Bloomingdale
Camden Tel. Co., Inc., Camden
Century Tel. Enterprises, Inc., Monroe, LA
    Central Indiana Tel. Co., Inc., Battle Ground
    Elberfeld Tel. Co., Inc., Elberfeld
Citizens Tel. Co., Inc., Fairmount
Citizens Tel. Corp., Warren
Clay City Rural Tel. Co-op. Inc., Cloverdale
Craigville Tel. Corp., Craigville
Daviess-Martin City Rural Tel. Corp., Montgomery
Greetingsville Tel. Co., Inc., Frankfort
Hancock Rural Tel. Corp., Maxwell
Ligonier Tel. Co., Inc., Ligonier
Merchants & Farmers Tel. Co., Hillsboro
Monon Tel. Co., Inc., Monon
Mulberry Co-op. Tel. Co., Inc., Mulberry
New Lisbon Tel. Co., Inc., New Lisbon
New Paris Tel. Inc., New Paris
Northwestern Indiana Tel. Co., Inc., Hebron
Odin & Madison Township Tel. Co., Odin
Perry Spencer Rural Tel. Co-op. Inc., Tell City
Poseyville Tel. Co., Inc., Poseyville
*Princeton Tel. Co., Princeton (21,821)
Pulaski-White Rural Tel. Co-op. Inc., Star City
Rochester Tel. Co., Inc., Rochester
S & W Tel. Co., Inc., Sanborn
*Smithville Tel. Co., Inc., Ellettsville (27,598)
Southeast Indiana Rural Tel. Co-op., Inc., Dillsboro
Sulphur Springs Tel. Co., Sulphur Springs
Sunman Tel. Co., Inc., Sunman

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

Swayzee Tel. Co., Swayzee
Sweetser Tel. Co., Inc., Sweetser
Telephone & Data Systems, Chicago, IL
    Communication Corp. of Indiana, Roachdale
    Elnora Tel. Co., Inc., Elnora
    Home Tel. Co. of Pittsboro, Inc., The, Pittsboro
    Home Tel. Co., Inc., Waldron
Thorntown Tel. Co., Inc., Thorntown
Tipton Tel. Co., Inc,. Tipton
Tri-City Tel. Co., Inc., Wadesville
Wabash Mutual Tel. Co., Celina, OH
Wadesville Tel. Co., Inc., Wadesville
Washington City Rural Tel. Co-op., Inc., Pekin
West Point Tel. Co., Inc., West Point
Yeoman Tel. Co., Yeoman

IOWA

Ace Tel. Assn., Houston, MN
Amana Society Service Co., Amana
Andrew Tel. Co., Andrew
Arcadia Tel. Co-op., Arcadia
Atkins Co-op. Tel. Co., Atkins
Ayrshire Tel. Co., Ayrshire
Baldwin-Nashville Tel. Co., Baldwin
Barnes City Co-op. Tel. Co., Barnes City
Bernard Tel. Co., Inc., Bernard
Breda Tel. Corp., Breda
    Prairie Tel. Co., Inc., Breda
Brooklyn Mutual Tel. Co., Brooklyn
Burt Tel. Co., Burt
Butler-Bremer Tel. Co., Plainfield
Cascade Tel. Co., Cascade
Casey Mutual Tel. Co., Casey
Center Junction Independent Tel. Co., Center Junction
Central Scott Tel. Co., Eldridge
Chester Tel. Co., Chester
Citizens Mutual Tel. Co., The, Bloomfield
Clarence Tel. Co., Inc., Clarence
*Clear Lake Independent Tel. Co., Clear Lake (10,362)
    Ventura Tel. Co., Inc., Ventura
C-M-L Co-op. Tel. Assn., Meriden
Colo Tel. Co., Colo
Coon Creek Tel. Co., Blairstown

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

Coon Valley Co-op. Tel. Assn., Inc., Menlo
Coop. Tel. Co., Victor
Coop. Tel. Exchange of Stanhope and Kamrar, Inc., Stanhope
Corn Belt Tel. Co., Wall Lake
Cumberland Tel. Co., Cumberland
Danville Mutual Tel. Co., Danville
Deep River Mutual Tel. Co., Deep River
Defiance Tel. Co., Defiance
Dixon Tel. Co., Dixon
Dumont Tel. Co., Dumont
Dunkerton Mutual Tel. Co., Dunkerton
Earling Mutual Tel. Co., Earling
East Buchanan Tel. Co-op., Winthrop
Ellsworth Co-op. Tel. Assn., Ellsworth
Farmers' & Business Men's Tel. Co., Wheatland
Farmers Co-op. Tel. Co., Dysart
Farmers and Merchants Mutual Tel. Co., Wayland
Farmers Mutual Co-op. Tel. Co., Harlan
Farmers Mutual Co-op. Tel. Co., Inc., Moulton
Farmers Mutual Tel. Co., Jesup
Farmers Mutual Tel. Co., Nora Springs
Farmers Tel. Co., Riceville
Farmers Mutual Tel. Co., Shellsburg
Farmers Mutual Tel. Co., Stanton
Farmers Tel. Co., Batavia
Farmers Tel. Co., Essex
Fenton Co-op. Tel. Co., Fenton
Ft. Atkinson Tel. Co., Ft. Atkinson
Gilman Tel. Co., Gilman
Goldfield Tel. Co., Goldfield
Graettinger Co-op. Tel. Assn., Graettinger
Grand Mound Co-op. Tel. Assn., Grand Mound
Grand River Mutual Tel. Co., Grand River
*Grand River Mutual Tel. Corp., Princeton, MO (8,424)
Griswold Co-op. Tel. Co., Griswold
Hawkeye Tel. Co., Hawkeye
Heart of Iowa Tel. Co-op., Union
Hills Tel. Co., Inc., Hills, MN
Hospers Tel. Exch. Inc., Hospers
Hubbard Co-op. Tel. Assn., Hubbard
Huxley Co-op. Tel. Co., Huxley
Iamo Tel. Co., Coin
Interstate "35" Tel. Co., Truro
Southwest Tel. Exchange, Inc., Emerson

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Jefferson Tel. Co., Jefferson
Jordan Soldier Valley Tel. Co-op., Soldier
Kalona Co-op. Tel. Co.,Inc., Kalona
Kellogg Co-op. Tel. Assn., Kellogg
Keystone Farmers Co-op. Tel. Co., Keystone
Lake Mills Tel. Co., Lake Mills
La Porte City Farmers Mutual Tel. Co., La Porte City
Laurel Tel. Co., Laurel
Lehigh Valley Co-op. Tel. Assn., Lehigh
Lone Rock Co-op. Tel. Co., Lone Rock
Lost Nation-Elwood Tel. Co., Lost Nation
Lynnville Community Tel. Co., Inc., Lynnville
McCausland Co-op. Tel. Assn., McCausland
Mabel Co-op. Tel. Co., Mabel, MN
Manilla Tel. Co., Manilla
Marne & Elk Horn Tel. Co., Elk Horn
Martelle Co-op. Tel. Assn., Martelle
Massena Tel. Co., Massena
Mechanicsville Tel. Co., Mechanicsville
Miles Co-op. Tel. Assn., Miles
Miller Tel. Co., Miller
Minburn Tel. Co., Minburn
Minerva Valley Tel. Co., Inc., Zearing
Modern Co-op. Tel. Co., South English-Webster
Montezuma Mutual Tel. Co., Montezuma
Morley Tel. Co., Inc., Morley
Mutual Tel. Co. of Mediapolis, Mediapolis
Mutual Tel. Co. of Morning Sun, Morning Sun
Northeast Iowa Tel. Co,. Monona
North English Co-op. Tel. Co., North English
Northern Iowa Tel. Co., Sioux Center
Mutual Tel. Co., Sioux Center
Northwest Iowa Tel. Co., Sergeant Bluff
Northwest Tel. Co-op. Assn., Havelock
Norway Rural Tel. Co., Kanawha
Ogden Tel. Co., Ogden
Olin Tel. Co., Inc., Olin
Onslow Co-op. Tel. Assn., Onslow
Oran Mutual Tel. Co., Oran
Palmer Mutual Tel. Co., Palmer
Palo Co-op. Tel. Assn., Palo
Panora Co-op. Tel. Assn., Inc., Panora
Peoples Tel. Co., Aurelia
Postville Tel. Co., Postville

Prairieburg Tel. Co., Inc., Prairieburg
Preston Tel. Co., Preston
Radcliffe Tel. Co., Inc., Radcliffe
Readlyn Tel. Co., Readlyn
Reasnor Mutual Tel. Assn., Reasnor
Ringsted Tel. Co., Ringsted
Rockwell Co-op. Tel. Assn., Rockwell
Royal Tel. Co., Royal
Ruthven Tel. Co., Ruthven
Sac Co. Mutual Tel. Co., Odebolt
Schaller Tel. Co., Schaller
Scranton Tel. Co., Scranton
Searsboro Tel. Co., Searsboro
Sharon Tel. Co., Hills
Shell Rock Tel. Co., Shell Rock
South Slope Co-op. Tel. Co., Inc., Norway
Springville Co-op. Tel. Assn., Inc., Springville
Stratford Mutual Tel. Co., Stratford
Sully Tel. Assn., Sully
Superior Tel. Co-op., Superior
Swisher Tel. Co., Swisher
Templeton Tel. Co., Templeton
Terril Tel. Co., Terril
Titonka Tel. Co., Titonka
United Farmers Tel. Co., Everly
Van Buren Tel. Co., Keosauqua
Van Horne Co-op. Tel. Co., Van Horne
Villisaca Farmers Tel. Co., Villisca
Wallingford Tel. Co-op., Wallingford
Walnut Tel. Co., Walnut
Webb-Dickens Tel. Corp., Webb
Webster-Calhoun Co-op. Tel. Assn., Gowrie
North Central Tel. Co., Badger
Wellman Co-op. Tel. Assn., Wellman
West Branch Tel. Co., West Branch
West Iowa Tel. Co., Remsen
West Liberty Tel. Co., West Liberty
Western Iowa Tel. Assn., Lawton
Westside Independent Tel. Co.,, Westside
Wilton Tel. Co., Wilton
Winnebago Co-op. Tel. Assn., Lake Mills
Woodward Mutual Tel. Co., Woodward
Woolstock Mutual Tel. Assn., Woolstock
Wyoming Mutual Tel. Co., Wyoming

KANSAS

Assaria Tel. Exch. Inc., Assaria
Benkelman Tel. Co., Inc., Benkelman, NE
Bison Tel. Co., Inc., Bison
Blue Valley Tel. Co., Inc., Home
Columbus Tel. Co., Columbus
Council Grove Tel. Co., Council Grove
*Craw-Kan. Tel. Co-op. Assn., Inc., Girard (14,591)
Cunningham Tel. Co., Inc., Glen Elder
Diller Tel. Co., Diller, NE
Elkhart Tel. Co., Inc., Elkhart
Golden Belt Tel. Assn., Inc., Rush Center
Burdett Tel. Co., Inc., Rush Center
Gorham Tel. Co., Inc., Gorham
H & B Communications Inc., Holyrood
Hartman Tel. Exchange, Inc., Danbury, NE
Haviland Tel. Co., Inc., Haviland
Home Tel. Co., Inc., Galva
J.B.N. Tel. Co., Inc., Wetmore
Jetmore Tel. Co., Inc., Dodge City
KanOkla Tel. Assn., Inc., Anthony
Kansas State Tel. Co., Baxter Springs
LaHarpe Tel. Co., LaHarpe
Lincoln Tel. Co., Lincoln, NE
Linn Rural Tel. Co., Linn
Madison Tel. Co., Inc., Madison
Mo.-Kan. Dial Co. Inc., Louisburg
Moundridge Tel. Co., Moundridge
Mutual Tel. Co., Little River
Peoples Mutual Tel. Co., LaCygne
*Pioneer Tel. Assn., Inc., Ulysses (20,279)
Pleasanton Tel. Co., Pleasanton
Rainbow Tel. Co-op. Assn., Inc., Everest
Rural Tel. Service Co., Inc., Lenora
S & A Tel. Co., Inc., Allen-Admire
S & T Tel. Co-op. Assn., Brewster
Salemsborg Farmers Tel. Co., Smolan
South Central Tel. Assn., Inc., Medicine Lodge
Southern Kansas Tel. Co., Inc., Clearwater
Sunflower Tel. Co., Inc., Dodge City
Totah Tel. Co. Inc., Ochelata, OK
Tri-County Tel. Assn. Inc., Council Grove
Twin Valley Tel. Inc., Miltonvale
United Tel. Assn. Inc., Dodge City
Wamego Tel. Co., Inc., Wamego
Wheat State Tel. Co., Inc., Udall
Wilson Tel. Co., Inc., Wilson
Zenda Tel. Co., Inc., Zenda

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KENTUCKY

Allied Tel. Co., Little Rock, AR
    Echo Tel. Co., Inc., Shepherdsville
Ballard Rural Tel. Co-op., Corp., Inc., La Center
*Brandenburg Tel. Co., Inc., Brandenburg (21,819)
Century Tel. Enterprises, Inc., Monroe, LA
    Uniontown Tel. Co., Inc., Uniontown
Duo County Tel. Co-op. Inc., Jamestown
Foothills Rural Tel. Co-op., Corp., Inc., Staffordsville
Harold Tel. Co., Inc., Harold
Highland Tel. Co-op. Inc., Sunbright, TN
Leslie County Tel. Co., Inc., Hyden
Lewisport Tel. Co., Inc., Lewisport
Logan Tel. Co-op. Inc., Auburn
Mountain Rural Tel. Co-op., Corp., Inc., West Liberty
North Central Tel. Co-op. Inc., Lafayette, TN
Peoples Rural Tel. Co-op., Corp., Inc., McKee
Salem Tel. Co., Salem
*So. Cent. Rural Tel. Co-op., Inc., Glasgow (25,211)
Thacker-Grigsby Tel. Co., Inc., Hindman
West Kentucky Rural Tel. Co-op., Corp., Inc., Mayfield

LOUISIANA

C.A.I.L. Enterprises, Baton Rouge
    Star Tel. Co., Inc., Maringouin
Cameron Tel. Co., Sulphur
Campti-Pleasant Hill Tel. Co., Pleasant Hill
*Century Tel. Enterprises Inc., Monroe (100,465)
    Athens Tel. Co., Inc., Athens
    Caddoan Tel. Co., Plain Dealing
    Central Louisiana Tel. Co., Inc., Jena
    Century Tel. Co., Inc., Greensburg
    Coastal Tel. & Electronics Corp., Breaux Bridge
    Evangeline Tel. Co., Welsh
    Louisiana Western Tel. Co., Welsh
    Northwest Louisiana Tel. Co., Inc., Cotton Valley
    Plain Dealing Tel. Co., Inc., Plain Dealing
    Union Tel. Co., Plain Dealing
    United Tel. Co. of Louisiana, Inc., Marion
Chatham Tel. Co., Chatham
    Elizabeth Tel. Co., Inc., Elizabeth
Data Comm., Inc.
    Offshore Tel. Co., New Orleans
Delcambre Tel. Co., Inc., Delcambre

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LOUISIANA (cont.)

Delcambre Tel. Co., Inc., Delcambre
*East Ascension Tel. Co., Inc., Gonzales (22,891)
Kaplan Tel. Co., Kaplan
Lafourche Tel. Co., Inc., Larose
Northeast Louisiana, Tel. Co., Inc., Collinston
Reserve Tel. Co., Reserve
Ringgold Tel. Co., Inc., Ringgold

MAINE

Bryant Pond Tel. Co., Bryant Pond
China Tel. Co., South China
Cobbosseecontee Tel. Co., West Gardiner
*Community Service Tel. Co., Winthrop (9,268)
Hampden Tel. Co., Hampden
Island Tel. Co., The, Frenchboro
Lincolnville Tel. Co., Lincolnville
Oxford Co. Tel. & Telegraph Co., Buckfield
Pine Tree Tel. & Telegraph Co., The, Gray
Saco River Tel. & Telegraph Co., Bar Mills
Standish Tel. Co., Standish
*Telephone and Data Systems, Inc., Chicago, Ill. (15,141)
    Hartland & St. Albans Tel. Co., Hartland
    Somerset Tel. Co., North Anson
    Warren Tel. Co., Warren
    West Penobscot Tel. & Telegraph Co., Corinna
Union River Tel. Co., Aurora
Unity Tel. Co., Unity

MARYLAND**

*Armstrong Utilities, Inc., Butler, PA (4,811)
    Armstrong Tel. Co., Rising Sun

MASSACHUSETTS

Elizabeth Islands Tel. Co., Naushon Islands
*Granby Tel. & Telegraph Co., Granby (2,796)
*Richmond Tel. Co., Richmond (1,028)
Taconic Tel. Corp., Chatham, NY

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** Does not include Washington, D.C. (see end of list).

MICHIGAN

Alba Tel. Co., Pigeon
Allendale Tel. Co., Allendale
Banfield Tel. Co., Banfield
Baraga Tel. Co., Baraga
Barry County Tel. Co., Delton
Blanchard Tel. Assn., Blanchard
Bloomingdale Tel. Co., Bloomingdale
Carr Tel. Co., Branch
*CC&S Systems Inc., Brooklyn (20,770)
    Camden Tel. Co., Camden
    Southern Tel. Co., Brooklyn
*Century Tel. Enterprises, Inc., Chesaning (26,487)
    Au Gres Tel. Co., Chesaning
    Central Tel. Co., Chesaning
    Hadley Tel. Co., Hadley
Chatham Tel. Co., Chatham
Chippewa County Tel. Co., Inc., Brimley
Climax Tel. Co., Climax
Concord Tel. Co., Inc., Concord
Deerfield Farmers Tel. Co., Deerfield
Drenthe Tel. Co., Zeeland
Drummond Island Tel. Co., Carney
Farmers Mutual Tel. Co. of Chapin, Elsie
Island Tel. Co., Beaver Island
Kaleva Tel. Co., Kaleva
Kingsley Tel. Co., Kingsley
Lennon Tel. Co., Lennon
Midway Tel. Co., Watton
Munising Tel. Co., Munising
National Communications Systems, Inc., Chesaning
    Mesick Tel. Co., Mesick
    Northern Tel. Co., Mesick
Ogden Mutual Tel. Co., Blissfield
Ontonagon County Tel. Co., Ontonagon
Peninsula Tel. Co., Old Mission
Pigeon Tel. Co., Pigeon
Sand Creek Tel. Co., Sand Creek
Shiawasee Tel. Co., Perry
Springport Tel. Co., Springport
Telephone & Data Systems, Inc., Chicago, IL
    Augusta Tel. Co., Augusta
    Clayton Tel. Co., Clayton
    Hickory Tel. Co., Augusta
Twining Tel. Co., Twining

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MICHIGAN (cont.)

Upper Peninsula Tel. Co., Carney
Waldron Tel. Co., Waldron
Westphalia Tel. Co., Westphalia
Winn Tel. Co., Winn
Wolverine Tel. Co., Millington

MINNESOTA

Ace Tel. Assn., Houston
Albany Mutual Tel. Co., Albany
Arvig Tel. Co., Pequot Lakes
Barnesville Municipal Tel. Co., Barnesville
Benton Cooperative Tel. Co., Rice
Blackduck Tel. Co., Blackduck
Blue Earth Valley Tel. Co., Blue Earth
Bricelyn Mut. Tel. Co., Bricelyn
Bridgewater Tel. Co., Monticello
Callaway Tel. Co., Callaway
Cannon Valley Tel. Co., Morristown
Chester Tel. Co., Chester, IA
Clara City Tel. Co., Clara City
Clements Tel. Co., Clements
Communications Systems, Inc., Hector
    Arrowhead Communications Corp., Hector
    Eagle Valley Tel. Co., Clarissa
    Pine Island Tel. Co., Pine Island
Consolidated Tel. Co., Brainerd
Crosslake Tel. Co., Crosslake
Danube Tel. Co., Danube
Deer River Tel. Co., Deer River
Delavan Tel. Co., Delavan
Deuel Tel. Co-op. Assn., Clear Lake, SD
Dunnell Tel. Co., Inc., Dunnell
Easton Tel. Co., Easton
East Otter Tail Tel. Co., Perham
Eckles Tel. Co., New Prague
Emily Tel. System, Emily
Farmers Mutual Tel. Co., Bellingham
Federated Tel. Co-op., Chokio
Felton Tel. Exch. Inc., Felton
*Garden Valley Tel. Co., Erskine (18,178)
Gardonville Co-op. Tel. Assn., Brandon
Granada Tel. Co., Granada
Halstad Tel. Co., Halstad

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

Hancock Tel. Co., Hancock
Harmony Tel. Co., Harmony
Hohman Tel. Co., Pelican Rapids
    Lake Region Tel. Co., Pelican Rapids
    Pelican Tel. Co., Pelican Rapids
Home Tel. Co., Grand Meadow
Hutchinson Tel. Co., Hutchinson
Johnson Tel. Co., Remer
Kasson & Mantorville Tel. Co., Kasson
K M P Tel. Co., Kerkhoven
Lakedale Tel. Co., Annandale
Larson Utilities, Inc., Franklin
    Minnesota Valley Tel. Co., Franklin
Lismore Co-op. Tel. Co., Lismore
Lonsdale Tel. Co., Lonsdale
Lowry Tel. Co. Inc., Lowry
Mabel Co-op. Tel. Co., Mabel
Madelia Tel. Co., Madelia
Manchester-Hartland Tel. Co., Manchester
*Mankato Citizens Tel. Co., Mankato (46,255)
    Mid-Commun. Inc., Mankato
Mazeppa Tel. Co., Mazeppa
Melrose Tel. Co., Melrose
Midwest Tel. Co., Parkers Prairie
Minnesota Lake Tel. Co., Minnesota Lake
New Ulm Rural Tel. Co., New Ulm
Northern Tel. Co., Wawina
Northland Tel. Co. Inc., Hill City
Ollig Utilities Co., Inc., Ada
    Hills Tel. Co., Inc., Hills
    Norman County Tel. Co., Ada
    Sioux Valley Tel. Co., Dell Rapids, SD
    Sleepy Eye Tel. Co., Sleepy Eye
Osakis Tel. Co., Osakis
Park Region Mutual Tel. Co., Underwood
Paul Bunyan Rural Tel. Co-op., Bemidji
Peoples Tel. Co., Big Fork
Polar Rural Tel. Corp., Park River, ND
Red River Rural Tel. Assn., Abercrombie, ND
Redwood County Tel. Co., Redwood Falls
Rock Dell Tel. Co., Kasson
Rothsay Tel. Co., Inc., Rothsay
Runestone Tel. Assn., Hoffman
Sacred Heart Tel. Co., Clara City
    Starbuck Tel. Co., Clara City
Scott-Rice Tel. Co., Prior Lake

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MINNESOTA (cont.)

Sherburne County Rural Tel. Co., Big Lake
Splitrock Tel. Co-op, Inc., Garretson, SD
Spring Grove Co-op. Tel. Co., Spring Grove
Telephone and Data Systems, Inc., Madison, WI
    Mid-State Tel. Co., Spicer
Twin Valley Ulen Tel. Co., Twin Valley
Universal Tel. Inc., Milwaukee, WI
    Solon Springs Tel. Co. Inc., Minong, WI
Upsala Co-op. Tel. Co., Upsala
Valley Tel. Co., Browns Valley
West Central Tel. Assn., Sebeka
Western Tel. Co., Springfield
Wikstrom Tel. Co. Inc., Karlstad
Winnebago Co-op. Tel. Assn., Lake Mills, IA
Winsted Tel. Co., Winsted
Winthrop Tel. Co., Winthrop
Wolverton Tel. Co., Wolverton
Woodstock Tel. Co., Ruthton
Wykoff Tel. Co., Grand Meadow
Zumbrota Tel. Co., Zumbrota

MISSISSIPPI

Ackerman Tel. Co., Inc., Ackerman
Bruce Tel. Co., Bruce
*Century Tel. Enterprises, Inc., Marion, LA (10,822)
    Home Tel. Co., Olive Branch
    Mississippi Tel. & Communications, Inc., Mound Bayou
    Myrtle Tel. Co., Inc., Myrtle
Decatur Tel. Co., Decatur
Delta Tel. Co., Inc., Louise
Franklin Tel. Co., Inc., Meadville
Fulton Tel. Co., Inc., Fulton
Georgetown Tel. Co., Georgetown
Glen Allan Tel. Co., Glen Allan
Hughes Tel. Co., Inc., Bailey
Mid-South Tel. Co., Inc., Guntown
Mississippi Tel. Corp., Leakesville
Sherwood Tel. Co., Merigold
Sledge Tel. Co., Sunflower
Smithville Tel. Co., Inc., Smithville
Telephone and Data Systems, Inc., Chicago, IL
    Calhoun City Tel. Co., Inc., Calhoun City
*Telephone Electronics Corp., Bay Springs (11,902)
    Bay Springs Tel. Co., Inc., Bay Springs
    Noxapater Tel. Co., Inc., Noxapater

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MISSOURI

*Allied Tel. Co., Little Rock, Ark. (34,249)
Allied Tel. Co. of Mo., Inc., Dixon
Doniphan Tel. Co., Doniphan
Alma Tel. Co., Alma
Century Tel. Enterprises, Inc., Hardy, AR
Carter County Tel. Co., Van Buren
Holway Tel. Co., Maitland
Webster County Tel. Co., Marshfield
Chariton Valley Tel. Corp., Bucklin
Choctaw Tel. Co., Halltown
Citizens Tel. Co., Higginsville
Craw-Kan Tel. Co-op. Assn., Inc., Girard, KS
Eastern Missouri Tel. Co., Bowling Green
Ellington Tel. Co., Ellington
F & M Tel. Co., Farber
Fidelity Tel. Co., Sullivan
Bourbeuse Tel. Co., Sullivan
Goodman Tel. Co., Goodman
Granby Tel. Co., Granby
Grand River Mutual Tel. Corp., Princeton
Green Hills Tel. Corp., Breckenridge
Iamo Tel. Co., Coin, IA
K L M Tel. Co., Rich Hill
Kingdom Tel. Co., Auxvasse
Lathrop Tel. Co., Lathrop
Le-Ru Tel. Co., Stella
Mark Twain Rural Tel. Co., Hurdland
McDonald County Tel. Co., Pineville
Mid-Missouri Tel. Co., Pilot Grove
Miller Tel. Co., Inc., Miller
*Missouri Tel. Co., Columbia (21,380)
Mo-Kan Dial Co., Inc., Louisburg, KS
New Florence Tel. Co., Inc., New Florence
New London Tel. Co., New London
Northeast Missouri Rural Tel. Co., Green City
Orchard Farm Tel. Co., Orchard Farm
Oregon Farmers Mutual Tel. Co., Oregon
Peace Valley Tel. Co., Peace Valley
Rock Port Tel. Co., Rock Port
Seneca Tel. Co., Seneca
Steelville Tel., Exch. Inc., Steelville
Stoutland Tel. Co., Stoutland
Wheeling Tel. Co., Wheeling

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MONTANA

Big Pine Rural Tel. Co., Great Falls
Blackfoot Tel. Co-op. Inc., Missoula
Century Tel. Enterprises, Inc., Monroe, LA
Lemhi Tel. Co., Salmon
Hot Springs Tel. Co., Hot Springs
InterBel Tel. Co-op. Inc., Eureka
Intermountain Tel. & Power Co., Billings
Lincoln Tel. Co., Lincoln
Mid-Rivers Tel. Co-op. Inc., Circle
Nemont Tel. Co-op., Inc., Scobey
Northern Tel. Co-op., Inc., Sunburst
Project Tel. Co., Inc., Worden
Range Tel. Co-op. Inc., Forsyth
Ronan Tel. System, Ronan
Southern Montana Tel. Co., Wisdom
*Telephone Utilities, Inc., Portland, OR (43,149)
Northwestern Tel. Systems, Inc., Kalispell
Three Rivers Tel. Co-op. Inc., Fairfield
*Triangle Tel. Co-op. Assn., Inc., Havre (12,449)
Valley Rural Tel. Co-op. Assn., Inc., Glasgow

NEBRASKA

Arapahoe Tel. Co., Arapahoe
Arthur Non-Stock Cooperative Tel. Assn., Arthur
Benkelman Tel. Co., Inc., Benkelman
Wauneta Tel. Co., Wauneta
Bingham Tel. Co., Bingham
Cambridge Tel. Co., Cambridge
Central Tel. and Utility Corp., Lincoln
Chrisp's Tel. Co., Paxton
Clarks Tel. Co., Clarks
Consolidated Tel. Co., Lincoln
Cozad Tel. Co., Cozad
Craig Tel. Co., Craig
Curtis Tel. Co., Curtis
Dalton Tel. Co., Dalton
Diller Tel. Co., Diller
Elsie Mutual Tel. Co., Elsie
Eustis Tel. Exch., Inc., Eustis
Extension Tel. Co., White Clay
Funk Tel. Co., Inc., Funk
Glenwood Tel. Membership Corp., Blue Hill
Hamilton Tel. Co., Aurora

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NEBRASKA (cont.)

Hartington Tel. Co., Hartington
Hartman Tel. Exch., Inc., Danbury
Hemingford Co-op. Tel. Co., Hemingford
Henderson Tel. Co., Henderson
Hershey Co-op. Tel. Co., Hershey
Home Tel. Co., of Nebraska, Brady
Hooper Tel. Co., Hooper
HunTel Systems, Inc., Blair
    Arlington Tel. Co., Blair
    Blair Tel. Co., Blair
    Eastern Nebraska Tel. Co., Blair
    Rock County Tel. Co., Blair
K & M Tel. Co., Inc., Chambers
Keystone-Arthur Tel. Co., Keystone
*Lincoln Tel. & Telegraph Co., The, Lincoln (330,568)
Nebraska Central Tel. Co., Gibbon
Northeast Nebraska Tel. Co., Jackson
Panhandle Tel. Co., Dix
Petersburg Tel. Co., Petersburg
Pierce Tel. Co., Inc., Pierce
Plainview Tel. Co., Inc., Plainview
Rodeo Tel., Inc., Burwell
Sodtown Tel. Co., Ravenna
Southeast Nebraska Tel. Co., Falls City
Stanton Independent Tel. Co.,Stanton
*UniTel of Nebraska, Blair (21,296)
    Central Nebraska Tel. Co., Blair
    Nebraska Tel. Co., Blair
    Northeastern Tel. Co., Blair
    Northern Tel. Co., Blair
    Union Tel. Co., Blair

NEVADA

*Calif-Pacific National Corp., Concord, CA (12,924)
*County of Churchill, State of Nevada (9,862)
    Churchill Co. Tel. & Telegraph System, Fallon
Filer Mutual Tel. Co., Filer, ID
Lincoln County Tel. Sys., Inc., Pioche
Moapa Valley Tel. Co., Overton
Nevada Tel. & Telegraph Co., Tonapah
Rio Virgin Tel. Co., Mesquite
Telephone Utilities, Ilwaco, WA
    Gem State Utilities Corp., Grand View, ID

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NEW HAMPSHIRE

Chichester Tel. Co., Chichester
Dixville Tel. Co., Dixville Notch
Dunbarton Tel. Co., Dunbarton
Granite State Tel. Co., South Weare
*Merrimack County Tel. Co., Contoocook (6,612)
Mountain Management Development Co., Bretton Woods
    Bretton Woods Tel. Co., Bretton Woods
*Telephone & Data Systems, Inc., Chicago, IL (6,678)
    Kearsarge Tel. Co., New London
    Meriden Tel. Co., Meriden
Union Tel. Co., Farmington
Wilton Tel. Co., Wilton

NEW JERSEY

*Warwick Valley Tel. Co., Warwick, NY (6,856)

NEW MEXICO

Baca Valley Tel. Co., Inc., Des Moines
Corona Tel. Co., Corona
Dell Tel. Co-op., Inc., Dell City, TX
*E.N.M.R. Tel. Co-op., Clovis (4,849)
*Great Southwest Tel. Corp., Grandview, TX (5,345)
    Navajo Communications Co., Inc., Window Rock, AZ
La Jicarita Rural Tel. Co-op. Assn., Mora
Leaco Rural Co-op., Inc., Lovington
Maxwell Tel. Exch., Maxwell
Panhandle Tel. Co-op., Inc., Guymon, OK
Penasco Valley Tel. Co-op., Inc., Artesia
Roosevelt County Rural Tel. Co-op., Inc., Portales
Universal Tel. Inc., Milwaukee, WI
    Universal Tel. Co. of Southwest -- Pecos Dist.
    Universal Tel. Co. of Southwest -- Zuni Dist.
Valley Tel. Corp. Inc., Willcox, AZ
Western New Mexico Tel. Co., Cliff
West Texas Rural Tel. Co-op., Hereford, TX

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NEW YORK

*Armstrong Utilities, Inc., Butler, PA
Addison Home Tel. Co., Addison
AuSable Valley Tel. Co., Inc., Keeseville
Berkshire Tel. Corp., Kinderhook-Valatie
Cassadaga Tel. Corp., Fredonia
Champlain Tel. Co., Champlain
Chautauqua & Erie Tel. Corp., Westfield
Chazy & Westport Tel. Corp., Westport
Citizens Tel. Co., Hammond
Crown Point Tel. Corp., Crown Point
Delhi Tel. Co., Delhi
Deposit Tel. Co., Inc., Deposit
Dunkirk & Fredonia Tel. Co., Fredonia
Empire Tel. Corp., Prattsburg
Fishers Island Tel. Corp., Fishers Island
Germantown Tel. Co., Inc., Germantown
Hancock Tel. Co., Hancock
Macomb Tel. Co., Macomb
Margaretville Tel. Co., Inc., Margaretville
Middleburgh Tel. Co., Middleburgh
Newport Tel. Co., Inc., Newport
Nicholville Tel. Co., Inc., Nicholville
Ogden Tel. Co., Spencerport
Oneida County Rural Tel. Co., Holland Patent
Oriskany Falls Tel. Corp., Oriskany Falls
Pattersonville Tel. Co., Rotterdam Junction
Port Byron Tel. Co., Port Byron
*Rochester Tel. Corp., Rochester (621,939)
Highland Tel. Co., Monroe
Sylvan Lake Tel. Co., Inc., Hopewell Junction
Seneca-Gorham Tel. Co-op., Holcomb
State Tel. Co., Coxsackie
Telephone and Data Systems, Inc., Chicago, IL
Edwards Tel. Co., Inc., Edwards
*Taconic Tel. Corp., Chatham (24,464)
Township Tel. Co., Chaumont
Trumansburg-Home Tel. Co., Trumansburg
Ontario Tel. Co., Inc., Phelps
Vernon Tel. Co., Inc., Vernon
Warwick Valley Tel. Co., Warwick

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NORTH CAROLINA

Atlantic Tel. Membership Corp., Shallotte
Citizens Tel. Co., Brevard
*Concord Tel. Co., Concord (93,122)
Ellerbe Tel. Co., Inc., Ellerbe
Heins Tel. Co., Inc., Sanford
Lexington Tel. Co., Lexington
Mebane Home Tel. Co., Inc., Mebane
*North State Tel. Co., High Point (110,940)
Piedmont Tel. Membership Corp., Lexington
Pineville Tel. Co., Pineville
Randolph Tel. Co., Inc., Liberty
Randolph Tel. Membership Corp., Asheboro
Saluda Mountain Tel. Co., Saluda
Skyline Tel. Membership Corp., West Jefferson
Star Tel. Membership Corp., Clinton
Surry Tel. Membership Corp., Dobson
Telephone and Data Systems, Inc., Chicago, IL
    Barnardsville Tel. Co., Barnardsville
    Service Tel. Co., Fair Bluff
Tri-County Tel. Membership Corp., Belhaven
Wilkes Tel. Membership Corp., Wilkesboro
Yadkin Valley Tel. Membership Corp., Yadkinville

NORTH DAKOTA

Absaraka Co-op. Tel. Co., Absaraka
BEK Tel. Mutual Aid Corp., Steele
Consolidated Tel. Co-op., Dickinson
Curlew Tel. Co., Glen Ullin
Dakota Central Rural Tel. Co-op. Assn., Carrington
Dickey Rural Tel. Mutual Aid Corp., Ellendale
Gilby Tel. Co., Gilby
Griggs County Tel. Co., Cooperstown
Inter-Community Tel. Co., Nome
Midstate Tel. Co., Stanley
    York Tel. Exchange, York
Moore & Liberty Tel. Co., Enderlin
Nemont Tel. Co-op. Inc., Scobey, MT
Noonan Farmers Tel. Co., Noonan
*Northern States Power Co., Tel. Dept., Minot (35,610)
Northwest Mutual Aid Tel. Corp., Ray
Polar Commun. Mut. Aid Corp., Park River
Red River Rural Tel. Assn., Abercrombie
Reservation Tel. Co-op., Parshall
*Souris River Tel. Mutual Aid Corp., Minot (22,236)
United Tel. Mutual Aid Corp., Langdon
West River Tel. Corp., Hazen
Wolverton Tel. Co., Wolverton, MN

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Arthur Mutual Tel. Co., Defiance
Ayersville Tel. Co., Defiance
Bascom Mutual Tel. Co., Bascom
Benton Ridge Tel. Co., Benton Ridge
Buckland Mutual Tel. Co., Buckland
Camden Tel. Co., Camden, MI
*Champaign Tel. Co., Urbana (12,732)
*Chillicothe Tel. Co., Chillicothe (35,533)
Columbus Grove Tel. Co., Columbus Grove
Community Tel. Co., Leipsic
Conneaut Tel. Co., Conneaut
Doylestown Tel. Co., Doylestown
Farmers Mutual Tel. Co., Okolona
Ft. Jennings Tel. Co., Ft. Jennings
Germantown Independent Tel. Co., Germantown
Glandorf Tel. Co., Inc., Glandorf
Harlan Tel. Co., Pleasant Plain
Kalida Tel. Co., Kalida
McClure Tel. Co., McClure
Middle Point Home Tel. Co., Middle Point
Minford Tel. Co., Minford-Stockdale
New Bavaria Tel. Co., New Bavaria
New Knoxville Tel. Co., New Knoxville
North Creek Mutual Tel. Co., North Creek
Nova Tel. Co., Nova
Oakwood Mutual Tel. Co., Oakwood
Orwell Tel. Co., Orwell
Ottoville Mutual Tel. Co., Ottoville
Pattersonville Tel. Co., Pattersonville
Ridgeville Tel. Co., Ridgeville Corners
Sherwood Mutual Tel. Assn., Inc., Sherwood
Sycamore Tel. Co., Sycamore
Telephone and Data Systems, Inc., Chicago, IL
    Arcadia Tel. Co., Arcadia
    Continental Tel. Co., Continental
    Fayetteville Tel. Co., Fayetteville
Tel. Service Co., Wapakoneta
Vanlue Tel. Co., Vanlue
Vaughnsville Tel. Co., Inc., Vaughnsville
Wabash Mutual Tel. Co., Wabash

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OKLAHOMA

*Allied Tel. Co., Little Rock, AR (34,795)
Allied Tel. Co. of Oklahoma, Inc., Roosevelt
Oklahoma Allied Tel. Co., Poteau
Wickes Tel. Co., Wickes, AR
Atlas Tel. Co., Big Cabin
Beggs Tel. Co., Inc., Beggs
Bixby Tel. Co., Bixby
Bromide Tel. Co., Fittstown
Canadian Valley Tel. Co., Crowder
Carnegie Tel. Co., Inc., Carnegie
Century Tel. Enterprises, Inc., Hardy, AR
Wyandotte Tel. Co., Wyandotte
Central Oklahoma Tel. Co., Davenport
Cherokee Tel. Co., Calera
Chickasaw Tel. Co., Sulfur
Chouteau Tel. Co., Chouteau
Cimarron Tel. Co., Mannford
Craw-Kan Tel. Co-op. Assn., Inc., Girard, KS
Cross Tel. Co., Warner
Dobson Tel. Co., Inc., Cheyenne
Grand Tel. Co., Jay
Hinton Tel. Co., Hinton
Hydro Tel. Co., Moore
KanOkla Tel. Assn., Inc., Anthony, KS
Lavaca Tel. Co., Inc., Lavaca, AR
McLoud Tel. Co., McLoud
Medicine Park Tel. Co., Medicine Park
Midwestern Tel. Co., Inc., Sentinel
Oklahoma Tel. & Telegraph, Inc., Dustin
Okla.-Western Tel. Co., Clayton
Panhandle Tel. Co-op., Inc., Guymon
Pine Tel. Co., Inc., Broken Bow
*Pioneer Tel. Co-op., Inc., Kingfisher (44,666)
Pottawatomie Tel. Co., Inc., Earlsboro
Salina-Spavinaw Tel. Co., Inc., Salina
Santa Rosa Tel. Co-op. Inc., Vernon, TX
Seneca Tel. Co., Seneca, MO
Shidler Tel. Co., Shidler
Sooner State Tel. Co., Oklahoma City
South Central Tel. Assn., Medicine Lodge, KS
Southwest Oklahoma Tel. Co., Duke
Sulphur Tel. Co., Inc., Sulphur
Telephone & Data Systems, Chicago, IL
Oklahoma Communication Systems, Inc., Choctaw
Terral Tel. Co., Terral
Totah Tel. Co., Inc., Ochelata
Universal Tel., Inc., Milwaukee, WI
Mid-America Tel., Inc., Stonewall
Valliant Tel. Co., Valliant

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OREGON

Beaver Creek Tel. Co., Beaver Creek
*Calif. - Pacific National Corp., Concord, CA (13,713)
Canby Tel. Assn., Canby
Cascade Utilities, Inc., Estacada
Clear Creek Mutual Tel. Co., Oregon City
Colton Tel. Co., Colton
Eagle Tel. System, Richland
Eastern Oregon Tel. Co., Pilot Rock
Gervais Tel. Co., Gervias
Halsey Tel. Co., Halsey
Helix Tel. Co., Helix
Molalla Tel. Co., Molalla
Monitor Co-op. Tel. Co., Woodburn
Monroe Tel. Co., Monroe
Mt. Angel Tel. Co., Mt. Angel
Nehalem Tel. & Telegraph Co., Nehalem
North State Tel. Co., Dufur
Oregon Tel. Corp., Mt. Vernon
Peoples Tel. Co., Lyons
Pine Tel. Systems, Halfway
Pioneer Tel. Co-op., Philomath
St. Paul Co-op. Tel. Assn., St. Paul
Scio Mutual Tel. Assn., Scio
Stayton Co-op. Tel. Co., Stayton
Telephone & Data Systems, Inc., Chicago, IL
    Asotin Tel. Co., Asotin, WA
    Home Tel. Co., Condon
*Telephone Utilities, Inc., Portland (52,854)
    Creswell Tel. Co., Creswell
    Northwestern Tel. Systems, Inc., Lebanon
    Rose Valley Tel. Co., Lebanon
    Telephone Utilties of Eastern Oregon Inc., Spray
    Telephone Utilties of Oregon, Inc., Lebanon
Trans-Cascade Tel. Co., Antelope

PENNSYLVANIA

Beallsville Tel. Co., Beallsville
Bentleyville Tel. Co., The, Bentleyville
Breezewood Tel. Co., Breezewood
Buffalo Valley Tel. Co., Lewisburg
Canton Tel. Co., Canton

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PENNSLYVANIA (cont.)

Centerville Tel. Co., Centerville
Citizens Tel. Co. of Kecksburg, Mammoth
Citizens Utilities Co., Stamford, CT
    Big Run Tel. Co., New Bethlehem
    Citizens Utilities Co. of Pennsylvania, New Bethlehem
*Commonwealth Tel. Co., Dallas (235,805)
    Leesport Rural Tel. Co., Leesport
    Lewisberry Tel. Co., Lewisberry
    Sullivan County Tel. Co., Estella
Conestoga Tel. & Telegraph Co., Birdsboro
Coopersburg Tel. Co., Coopersburg
*Denver & Ephrata Tel. & Telegraph Co., Ephrata (52,506)
Deposit Tel. Co., Deposit, NY
Enterprise Tel. Co., New Holland
Hancock Tel. Co., Hancock, NY
Hickory-Woodrow Tel. Co., Hickory
Ironton Tel. Co., Ironton
Lackawaxen Tel. Co., Rowland
Lakewood Rural Tel. Co., Barnesville
Laurel Highland Tel. Co., Stahlstown
Mahoney & Mahantango Tel. Co., Herndon
Marianna & Scenery Hill Tel. Co., Marianna
Murdocksville Tel. Co., Murdocksville
North Eastern Pennsylvania Tel. Co., Forest City
North Penn Tel. Co., Mansfield
North Pittsburgh Tel. Co., Gibsonia
    Freeport Tel. & Telegraph Co., Freeport
Oswayo River Tel. Co.,Shinglehouse
Otto Tel. Co., Inc., Duke Center
Palmerton Tel. Co., Palmerton
Pennsylvania Tel. Co., Jersey Shore
Pymatuning Independent Tel. Co., Greenville
South Canaan Tel. Co., South Canaan
Telephone and Data Systems, Inc., Chicago, IL
    Sugar Valley Tel. Co., Loganton
Venus Tel. Corp., Venus
West Jersey Tel. Co., Belvidere, NJ
Yukon-Waltz Tel. Co., Yukon

RHODE ISLAND

No "other" independents

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SOUTH CAROLINA

Bluffton Tel. & Appliance Co., Inc., Bluffton
Chesnee Tel. Co., Inc., Chesnee
Chester Tel. Co., Chester
*Farmers Tel. Co-op., Inc., Kingstree (44,410)
Fort Mill Tel. Co., Fort Mill
Hargray Tel. Co., Inc., Hilton Head Island
Heath Springs Tel. Co., Heath Springs
Home Tel. Co., Inc., Moncks Corner
Horry Tel. Co-op. Inc., Conway
Lancaster Tel. Co., Lancaster
Lockhart Power Co., Lockhart
Norway Tel. Co., Inc., Norway
Palmetto Rural Tel. Co-op., Inc., Walterboro
Piedmont Rural Tel. Co-op., Inc., Laurens
Pond Branch Tel. Co., Gilbert
Ridge Tel. Co., Inc., Ridge Spring
Ridgeway Tel. Co., Inc., Ridgeway
*Rock Hill Tel. Co., Rock Hill (45,012)
St. Matthews Tel. Co., St. Matthews
Sandhill Tel. Co-op., Inc., Jefferson
Telephone and Data Systems, Inc., Chicago, IL
    McClellanville Tel. Co., Inc., McClellanville
    St. Stephen Tel. Co., St. Stephen
    Williston Tel. Co., Williston
West Carolina Rural Tel. Co-op., Inc., Abbeville

SOUTH DAKOTA

Armour Independent Tel. Co., Armour
Baltic Co-op. Tel. Co., Baltic
Beresford Municipal Tel. Co., Beresford
Brookings Lake Tel. Co., Brookings
Cheyenne River Sioux Tribe Tel. Co., Eagle Butte
*City of Brookings Municipal Tel. Dept., Brookings (13,124)
Consolidated Tel. Co-op., Dickinson, ND
Dakota Co-op. Tel. Co., Inc., Irene
Deuel Tel. Co-op. Assn., Clear Lake
Dickey Rural Tel. Mutual Aid Corp., Ellendale, ND
*Golden West Tel. Co-op. Inc., Wall (9,612)
Great Plains Tel. Co., Keystone
Hanson County Tel. Co., Alexandria
James Valley Co-op. Tel. Co., Groton
Jefferson Tel. Co., Jefferson
Kadoka Tel. Co., Kadoka
Kennebec Tel. Co., Kennebec

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SOUTH DAKOTA (cont.)

McCook Cooperative Tel. Co., Salem
Midstate Tel. Co., Kimball
Ollig Utilities Co., Ada, MN
    Sioux Valley Tel. Co., Dell Rapids
Peoples Tel. & Telegraph Co., Hot Springs
Pettigrew Tel. Line, Oelrichs
Robert County Tel. Co-op. Assn., New Effington
Rosefield Tel. Co., Marion
Sanborn Tel. Co-op., Woonsocket
Split Rock Tel. Co-op., Inc., Garretson
Stockholm-Strandburg Tel. Co., Stockholm
Sully-Buttes Tel. Co-op., Inc., Highmore
Tri-County Mutual Tel. Co., Emery
Union Tel. Co., Hartford
Valley Tel. Co-op. Assn., Inc., Herreid
Vivian Tel. Co., Vivian
Western Tel. Co., Faulkton
West River Co-op. Tel. Co., Bison
West River Tel. Corp., Hazen, ND
Wood Community Tel. Co., Wood

TENNESSEE

Adamsville Tel. Co., Adamsville
Allied Tel. Co., Little Rock, AR
    Powell Tel. Co., Powell
Ardmore Tel. Co., Ardmore, AR
Ben Lomand Rural Tel. Co-op., Inc., McMinnville
Bledsoe Telephone Co-op., Pikeville
Century Tel. Enterprises, Inc., Monroe, LA
    Claiborne Tel. Co., Inc., New Fazewell
Crockett Tel. Co., Friendship
DeKalb Tel. Co-op., Alexandria
Englewood Tel. Co., Inc., Englewood
Highlands Tel. Co-op., Inc., Sunbright
Humphreys County Tel. Co., New Johnsville
Loretto Tel. Co., Inc., Loretto
Millington Tel. Co., Millington
North Central Tel. Co-op. Inc., Lafayette
Ooltewah-Collegedale Tel. Co., Inc., Collegedale
People's Tel. Co., Inc., Erin
Skyline Tel. Memb. Corp., West Jefferson, NC
*Telephone and Data Systems, Inc., Chicago, IL (52,593)
    Concord Tel. Exchange Inc., Concord
    Tennessee Tel. Co., Halls Crossroads

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TENNESSEE (cont.)

Tellico Tel. Co., Tellico Plains
*Twin Lakes Tel. Co-op., Gainesboro (27,628)
United Tel. Co., Inc., Chapel Hill
West Kentucky Rural Tel. Co-op., Mayfield , KY
West Tennessee Tel. Co., Bradford
Yorkville Tel. Co-op., Yorkville

TEXAS

Allenco Communications, Carlton
Allied Tel. Co., Little Rock, AR
    Nocona Tel. Co., Nocona
Big Bend Tel. Co., Alpine
Blossom Tel. Co., Inc., Blossom
Brazoria Tel. Co., Brazoria-Churchill
Brazos Tel. Co-op., Inc., Olney
Byers-Petrolia Tel. Co., Byers
Cameron Tel. Co., Sulphur, LA
Campbell Tel. Co-op., Inc., Campbell
Cap Rock Tel. Co., Inc., Spur
Century Tel. Enterprises, Inc., Monroe, LA
    Avery Tel. Co., Hooks
    Caddoan Tel. Co., Plain Dealing, LA
    Hooks Tel. Co., Inc., Hooks
    Karnack Tel. Co., Karnack
    Mustang Tel. Co., Port Arkansas,
Central Texas Tel. Co-op., Inc., Goldthwaite
Coahoma Tel. Co., Inc., Coahoma
Coleman County Tel. Co-op., Inc., Santa Anna
Colmesneil Tel. Co., Colmesneil
Colorado Valley Tel. Co-op., Inc., LaGrange
Comanche County Tel. Co., Inc., Comanche
Community Tel. Co., Inc., Windthorst
Cumby Tel. Co-op. Inc., Cumby
Dell Tel. Co-op., Inc., Dell City
Eastex Tel. Co-op., Inc., Henderson
Electra Tel. Co., Electra
E.N.M.R. Tel. Co-op., Clovis, NM
Etex Tel. Co-op., Inc., Gilmer
Five Area Tel. Co-op., Inc., Muleshoe
Ft. Bend Tel. Co., Rosenberg
Ganado Tel. Co., Inc., Ganado

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Garwood Tel. Co., Garwood
Gary Tel. Co., Gary
Great Southwest Co., Grandview
    Romain Tel. Co., Inc., Plains
    Texas Midland Tel. Co., Grandview
    Trinity Valley Tel. Co., Winnie
Guadalupe Valley Tel. Co-op., Inc., Smithsons Valley
Hill Country Tel. Co-op., Inc., Ingram
Industry Tel. Co., Industry
Kerrville Tel. Co., Kerrville
Knippa Tel. Co., Knippa
Lake Dallas Tel. Co., Inc., Lake Dallas
Lake Tel. Co., Livingston
Lakeside Tel. Co., Inc., Whitehouse
Laward Tel. Exch., Inc., Laward
Lipan Tel. Co., Lipan
Livingston Tel. Co., Livingston
*Lufkin-Conroe Communications Co., Lufkin (76,600)
Mid-Plains Rural Tel. Co-op., Inc., Tulia
Montague Tel. Co., Montague
Muenster Tel. Corp. of Texas, Muenster
    Valley View Tel. Co., Muenster
O'Donnell Tel. Co., Inc., O'Donnell
Panhandle Tel. Co-op., Inc., Guymon, OK
Peeples Tel. Co., Inc., Coolidge
Peoples Tel. Co-op., Inc., Quitman
Poka-Lambro Rural Tel. Co-op., Inc., Tahoka
Riviera Tel. Co., Inc., Riviera
Rocksprings & Nueces Canyon Tel. Co., Inc., Rocksprings
San Marcos Tel. Co., Inc., San Marcos
Santa Rosa Tel. Co-op., Inc., Vernon
South Plains Tel. Co-op., Inc., Lubbock
Southwest Arkansas Tel. Co-op., Inc., Texarkana, AR
*Sugar Land Tel. Co., Sugar Land (28,310)
    Sweeny-Old Ocean Tel. Co., Sweeny
Tatum Tel. Co., Tatum
Taylor Tel. Co-op., Inc., Merkel
    Lueders Tel. Co., Inc., Lueders
Tri-County Tel. Co., Inc., Garrison
Valley Tel. Co-op., Inc., Raymondville
Waterwood Tel. Co., Inc., Waterwood
West Texas Rural Tel. Co-op., Inc., Hereford
Wes-Tex. Tel. Co-op., Inc., Stanton
XIT Rural Tel. Co-op., Inc., Dalhart

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

UTAH

Albion Tel. Co., Inc., Albion, ID
Beehive Tel. Co., Grouse Creek
Central Utah Tel., Inc., Fairview
*Emery County Farmers Union Tel. Assn., Inc., Orangeville (4,526)
Great Southwest Tel. Corp., Grandview, TX
    Navajo Communications Co. Inc., Window Rock, AZ
Gunnison Tel. Co., Gunnison
Kamas Woodland Tel. Co., Kamas
Manti Tel. Co., Manti
South Central Utah Tel. Assn., Inc., Escalante
*Unitah Basin Tel. Assn., Inc., Roosevelt (3,154)
Union Tel. Co., Mountainview, WY
Utah-Wyoming Tel. Co., Salt Lake City

VERMONT

Franklin Tel. Co., Franklin
Shoreham Tel. Co., Shoreham
*Telephone and Data Systems, Inc., Chicago, IL (7,754)
    Ludlow Tel. Co., Ludlow
    Northfield Tel. Co., Northfield
    Perkinsville Service Corp., Perkinsville
Topsham Tel. Co., West Topsham
*Waitsfield-Fayston Tel. Co., Waitsfield (3,300)

VIRGINIA**

Buggs Island Tel. Co-op., Bracey
Burke's Garden Tel. Co., Burke's Garden
Citizens Tel. Co-op., Floyd
*Clifton Forge-Waynesboro Tel. Co., Staunton (41,291)
Deerfield Tel. Co., Deerfield
Merchants & Farmers Tel. Co., Montpelier
Mountain Grove-Williamsville Tel. Co., Williamsville
Mutual Tel. Co. of Highland, Inc., Monterey
New Hope Tel. Co., New Hope
North River Tel. Co., Dayton
Pembroke Tel. Co-op., Pembroke
Peoples Mutual Tel. Co. Inc., Gretna
Roanoke & Botetourt Tel. Co., Daleville
Scott County Tel. Co-op., Inc., Gate City

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

** Does not include Washington, D.C. (see end of list).

VIRGINIA (cont.)

*Shenandoah Tel. Co., Edinburg (19,141)
Telephone and Data Systems, Inc., Chicago, IL
Amelia Tel. Corp., Amelia
Virginia Hot Springs Tel. Co., Hot Springs

WASHINGTON

Cowiche Tel. Co., Cowiche
*Ellensburg Tel. Co., Ellensburg (21,502)
Hat Island Tel. Co., Langley
Hood Canal Tel. Co., Union
Inland Tel. Co., Uniontown
Inter-Island Tel. Co., Inc., Friday Harbor
Kalama Tel. Co., Kalama
Lewis River Tel. Co., La Center
McDaniel Tel. Co., Salkum
Mashell Tel. Co., Inc., Eatonville
Peninsula Tel. & Telegraph Co., Forks
Pioneer Tel. Co., LaCrosse
Prescott Tel. & Telegraph Co., Roslyn
St. John Tel. Co., St. John
Telephone and Data Systems, Inc., Chicago, IL
Asotin Tel. Co., Asotin
*Telephone Utilities, Inc., Portland, OR (90,887)
Telephone Utilities of Washington, Inc.
(East & West Divisions), Cheney and Gig Harbor
Tenino Tel. Co., Tenino
Toledo Tel. Co., Inc., Toledo
Western Wahkiakum County Tel. Co., Grays River
Whidbey Tel. Co., Langley
Yelm Tel. Co., Yelm

WEST VIRGINIA

*Armstrong Utilities, Inc., Butler, PA (8,500)
Armstrong Tel. Co., Hamlin
Ritchie Tel. Co., The, Harrisville
*Century Telephone Enterprises, Inc., Monroe, LA (2,318)
War Tel. Co., War
Hardy Tel. Co., Inc., Mathias
Spruce Knob Seneca Rocks Tel., Inc., Rivertown
West Side Tel. Co., Morgantown

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

Almond Tel. Co., Almond
Amery Tel. Co., Amery
Amherst Tel. Co., Amherst
Baldwin Tel. Co., Baldwin
Bayland Tel. Inc., Abrams
Belmont Tel. Co., Platteville
Bloomer Tel. Co., Bloomer
Bruce Tel. Co., Bruce
Casco Tel. Co., Casco
Cencom, Inc., Rushford, MN
    Cencom of Wisconsin, Inc., Milton
Century Telephone Enterprises, Inc., Monroe, LA
    La Crosse Tel. Corp., La Crosse
Chequamegon Tel. Co-op., Inc., Cable
Chibardun Tel. Co-op., Inc., Dallas
Citizens Tel. Co-op., Inc., New Auburn
Clear Lake Tel. Co., Clear Lake
Cochrane Co-op. Tel. Co., Cochrane
Coloma Tel. Co., Coloma
Communications Systems, Inc., Hector, MN
    Indian Head Tel. Co., Inc., Weyerhauser
Coon Valley Farmers Tel. Co., Coon Valley
Crandon Tel. Co., Crandon
Dickeyville Tel. Corp., Dickeyville
Fair Water-Brandon-Alto Tel. Co., Brandon
Farmers Independent Tel. Co., Grantsburg
Farmers Tel. Co., Lancaster
Footville Tel. Co., Footville
Hager City Tel. Co., Hager City
Hillsboro Tel. Co., Hillsboro
Lakefield Tel. Co., Newton
Lakeshore Tel. Co., Cecil
LaValle Tel. Co-op., LaValle
Lemonweir Valley Tel. Co., Camp Douglas
Luck Tel. Co., Luck
Madeline Island Tel. Co., LaPointe
Manawa Tel. Co., Inc., Manawa
Maple Tel. Co-op., Inc., Maple
Marquette-Adams Tel. Co-op., Inc., Oxford
Mid-Plains Tel., Inc., Middleton
Milltown Mutual Tel. Co., Milltown
Mondovi Tel. Co., Mondovi
Mosinee Tel. Co., The, Mosinee
Mt. Horeb Tel. Co., Mt. Horeb
Nelson Tel. Co-op., Durand
Niagara Tel. Co., Niagara

Northeast Tel. Co., Pulaski
*North-West Tel. Co., Tomah (73,536)
Novy's Tel. Co., Kendall
Peoples Tel. Co., Randolph
Platteville Tel. Co., Platteville
Price County Tel. Co., Phillips
Rhinelander Tel. Co., Rhinelander
    Headwaters Tel. Co., Rhinelander
Rib Lake Tel. Co., Rib Lake
Richland Grant Tel. Co-op., Blue River
Rock River Tel. Co., Johnson Creek
St. Croix Tel. Co., New Richmond
Sharon Tel. Co., Sharon
    Bergen Tel. Co., Sharon
Shell Lake Tel. Co., Shell Lake
Siren Tel. Co., Inc., Siren
Somerset Tel. Co., Inc., Somerset
Southeast Tel. Co., Waterford
Southwest Wisconsin Communications, Inc., Platteville
    Cuba City Tel. Exchange Co., Platteville
Spring Valley Tel. Co., Inc., Spring Valley
State Long Distance Tel. Co., Elkhorn
Sullivan Tel. Co., Sullivan
*Telephone & Data Systems, Chicago, IL (64,913)
    Badger State Tel. Co., Inc., Neillsville
    Black Earth Tel. Co., Black Earth
    Bonduel Tel. Co., Bonduel
    Burlington Brighton & Wheatland Tel. Co., Burlington
    Central State Tel. Co., Vesper
    Dodge County Tel. Co., Reeseville
    Fennimore Tel. Co., Fennimore
    Greenwood Tel. Co., Greenwood
    Midway Tel. Co., Medford
    Mosel & Centerville Tel. Co., Cleveland
    Mt. Vernon Tel. Co., Verona
    Peoples Tel. Co., Mt. Hope
    Scandinavia Tel. Co., Iola
    Stockbridge & Sherwood Tel. Co., Sherwood
    Valders Tel. Co., Valders
    Waunakee Tel. Co., Waunakee
Tenney Tel. Co., Alma
Thorp Tel. Co., Thorp
Tri-County Tel. Co-op., Strum
Turtle Lake Tel. Co., Turtle Lake
Union Tel. Co., Plainfield
United Tel. Co., Monroe

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

WISCONSIN (cont.)

Universal Tel., Inc., Milwaukee, WI
Badger Tel. Co., Inc., Webster
Chippewa County Tel., Inc., Jim Falls
Cream Valley Tel. Co., Hawkins
Forestville Tel. Co., Forestville
Frederic Tel. Co., Frederic
Hammond Tel. Co., Hammond
Lakeland Tel. Co., Minong
Larsen-Readfield Tel. Co., Larsen
Monroe County Tel. Co., Sparta
Ogema Tel. Co., Hawkins
Osceola Tel. Co., Osceola
Poplar Tel. Co., Inc., Minong
Solon Springs Tel. Co., Minong
Universal Tel. Co. of Northern Wisconsin Inc., Mantowish Waters
Union Tel. Co., Plainfield
United Tel. Co., Monroe
Urban Tel. Corp., Clintonville
Vernon Tel. Co-op., Westby
Viroqua Tel. Co., Viroqua
Wayside Tel. Co., Greenleaf
West Wisconsin Tel. Co-op., Downsville
Weyauwega Tel. Co., Weyauwega
Wittenberg Tel. Co., Wittenberg
Wood County Tel. Co., Wisconsin Rapids

WYOMING

Chugwater Tel. Co., Chugwater
Cokeville Tel. Co., Inc., Cokeville
Dubois Tel. Exchange, Inc., Dubois
Eden Valley Tel. Co., Farson-Eden
Medicine Bow Tel. Co., Medicine Bow
Range Tel. Co-op., Inc., Forsyth, MT
Silver Star Tel. Co., Inc., Freedom
Tri-County Tel. Assn., Inc., Basin
*Union Tel. Co., Mountainview (3,700)
Valley Tel. Co., Baggs
*Wyoming Tel. Co., Inc., Pinedale (3,818)

WASHINGTON, D.C.

Telecommunications Concepts, Inc., Fairfax, VA
Potomac Telecommunications, Ltd., Washington, D.C. (private telephone company serving only the Washington metropolitan area)

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* Designates #1 and #2 independent telephone companies (ranked by number of telephones) within that state listing.

APPENDIX B:
COMPUTER GRAPHICS USED TO PLOT MAPS

Computer graphics (the producing of graphical images with the aid of a computer) has been used since the early 1960s, but, for over a decade, nearly all graphics equipment was large and very expensive. During the 1970s, less expensive minicomputers and CRT displays became available, and storage capabilities began to expand with the addition of floppy disks and tape drives. Soon after, users discovered the advantages of digitizing (assigning coordinate values to a point or series of points which generate lines or "pictures" which are stored in some data storage device).

One of the most important advantages of using interactive graphing is its capability to update data with very minimal effort. Because of this, a number of organizations that rely on geographic and demographic statistics are using interactive graphic systems to update their maps of population densities, river drainages, transportation networks, utility lines, etc. (Phillips, 1974; Emery, 1981; Jenkins, 1981; Hootnick, 1981).

This updating capability convinced the authors that the telephone maps in this report should be plotted via an interactive computer system. The Tektronix graphics system that was used consisted of these units:

4054, a 64K 16-bit high resolution desktop graphic computer;

4907, a file manager with three floppy disk drives;

4956, a 36" X 48" graphic tablet with a push-button cursor;

4631, a high-quality image hard copy unit; and

4662, an intelligent interactive digital plotter.

The computer software was purchased from Arthur Ungar of ICONICA, Oakland, CA. His graphing package, "Simple Handling of Areal Data Expressions" (known as SHADE II), was the only one that not only provided facilities for map digitizing, data input, editing, and display, but also did not require the use of a mainframe computer. As an added bonus, it also had the capability to compute the polygon areas owned by each telephone company and shade specified boundaries within each of these.

Digitizing of the maps was accomplished by the use of the Tektronix graphics tablet. The map boundaries were traced by recording enough consecutive points to accurately outline every polygon representing any telephone company area. The coordinates of each point were recorded in the computer memory by use of a four-button cursor. The four cursor codes instructed the computer to: (1) input the point as one of a continuing series, representing a line, (2) close up the boundary of the current polygon, (3) duplicate points from any previously digitized polygon (when it had some part of its boundary contiguous with the polygon now being digitized), or (4) duplicate the points (and reverse the direction, thus subtracting the area) of an interior polygon totally enclosed within a larger polygon.

In order to insure proper definition and resolution of points (in case any map needed to be duplicated or corrected), each map was given a scale by digitizing two points and entering the coordinates of these two points into the computer. If a key to scale wasn't included on the original telephone maps, an arbitrary scale was chosen, depending upon the required resolution for that map. The software allowed nine distinct types of shading within the polygons by instructing the computer to use lines with varying angles and spacing.

The SHADE II software proved to be a fortunate choice for our map digitizing, because it had a number of very useful features that seemed "made to order" for our purposes. The most useful feature was its extensive editing capability. This not only permitted changes in telephone company areas (depicted as polygons on the maps), but also provided for the reclassification, the deletion, or the addition of any polygon. For example, in Figure B-1, the second polygon of Company C in New York was labelled C2. If, sometime in the future, this area were to be sold to Company Y (see polygon labelled Y1 in the figure), the editing capabilities of SHADE II could be used to quickly reclassify and reshade the C2 polygon. This maneuver would also subtract 152 sq. mi. (the area of C2) from the total Company C area and add it to the total area for Company Y.

Another very useful feature was the "map window" that permitted the selective viewing and digitizing of any portion of a total map. When very large maps were to be digitized, they were divided into sections so as to permit more working detail. Texas, for example, was completed as four separate digitized sections. Because the coordinates of each were carefully recorded, individual sections could later be combined into a single map. In the case of Texas, the final coordinated map was printed in three sections which appear as Figures 43a, 43b, and 43c.

Only a few problems were encountered while using the SHADE II software. These occurred because the preparation of the telephone maps required more complicated procedures than those needed for most thematic maps. Three changes were made (with the assistance and approval of Mr. Ungar) to modify the software for the telephone map digitizing. The first change was to increase the maximum number of points per polygon from 300 to 1700. To do this, it was necessary to gain

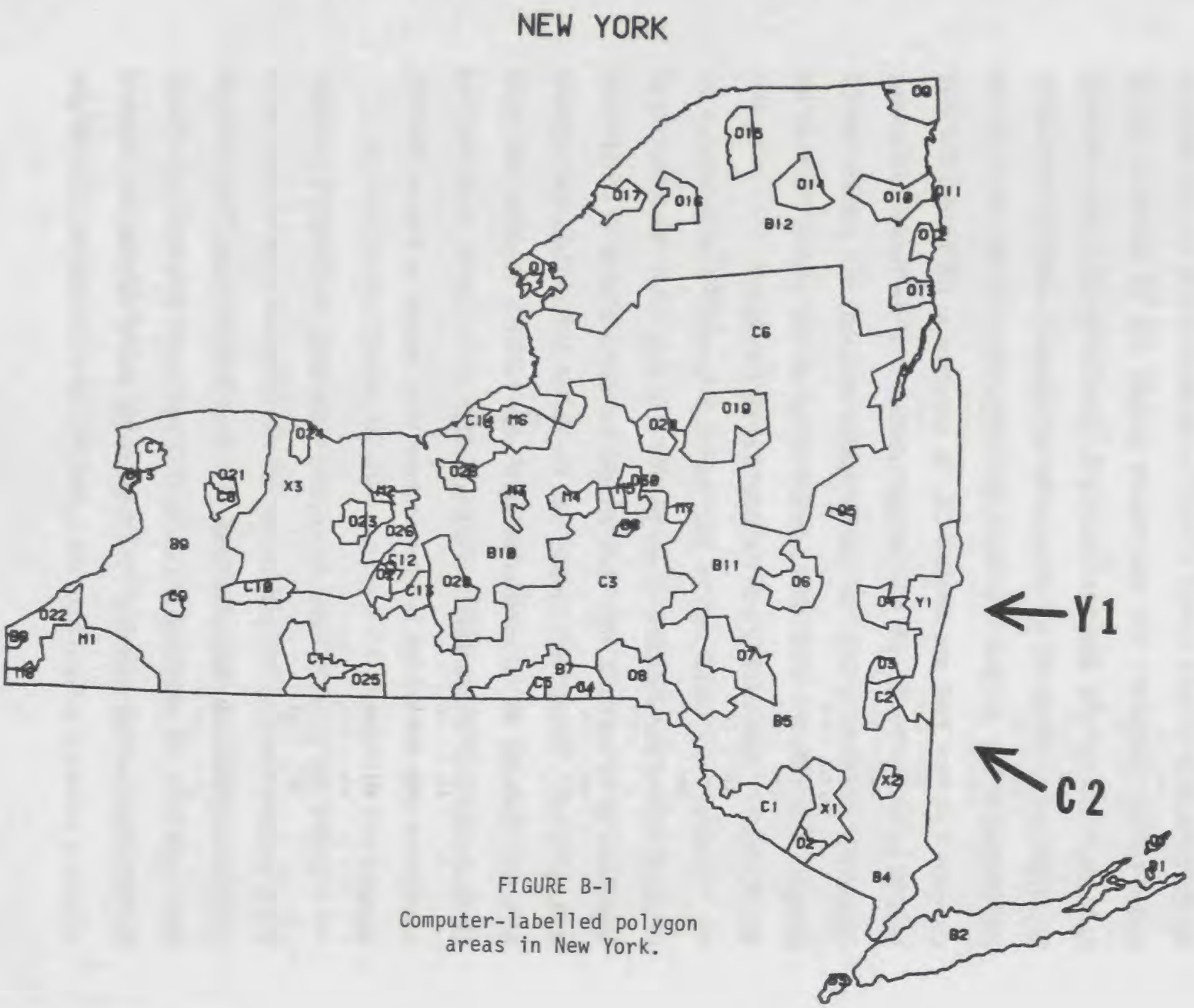

FIGURE B-1

Computer-labelled polygon areas in New York.

more memory by reducing the maximum number of polygons per map window from 60 to 35 and cancelling two SHADE II functions (overlay and grid) that were not needed. However, the digitizing of some of the larger polygons required even more points; so a second modification was made which permitted lines to be flagged "invisible" -- a technique by which large polygons could be split into smaller polygons with invisible lines between them. (See the B Company polygons on Figure B-1.) The third change was done for convenience. It converted the ratios of the SHADE II software to calculations of the square miles within each polygon and summarized the total area for all polygons comprising a single telephone company.

This updated version of the telephone areas serviced by Bell and the independent telephone companies should be more useful than the 1973 report since it not only includes all current telephone company boundary changes, but it also was drafted in a manner (interactive computer graphics) that permits almost instantaneous corrections to, or revisions of, any of the telephone company areas.

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Phillips, R.L. (1974), Computer graphics in urban and environmental systems, Proceedings of the IEEE, Vol. 62, April, p. 437.

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The geographic coverage of all telephone companies in the United States is presented in a series of maps depicting the operating companies. Tables are also presented of state-by-state listings of (1) almost 1500 telephone companies and their headquarters, and (2) the land areas of each state's major telephone companies. In the future, this updated version of telephone company areas should be more useful than the original 1973 report, since it was plotted with an interactive computer system, which has the capability of updating boundary changes with minimal effort.

16. Key Words *(Alphabetical order, separated by semicolons)*

independent telephone companies; interactive computer graphic system; telephone company areas; telephone company maps

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Policy Implications of Information Technology

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NTIA Report 84-144

Policy Implications of Information Technology

R. K. Salaman
E. C. Hettinger

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
David J. Markey, Assistant Secretary
for Communications and Information

February 1984

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POLICY IMPLICATIONS OF INFORMATION TECHNOLOGY

R. K. Salaman* and E. C. Hettinger**

Today, three-quarters of the U.S. employment and one-half of the Gross National Product (GNP) are associated with services. In 1981, services employment predominated, for the first time, over both agriculture and manufacturing, even in the Third World countries. The increasing importance of services to the economy and the society has been stimulated by the greater availability of information and communications products. This report presents the initial analysis of a project devoted to formulation of national information policy as necessary to accommodate the new opportunities presented by advanced information technologies, and the impact on the economy and society. After defining the meaning of information policy, the report discusses current issues concerning domestic industry growth, maintaining international leadership, and new considerations regarding intellectual property.

Key words: economic development; education; information policy; intellectual property; international trade; research and development; services economy; telecommunications policy

1. INTRODUCTION

The shift of private sector employment trends from production of goods to the offering of services is evident in the curves of Figure 1.[1] Agriculture predominated in the first 100 years of our Nation's development. This was followed by a relatively short 50 years of concentration on manufacturing of goods.[2] As explained by many authors (e.g., Machlup, 1962; Bell, 1973; Toffler, 1980; Naisbitt,

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[1] These curves do not include transportation (which today is about 7% of employment), nor government employment at any level. Including public sector services employment would, of course, further de-emphasize the length of the manufacturing era.

[2] It is interesting to note that the Departments of Commerce and Labor were established at precisely the time when manufacturing became dominant over agriculture.

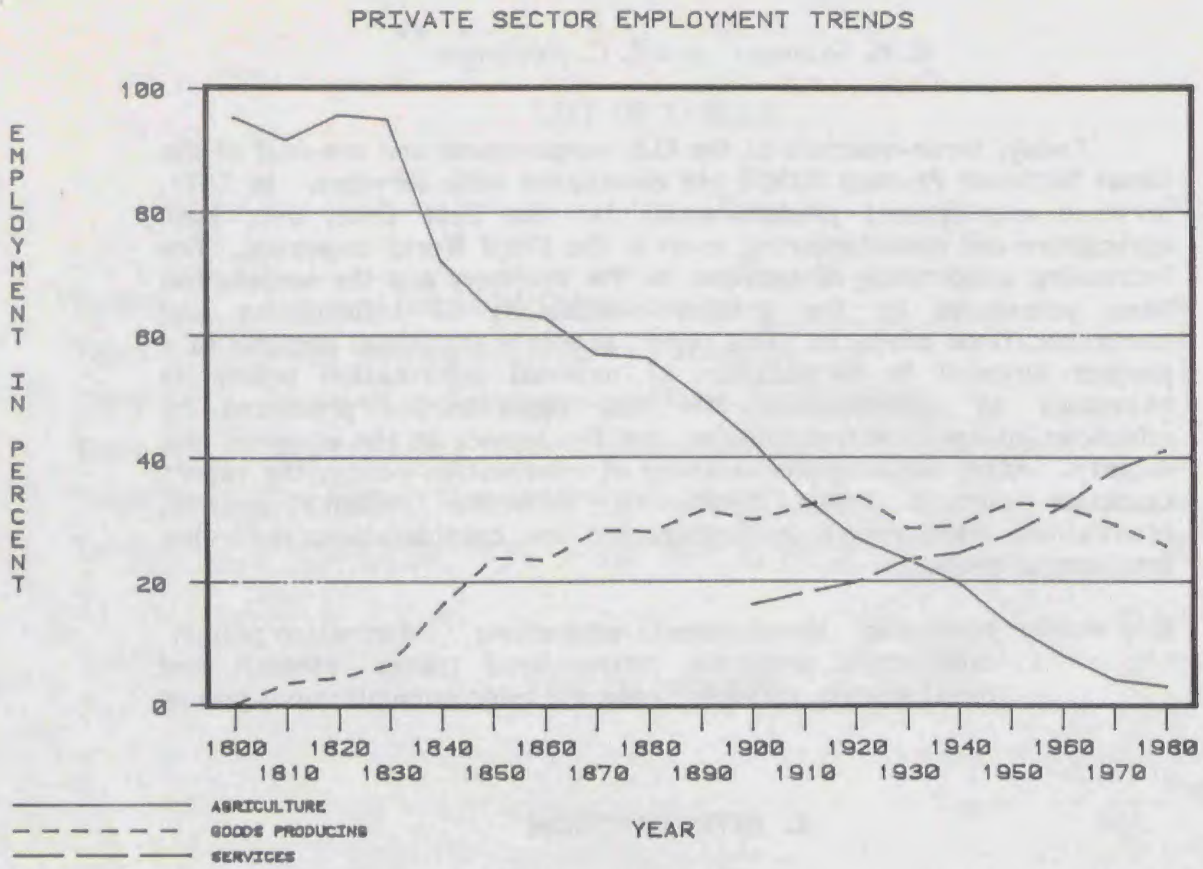

Figure 1. Private sector employment.

1982), this second period was spent in developing skills for the production of material goods, and in becoming proficient in amplifying our physical power through control of energy derived from natural resources. The peak in manufacturing occurred in the 1950's. By the mid-1960's, the economy had increased emphasis on services, a trend which is expected to prevail into the twenty-first century. The excitement of this new era lies in amplifying our mental capabilities. The basic fuel of this era is not the scarce natural energy resources, but the nonexpendable quantity called information. Since a significant part of these services is becoming increasingly dependent upon information, the current period has been called the "information society."

The current transition period has been characterized by the mismatch between employment demands and available skill levels. But just as important is the growth of new information-oriented business.[3] New business starts were up 29% from 1981 to 1982, with electronics, primarily communications and computers, receiving 73% of the venture capital in 1982. (Electronics, 1983)

Two particularly important results of this era now being realized are the substitution of intelligent machines for the toil of labor, and in enhancing our mental capabilities to think, reason, and make more intelligent decisions. The automation of information is leading to new products such as robots and word processors that are improving productivity and substituting for labor in redundant or dangerous processes. At the same time, the application of information products, including communications and computer goods and services, is being used to overcome inherent limitations of the human mind. The "information society" is becoming a reality as the capabilities of products such as the personal computer become a significant component of business and individual decision making. Such products are now extending our memory and our access to diverse data sources, increasing the speed at which we can comprehend and analyze information, stimulating human creativity, and allowing us to simulate specific courses of action without incurring the risks of bad decisions. By the year 2000, integrated circuits the size of a fingernail, which are the heart of these devices, are expected to have as many cells as the human brain. Although hardware development has predominated till now, the emphasis is now shifting to development of software and the application of these "information machines" to create new intellectual products. With the ease by which information can now be accessed and reproduced, there is increasing concern about the lines drawn between the economic and social rights associated with these "intellectual properties."

It is no simple task to understand the significance that this transition from manufacturing to services is having on the Nation's ecomony and society, and in fact on the world. Current policies are largely based on the 50-year

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[3] It is unfortunate that the changes occurring today are often perceived as problems rather than opportunities. The difference is that in evaluating problems, one looks to the experience of the past for modifications to policy. In the present transition, however, when considering opportunities not previously available, one must look to the future in developing new policies that will allow the greatest latitude for product diversity and economic and social development.

manufacturing era in which economic growth depended upon improving the production of goods. It is only the current generation now entering the workforce after high school and college that has lived only in a predominantly service-oriented, rather than goods-oriented society. However, after two decades of moving toward an information-based services economy and society, new policies are needed that are appropriate to an era where human resources are devoted to serving man rather than machine. (Congressional concerns of this sort are discussed in Section 1.3.)

The first step in developing new information policies was taken in 1968. A Presidential task force, after a year of study, set policy directions that expanded our telecommunications opportunities consistent with information demands still emerging. (Rostow, 1968) The significance of this task force is discussed in Section 1.2. Today it may be appropriate to take the next step by establishing the same type of cooperative joint industry and government effort, this time devoted to setting the framework for information policy into the next century.

1.1 Definition of Information Policy and the Information Industries

The conventional meaning, which is applicable here, is that information is the fact of knowing, as well as the communication of this knowledge. Included in information policy is both information intensive goods and services, and conceptual issues such as freedom of speech, privacy, intellectual property rights, etc. Information policy and the information industries deal not only with information, but also the development of this knowledge and intelligence--learning, reasoning, understanding, and applying what is known. Since information is acquired or used in almost every human endeavor, it is useful to focus the scope of issues by considering which information policies and which information industries are information intensive, that is, where the primary quantity involved is information.

From an economic standpoint, the Nation's condition is often categorized by use of the Gross National Product (GNP), the total of goods and services. Only part of the GNP concerns information intensive goods and services. In terms of goods, for example, the telecommunications and much of the computer industry is developing products where the primary function is the handling, processing, and communication of information, knowledge, and intelligence. Likewise, services

such as professional consulting, education, finance, and real estate are primarily engaged in brokering information, and therefore are also considered as information intensive.

To understand better the information industries, it is useful to search for this categorization in the Standard Industrial Classification (SIC).[4] The industry subdivisions are shown in Table 1. (U.S. Department of Commerce, 1972) The major industry divisions are: agriculture and the extractive industries (A and B), construction (C), manufacturing (D), the services Divisions, (E through J). The services category has been defined in the U.S. Department of Commerce publication "Services Industry Trends and Products" (1975). The contribution of these areas to the GNP is given in Table 4 on page 15.[5] The information industries are not segregated in the SIC code listing. They mainly form a subset of those service industries that supply information-intensive services, and the few manufacturing divisions where such equipment facilitates the handling, processing, and dissemination of information. Table 2 provides a listing of the industry categories that exemplify the information industries. A good topological description of the information field is contained in an information map copyrighted by Harvard (McLaughlin and Birinyi, 1979). The basic question distinguishing information policy is whether the product (i.e. good or service) that is supplied primarily performs a physical or an informational function.

1.2 Perspective

Telecommunications and computers are primary information industry tools. With 20 years of progress in stimulating diversity in telecommunications products and services, the emphasis in policy making seems now to be shifting toward information technology that has primary application in enhancing intellectual creation. Although the telephone was invented over 100 years ago, it

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[4] The Statistical Policy Division of OMB is beginning the revision of the SIC codes, which is scheduled for completion in 1988. The latest supplement to the present 1972 manual was issued in 1977.

[5] In Table 4, Division E is subdivided into communications and utility services, and does not include public administation or nonclassifiable establishments.

Table 1. Standard Industrial Classifications

(including numbers of Major Groups)

Division A. Agriculture, forestry, and fishing
- 01. Agricultural Production--crops
- 02. Agricultural production--livestock
- 07. Agricultural Services
- 08. Forestry
- 09. Fishing, hunting, and trapping

Division B. Mining
- 10. Metal mining
- 11. Anthracite mining
- 12. Bituminous coal and lignite mining
- 13. Oil and gas extraction
- 14. Mining and quarrying of nonmetallic minerals, except fuels

Division C. Construction
- 15. Building construction--general contractors and operative builders
- 16. Construction other than building construction--general contractors
- 17. Construction--special trade contractors

Division D. Manufacturing
- 20. Food and kindred products
- 21. Tobacco manufactures
- 22. Textile mill products
- 23. Apparel and other finished products made from fabrics and similar materials
- 24. Lumber and wood products, except furniture
- 25. Furniture and fixtures
- 26. Paper and allied products
- 27. Printing, publishing, and allied industries
- 28. Chemicals and allied products
- 29. Petroleum refining and related industries
- 30. Rubber and miscellaneous plastics products
- 31. Leather and leather products
- 32. Stone, clay, glass, and concrete products
- 33. Primary metal industries
- 34. Fabricated metal products, except machinery and transportation equipment
- 35. Machinery, except electrical
- 36. Electrical and Electronic machinery, equipment, and supplies
- 37. Transportation equipment
- 38. Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks
- 39. Miscellaneous manufacturing industries

Table 1 (continued)

Division E. Transportation, communications, electric, gas, and sanitary services
- 40. Railroad transportation
- 41. Local and suburban transit and interurban highway passenger transportation
- 42. Motor freight transportation and warehousing
- 43. U.S. Postal Service
- 44. Water transportation
- 45. Transportation by air
- 46. Pipe lines, except natural gas
- 47. Transportation services
- 48. Communications
- 49. Electric, gas, and sanitary services

Division F. Wholesale trade
- 50. Wholesale trade--durable goods
- 51. Wholesale trade--nondurable goods

Division G. Retail trade
- 52. Building materials, hardware, garden supply, and mobile home dealers
- 53. General merchandise stores
- 54. Food stores
- 55. Automotive dealers and gasoline service stations
- 56. Apparel and accessory stores
- 57. Furniture, home furnishings, equipment stores
- 58. Eating and drinking places
- 59. Miscellaneous retail

Division H. Finance, insurance, and real estate
- 60. Banking
- 61. Credit agencies other than banks
- 62. Security and commodity brokers, dealers, exchanges, and services
- 63. Insurance
- 64. Insurance agents, brokers, and service
- 65. Real estate
- 66. Combinations of real estate, insurance, loans, law offices
- 67. Holding and other investment offices

Division I. Services
- 70. Hotels, rooming houses, camps, and other lodging places
- 72. Personal services
- 73. Business services
- 75. Automotive repair, services, and garages
- 76. Miscellaneous repair services
- 78. Motion pictures
- 79. Amusement and recreation services, except motion pictures

80. Health services
81. Legal services
82. Educational Services
83. Social Services
84. Museums, art galleries, botanical and zoological gardens
86. Membership organizations
88. Private households
89. Miscellaneous services

Division J. Public administration
91. Executive, legislative, and general government, except finance
92. Justice, public order, and safety
93. Public finance, taxation, and monetary policy
94. Administration of human resources programs
95. Administration of environmental quality and housing programs
96. Administration of economic programs
97. National security and international affairs

Division K. Nonclassifiable establishments
99. Nonclassifiable establishments

Table 2. Major Information Industry Categories
(with major SIC groups)

COMMUNICATIONS
Broadcasting (36, 48, 50,57)
Newspapers, periodicals, and wire services (27,73)
Postal Service (43)
Private delivery systems (47, 59)
Telephone (36, 48, 50)

INFORMATION ACCESS AND PROCESSING
Book publishing and printing (27)
Computer systems, services, and software (35, 73)
Libraries, service bureaus, and other information utilities (73)

INFORMATION SERVICES
Business services including advertising and legal (73, 81, 86)
Consulting and Brokerage (62, 64, 89)
Education (82)
Entertainment including theaters and organized sports (78, 79)
Finance, insurance and real estate (60 series)
Government (90 series)
Research and development (73, 89)
Social services (83)

took until the mid-1960's before universal service was essentially attained (Figure 2). The emphasis then turned toward diversifying the use of the telephone system. A new demand for data transmission began to emerge, primarily to and from computers. It became evident that new concepts were needed to handle the data communications traffic expected to arise from the rapidly developing computer field. There was reluctance by the established telephone companies to allow connection of new diverse terminal equipment to the Nation's primary telephone system. In addition, the potential was growing for new communications services through use of emerging satellite and cable technology.[6]

Twenty years after the invention of the transistor (in 1948), commercial opportunities for new, cheap, lightweight, small-volume communications and data processing equipment and new information services provided the potential to

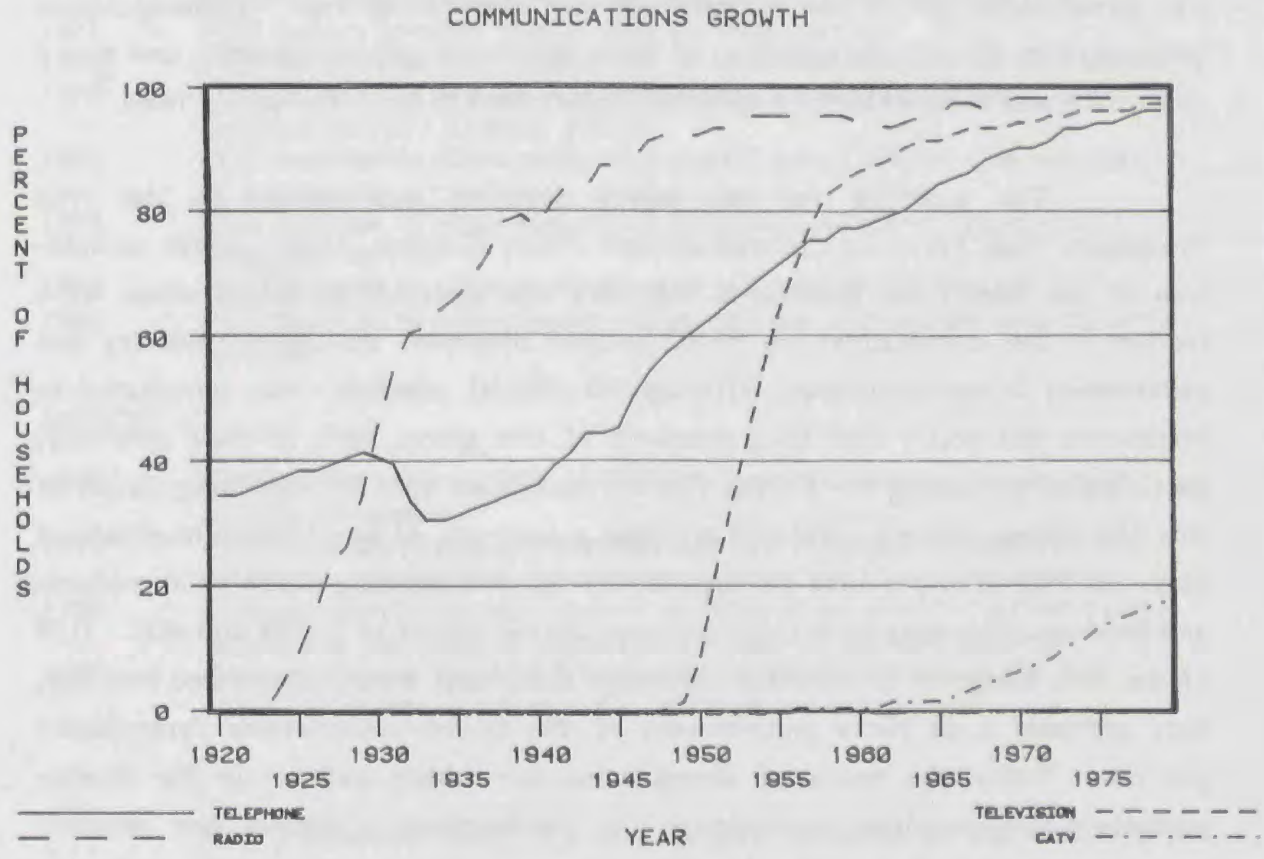

Figure 2. Penetration of communications service.

[6] Satellite communications was stimulated by the Soviet launching of Sputnik in 1957, and the U.S. launch of Explorer I in 1958.

greatly expand the diversity of information services. The Carterfone case and industry interest in offering specialized and value-added services in the mid-1960's (see Table 3) created pressure on the FCC to shift telecommunications policy from merely promoting universal service (the direction of the Communications Act of 1934 which, as shown in Figure 2, had essentially been achieved), to stimulating a diversity of service offerings. (U.S. Department of Commerce, 1982)

It was just at this time, the mid-1960's, that new electronic communications and information processing opportunities were driving the economy toward a services orientation. (See Figure 1 on page 2) The computer microelectronics industry, largely devoid of government regulation found in the telecommunications industry, was developing at a very rapid pace--decreasing prices and at the same time increasing equipment capabilities. The time had come for government policy to concentrate on stimulating new communications opportunities, through deregulation of the telecommunications industry, and thus a new office was created in the Executive Department to meet this policy need.[7]

The guideline for this policy direction was mapped by the 1968 President's Task Force on Communications Policy (Rostow, 1968). After completion of the study, the task force members and their staffs, all of whom were leaders in the communications field, became dispersed throughout industry and government in key positions. Although no official schedule was formulated to implement this policy direction, members of this group, each in their own way, participated in leading the Nation through an intense step-by-step deregulation of this $50 billion industry. Table 3 provides a summary of key telecommunications decisions that have provided the opportunity for an expanding diversity in products and services. The apex of activity occurred during debate of S. 898 and H.R. 5158 of the 97th Congress in 1981-82. Although these bills were not enacted into law, they provided a de facto endorsement of the telecommunications deregulation process. Today the fruits of deregulation are widely evident in the diverse equipment and services available in the marketplace. Congress has recently become involved in the details of implementing deregulation.

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[7] The Office of Telecommunications Policy, containing the President's advisor on telecommunications and information policy, was created in the Executive Office in 1970. These functions were transferred to the National Telecommunications and Information Administration in the Department of Commerce in 1978.

Table 3. Emphasis on Telecommunications Deregulation

Equipment	
1956	Hush-a-phone decision by the D.C. Court of Appeals
1968	Carterfone decision by the FCC to allow consumer provided devices to be connected to the telephone system
1976	4th Circuit Court upholding FCC decision to allow non-AT&T terminal equipment interconnection to the telephone system
1978	FCC decision to allow any equipment to be interconnected to the public telephone system (except on party lines and pay phones), provided that the equipment has technical registration at the FCC
1980	FCC extended terminal equipment interconnection to private line in addition to switched network
Transmission	
1959	FCC decision to allow point-to-point private microware links above 890 MHz, even if facilities duplicate those of common carriers
1971	FCC inquiry to allow specialized common carriers
1972	FCC decision to allow open entry of domestic satellite service suppliers
1974	FCC decision to require interconnection between traditional and other common carriers (Docket 19896)
1976	FCC decision to allow resale and shared use of private line services by customers
1978	FCC decision to allow non-AT&T Execunet switched long-distance telephone service
1980	FCC decision to allow open entry to MTS and WATS service
1980	FCC decision to allow resale and shared use of switched long-distance service
Services	
1956	Consent Decree excluding AT&T from unregulated businesses such as data processing
1971	FCC decision to require common carriers to establish separate subsidiary to provide data processing services (1st Computer Inquiry)
1980	FCC decision to allow enhanced services to be provided without regulation, but maintaining regulation for basic telephone service.
1982	Consent Decree for AT&T to divest the local portions of the Bell operating companies from other parts of the company

Policy concerns today are now largely centered on the diversity and deregulation of services at the local level, called the "last mile." (Report of limited circulation: Local Distribution--The Next Frontier, by J. Charter, D. Hatfield, and R. Salaman, NTIA-TM-81-54, 1981) Current issues include cost recovery by local operating companies, cost of local basic service to the consumer, and the conflict between the opportunity for new diverse services (made possible by cable and

satellite systems) and local regulatory constraints. Today, only traditional telephone service, called "basic service", remains tightly regulated by the FCC. Much of the remaining work in domestic telecommunications is devoted to oversight of deregulatory policies, and is being carried out at the regulatory level.

Following the past 15 years of concentration in the telcommunications area of information policy, it appears that the policy focus is changing, or at least broadening, with the focus now on new opportunities available for telecommunications diversity. Concern about the United States leadership in information technology is being addressed at the present time. One might expect the policy focus to move to issues concerning the development and protection of intellectual property that is created by this technology as we move into the 1990's. An indication of the current concerns is contained in the following section.

1.3 Congressional Concerns

In the first session of the 98th Congress, 255 bills were submitted relating to development of information policy. The issues with the percent of bills can be categorized as follows:

- 60% of the bills dealt with high technology including information
  - o deficiencies in science and mathematics education
  - o improvement of R&D, International Trade, and government organization

- 35% of the bills were related to information and communications
  - o deregulation of telecommunciations services
  - o intellectual property rights including copyright, privacy, and Freedom of Information

- 5% of the bills were concerned with Federal Government enterprise
  - o Government competition with the private sector
  - o United States Postal Service.

The principle concern of the Congress in this area has been directed mainly toward how high technology products, principally those of the information industries can assist in improving the U.S. economic condition. A consistent theme for action has been the threat of foreign competition in light of the increased merchandise trade imbalance. Few bills recognized the significance of the services sector in the domestic and international economy. Although services account for only 40 percent of exports, they are sufficiently larger than service imports to make the overall balance of goods and services a positive quantity.

By far the largest Congressional effort in both the House and Senate has been devoted to maintain technology leadership by improving science, mathematics, and foreign language education--primarily in the elementary and secondary schools. This is aimed at developing a labor force necessary to produce high technology products, but with little attention paid to developing a society capable of using these products, and thus creating the demand for their production.

The next largest effort has been devoted largely to maintaining leadership in international trade. One area has been reorganization of the Federal Government to deal better with international commerce issues. Another effort has been to provide Federal support for cooperative research and development of high-technology products, attempting to reduce the risks associated with individual company creativity, possibly with the side effect of reducing the diversity of products and ideas as well.

Also of significant interest is legislation directed toward continuing the telecommunications deregulation process--primarily through extension to broadcasting, but also with recent concern about the availability and cost of local telephone service. Legislation concerning intellectual property rights is also gaining momentum, with most of the concern being with copyright issues where new technology is facilitating easy reproduction of copyrighted material. There is less concern about privacy than was apparent several years ago.

Finally, there continues to be a marginal concern about the Government continuing to provide services that are also now being offered by private sector businesses.

2. ISSUES

With national policies now in place that stimulate diversity in communicating information, the basic policy concern is shifting toward issues regarding the generation, use, and rights associated with information. The 1976 revision of the Copyright Act probably provided a milestone in focusing attention on the information issues. However, it was not until Japan made significant inroads into U.S. information product markets in the last several years (largely with technology we provided to them) that information policy became a highly visible item in the Congress. Although in the next several years, information policies are expected to continue to center on assuring the opportunity to maintain leadership in developing information technology, it is likely that for the remainder of this century, information policy will emphasize the use of this technology consistent with the United States and world market orientation toward service economies.

As discussed above in Section 1.3 on Congressional Concerns, there are three major active issues: 1) enhancing our educational system to sustain growth and to insure that society can take advantage of the new information technology, 2) maintaining U.S. leadership in meeting the market requirements for information technologies, and 3) reassessing the policies and laws regarding rights and freedoms associated with information. The following three major sections in this chapter provide some insights into these issues.

2.1 Industry Growth

There is substantial concern in Congress about maintaining the educational environment to sustain growth in certain sectors of the information industries--primarily those concerned with hardware development. Some concern also exists regarding Government competition with the private sector.

The following two tables indicate that in general the information industries are a very healthy segment of the economy. Table 4 shows the traditional aggregation of industry by major sector. It is quite apparent that the information-intensive sectors (that is, communications, finance, insurance, and real estate, and about half of the other services), show the greatest annual compounded growth rate and provide a sizable contribution to the GNP. An evaluation of

Table 4. Major Industry Sector Compounded Annual Growth Rate

Major Sector	1973-81 Compounded Annual Growth Rate %	GNP Contribution $ Billions
Communications	7.3	$ 77.9
Finance, Insurance and Real Estate	4.1	448.2
Other Services	3.9	386.9
Agriculture Forestry and Fishing	2.6	85.6
Wholesale and Retail Trade	2.2	472.7
Utility Services	2.0	76.4
Mining	1.9	127.2
Manufacturing	1.2	644.0
Transportation	.5	107.6
Construction	-1.8	127.2

Table 4 is from the 1983 U.S. Industrial Outlook, Bureau of Industrial Economics, U.S. Department of Commerce, page XXI, January 1983.

Table 5. Ten Fastest Growing Industry Sectors

Rank	SIC	Industry Segments	1982-83 growth rate in percent
1	3573	Electronic computing equipment	17.8
2	2448	Wood pallets and skids	14.9
3	3674	Semiconductors and related devices	14.6
4	3678	Electronic connectors	13.2
5	3679	Electronic components n.e.c.	12.7
6	3944	Games, toys, children's vehicles	9.4
7	3623	Welding apparatus, electric	9.0
8	3841	Surgical and medical instruments	8.5
9	3662	Radio and TV communications equip.	8.2
10	3761	Guided missiles and space vehicles	8.0

Table 5 is from the 1983 U.S. Industrial Outlook, Bureau of Industrial Economics, U.S. Department of Commerce, page XXXVI, January 1983.

specific industry segments, as presented in Table 5, shows that four of the five fastest growing industry segments support the handling of information. In addition, computers, telephone equipment, office machines, and radio and television equipment are estimated to have the greatest compounded annual growth rate over the past decade. These rates varying from 15.5 to 9.3. (U.S. Department of Commerce, 1983) As previously stated, new business starts are up 29 percent from 1981 to 1982, electronics firms, primarily communications and computers, receiving 73 percent of the new venture capital in 1982. Computer services alone are expected almost to triple to a $74.4 billion market between 1982 and 1987. (Association of Data Processing Service Organizations, 1983)

2.1.1 Educational Considerations

In order to maintain a viable industry, it is necessary to assure that adequate talent is available to perform the research necessary to develop new concepts and new products. This is particularly important in rapidly emerging industries such as the information industries. Problems that exist at present include the reduced number of engineers being graduated, the void created by engineering and science teachers being attracted away from education by industry, the decrease in mathematics and science competency of students graduating from the public education system.

There were about 18,000 graduating college students with bachelor's, master's, and doctoral degrees in high-technology fields in this country in 1981. The fact that Intel, one of the leading U.S. semiconductor manufacturers, recruits about 30% of its employees from foreign nationals may be an indication of the shortage of U.S. engineers. (Electronics, 1982) The Immigration Reform and Control Act was introduced in Congress in 1982, aimed primarily at reducing the number of illegal aliens in this country. Concern has been raised that such legislation would decrease the number of qualified potential research employees educated at U.S. universities.

The basic problem is, of course, not the retention of foreign students, but rectification of deficiencies in the current educational system that leads to this lack of U.S. engineering talent. Research Management (1982) reported a declining number of qualified science and engineering students, with peaks in bachelor's, master's, and doctor's degrees occurring in 1974, 1979, and 1973, respectively. The 98th Congress has introduced 24 bills associated with this problem, but with little action. The significance of the educational problem is pointed out in a recent GAO publication (P-95 No. 76), which observed that the total number of Soviet scientists and engineers engaged in R&D during 1979 was 57% more than the number in the United States. In that year, 179,000 U.S. students (18 percent) received their bachelor's degree in science and engineering compared to 426,000 (53 percent) in the Soviet Union. (National Science Board, 1981)

A recent Engineering Manpower Commission report concludes that enrollment in engineering schools reached an all-time high in fall of 1981. There

are several problems, however, that provide significant deficiencies in engineering education. First, there is a shortage of 40% to 50% in engineering faculty. Competent university and high school instructors are leaving teaching careers to double their salaries in industry. Second, laboratory equipment in the academic environment has become obsolete. The 97th Congress considered several bills (S. 2475 and H.R. 9242, and P.L. 97-34--which passed) to establish tax incentives to industry to provide more recent equipment to higher level institutions. These same opportunities are not available for secondary school education.

Third, there is a significant deficiency in the preparation of students entering higher level education in science and engineering, where, at the primary and secondary education level, there is a general deficiency in mathematics and science competency. At the May 1982 National Academy of Science Conference, President Reagan told science educators that elementary and secondary school science and mathematics has reached such a state that it threatens "to compromise the Nation's future ability to develop and advance our traditional industrial base to compete in the international marketplace." Action on this problem, he said, is "long overdue." The Administration has called on private industry to do more to help local schools. The Administration has endorsed two related projects: 1) The National Commission on Excellence in Education within the Department of Education, and 2) The National Science Board's Commission on Pre-College Education in Mathematics, Science, and Technology. (Research Management, 1982a)

Education at the secondary level provides the basis for those pursuing higher level education which is generally needed for the development and innovation of information technology products, so critical to the advancement of the U.S. society and its standing in international trade.

Eighteen bills have been introduced so far this Congress on this issue. H.R. 1310 has already passed the House. Although it is important that the workforce include those with adequate science and mathematics competence, the major deficiency in the legislation appears to be that it does not stimulate the development of the competence necessary for the society to use the new information technologies. It is well-known in the computer field that the problem today is not hardware, but the lack of software to make information-handling

equipment useful. Raising the level of computer literacy for people in all disciplines, and not just improving the quality of mathematics and science students, is needed to assist in sustaining United States leadership in the offering and use of information technology.

The school systems are only at the beginning stages of introducing the subject of computer literacy, and even there, the approach is oriented to development of programmers rather than developing people literate in using the computer to improve the intellectual productivity of the workforce. Although industry has tax incentives to stimulate equipment donation to universities, the same incentives are lacking in the public school system. The "Apple Bill" has been reintroduced in this Congress as H.R. 701 to provide industry with a tax incentive to supply computers to primary and secondary schools. This bill has become lost with the emphasis on science and mathematics education. States are also considering similar legislation. In September 1982, California passed a similar bill which has stimulated a donation of about 9300 computers for elementary and secondary education in that state. (Uston, 1983) Consideration might be given to modifying Federal science and mathematics education legislation to include incentives for the elementary and secondary school system to stimulate a broad level of computer literacy, i.e., beyond just computer programming.

2.1.2 Government Versus Private Enterprise

Throughout the agricultural and industrial eras, Government has been a major supplier of a broad range of information services, from reports to massive data bases, to communications services. The Government has built substantial enterprises including the Postal Service, the Weather Bureau, the Census Bureau, and the National Technical Information Service, and many information systems like the Agricultural Service, the Federal Reserve electronic transaction system, and the National Library of Medicine. As the Nation moves further into an information society, the private sector has begun to offer services that overlap with those of Government. It is important that Government now evaluate what its role should be as it becomes a competitor with the private sector, and as new technology both changes the character of these products and demands a major rebuilding of Government information systems consistent with the electronic age.

United States Postal Service

There is little doubt that the nature of physical mail will continue to change as electronic communications carry more personal and business transactions. (Ewing and Salaman, 1976, McLaughlin et al., 1979) The Postal Service has already expanded into electronic communications by developing and offering a domestic electronic mail service (E-COM), and an international service (INTELPOST). Both of these services had ,direct private sector competitors even at the time of their introduction.

Because of this competition, the Service has been constrained in its development of these and other services to meet perceived demand. In turn, the private sector has been hesitant to develop services when there is the potential of Government competition. Because of this conflict, there was a 4-years policy and regulatory delay in development of electronic mail systems. This issue is still not adequately resolved. Rather than having the Postal Service's role in provision of electronic mail continually questioned, it may be desirable to decide either that the Postal Service should be kept out of the electronic communications business, or that it should be unrestrained in offering such service.

Were the Postal Service not a Government agency, there would be little question of not only its being able to offer such service, but that such new services would be available today. This leads directly to the issue of whether the Service should be a Government organization, where it is sometimes constrained from offering innovative services, and from implementing programs that would decrease the cost of postal services. As in previous years, bills have been introduced in this Congress to reorganize the Service (H.R. 86, 1205, 1830, 1831). With the changing character of mail in the next 10 to 20 years (e.g., a significant part of First Class mail--financial statements--conveyed via electronic communications), there is little question of the need to make changes. The questions are, whether and when should postal reorganization be reconsidered, how can basic mail service be sustained, and whether the Service should continue to expand into offering electronic mail services now offered by private sector business.

Government Competition in Information Services

There are other Government communications and information services that are encountering competitive challenges from the private sector. The

potential of moving several of NOAA's satellite programs to the private sector has illuminated the fact that the private sector is prepared to provide many types of information services.

The National Technical Information Service has been a candidate for transfer to the private sector almost since its inception. It and other governmental information services, such as the Department of Energy RECON system, have been expanding their offerings to provide on-line data base services that are also available from private suppliers.

As discussed above, Government information services are available that are competitive with emerging private business offerings. The primary issue is what role the Government should have in offering communications and information services that are competitive with similar private-sector offerings.

2.2 Maintaining International Leadership

2.2.1 Importance of Services in the Balance of International Transactions

Much of the concern about the U.S. information industry has centered around the ability to keep up with foreign competition. The origin of the debate is the deficit position of the United States merchandise trade balance (normally called the 'trade balance'). The trade deficit increased from $27.9 billion in 1981 to $36.3 billion in 1982, and is estimated to reach $57 billion in 1983 (Baldrige, 1983). As Lester Davis of the International Trade Administration points out (Davis, 1982), we have been looking to the high-technology area to offset declining competitiveness in lower technology products produced by the more mature U.S. industries. To analyze whether this has been the case, he develops two measures:

Export Surplus Share of Exports - which would be an increasing percentage figure for an increasing U.S. competitive position in foreign markets versus foreign producers' competitiveness in the U.S. market. It is determined by (exports - imports)/exports, in percent.

Import Share of Apparent Consumption - which would decrease as U.S. producers gain in their ability to compete against foreign imports. It is the imports/(U.S. shipments - U.S. exports + foreign imports), in percent.

From these measures, as shown in Figure 3, he concludes that the United States is losing both the ability to compete in foreign markets (relative to foreign competition in the United States), and the ability to maintain dominance in the U.S. domestic market, even in the area of high-technology merchandise.

The significance of telecommunications and information merchandise, which are important high-technology areas, is reflected in electronics equipment statistics (Electronic Industries Association, 1983). Figure 4 shows that the balance of electronics merchandise trade has remained positive. Figures 5 and 6 show the trade balance in the specific electronic categories. Consumer electronics is the primary detriment in electronics merchandise trade, with a $6.4 billion trade deficit. Industrial products (largely computers) are the primary asset with a $10.5 billion trade surplus. The electronic merchandise trade surplus decreased from $6.9 billion in 1980 to $3.2 billion in 1982 because of increased imports in consumer electronics from $4.5 billion to $6.7 billion, with little change in U.S. exports in this area. The electronic industrial products increase of $744 million in exports to $14,960 million was not sufficient to compensate for the consumer electronics imports increase. The overall electronics merchandise trade balance, however, has remained positive.

Information products (as well as other items in the economy) have significance not only as merchandise, but also as services. Although statistics on services are not as well documented, the following rough analysis shows the influence of services to the overall international balance of goods and services. Services, as defined by the U.S. international transaction accounts, are only about 40% of U.S. exports and 30% of U.S. imports. Figure 7 shows that when including both merchandise and services, the international balance has in fact been positive for all years in the last decade but 1977, 1978, and the current value for 1982 (not shown on the graph).[8]

Figure 8 compares imports and exports, as well as the trade balance for private sector merchandise and service. Again it can be seen that the positive balance of services has been greater than the deficit of merchandise, thus insuring

[8] Figure 7 also shows the balance in the overall Current Account, which includes unilateral transfers (U.S. Government grants, pensions, etc.) in addition to the balance on goods and services.

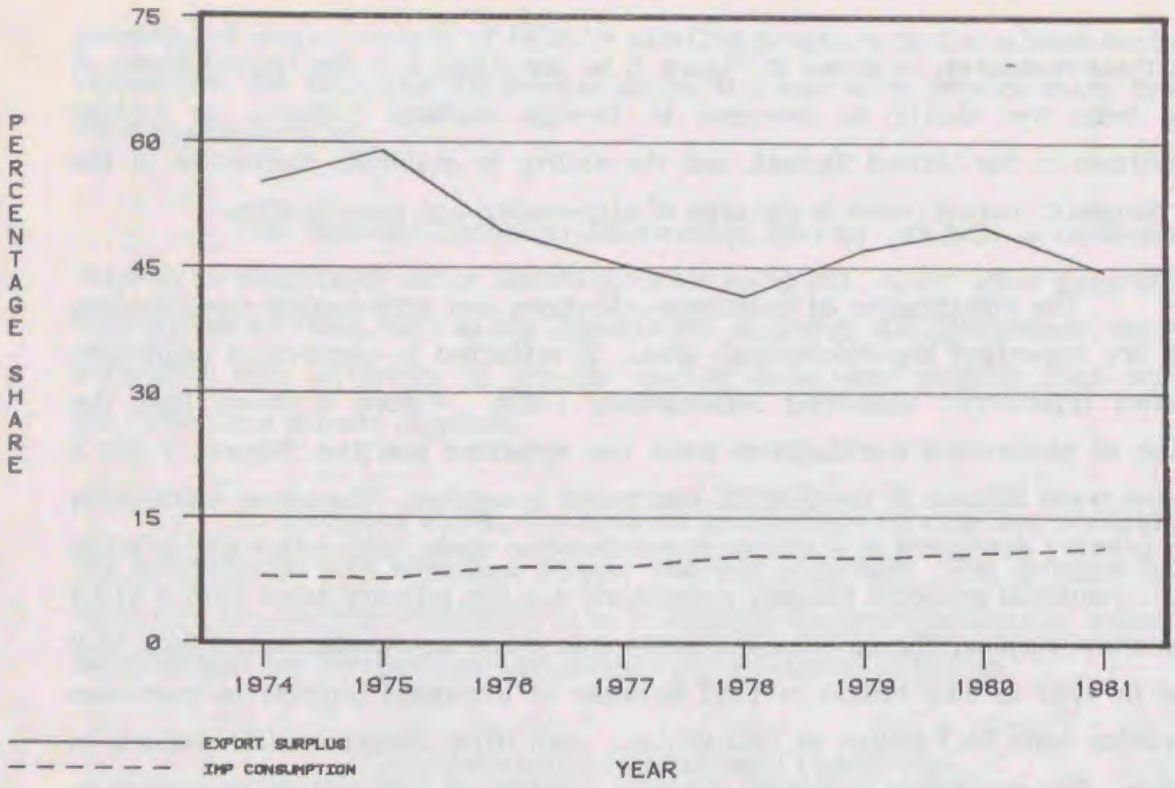

Figure 3. U.S. high-technology competitive measures.

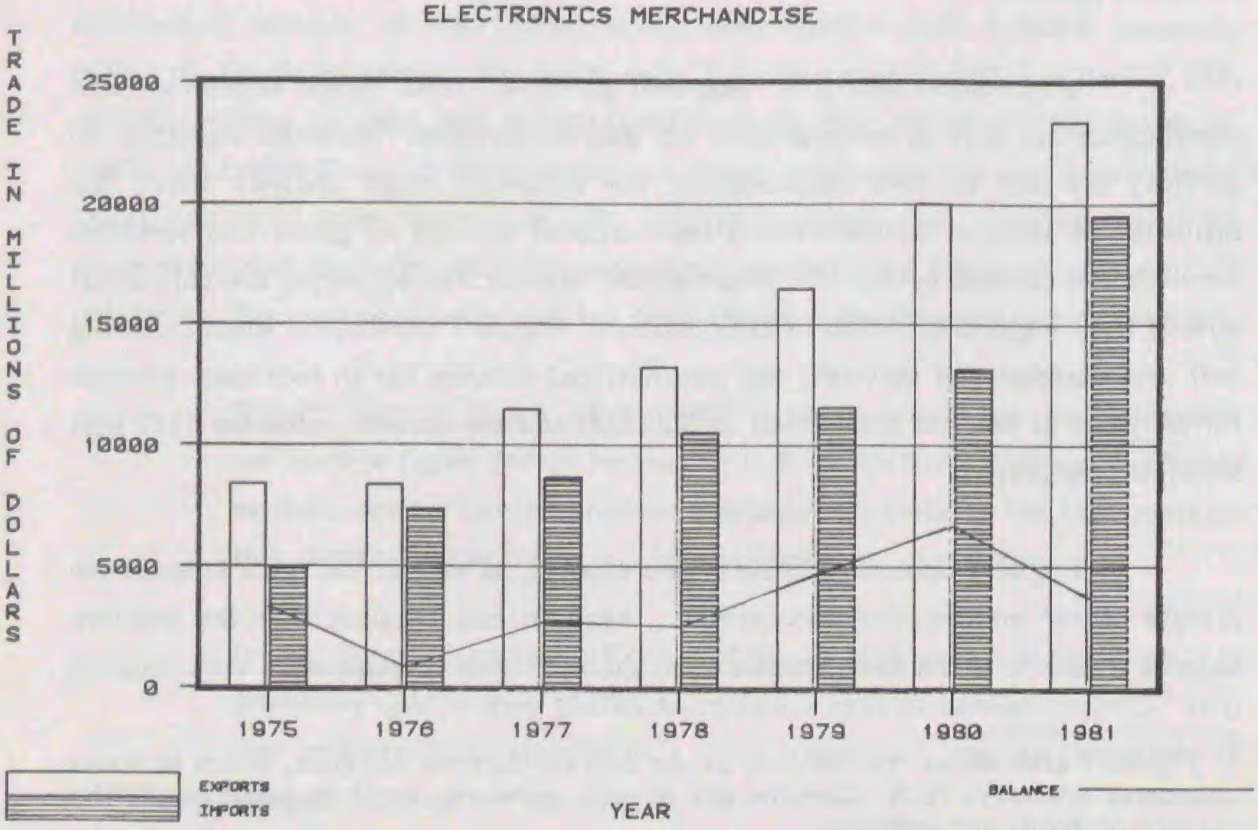

Figure 4. Electronics merchandise trade balance.

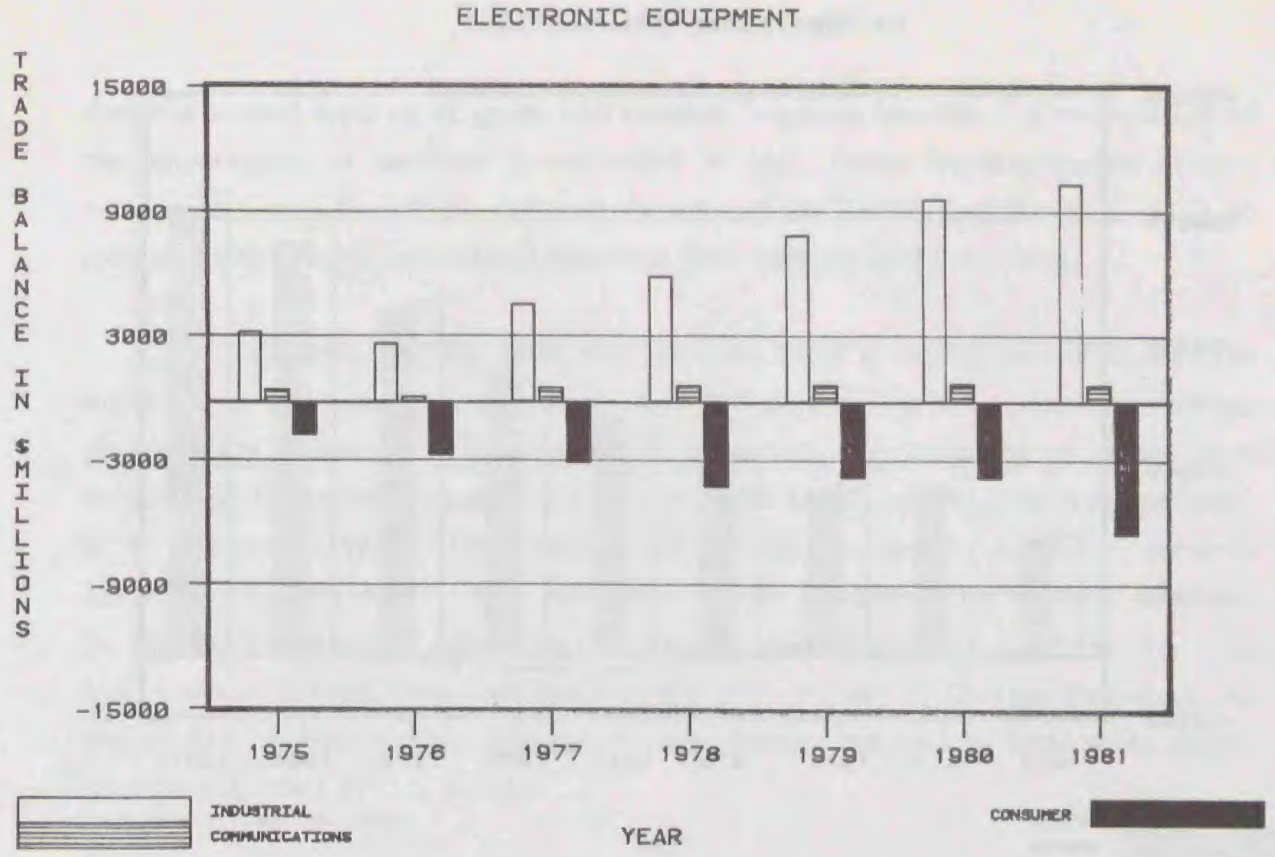

Figure 5. Electronic equipment trade balance.

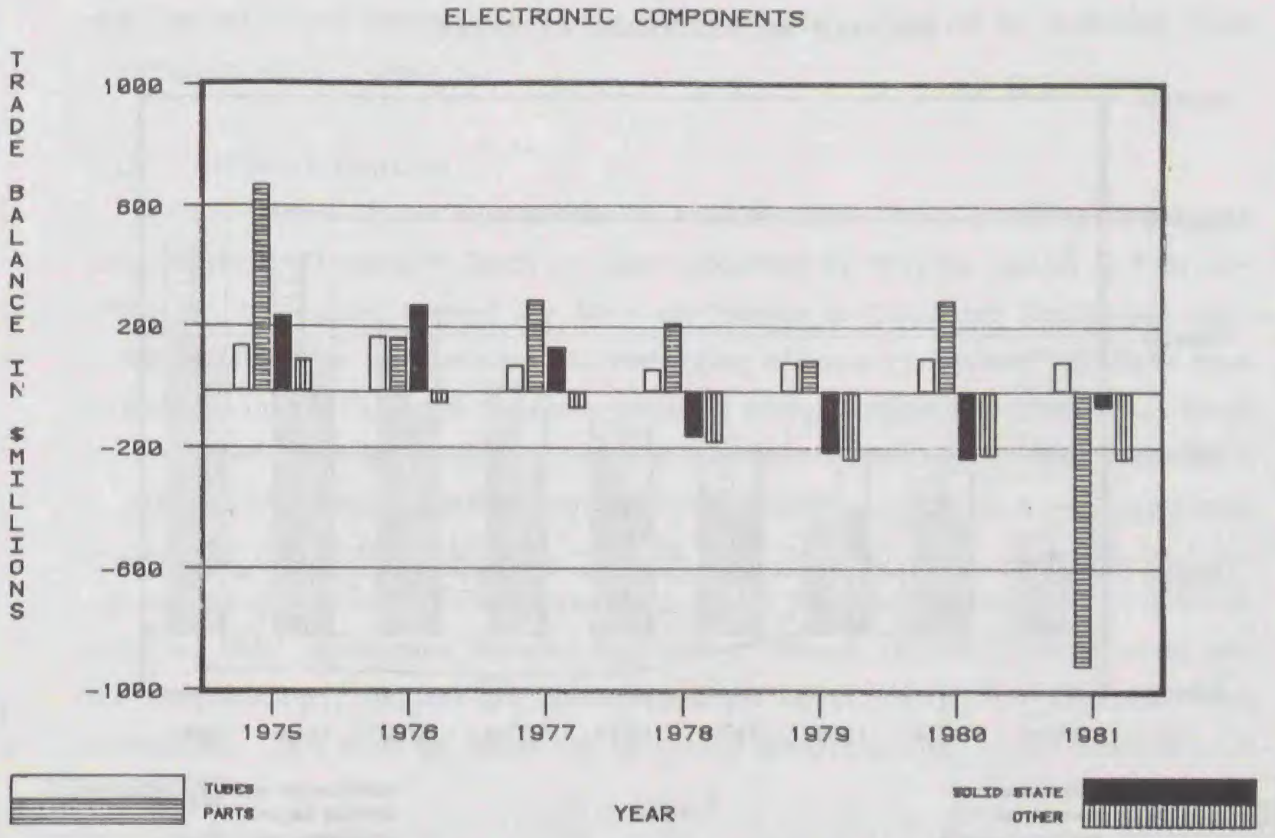

Figure 6. Electronic components trade balance.

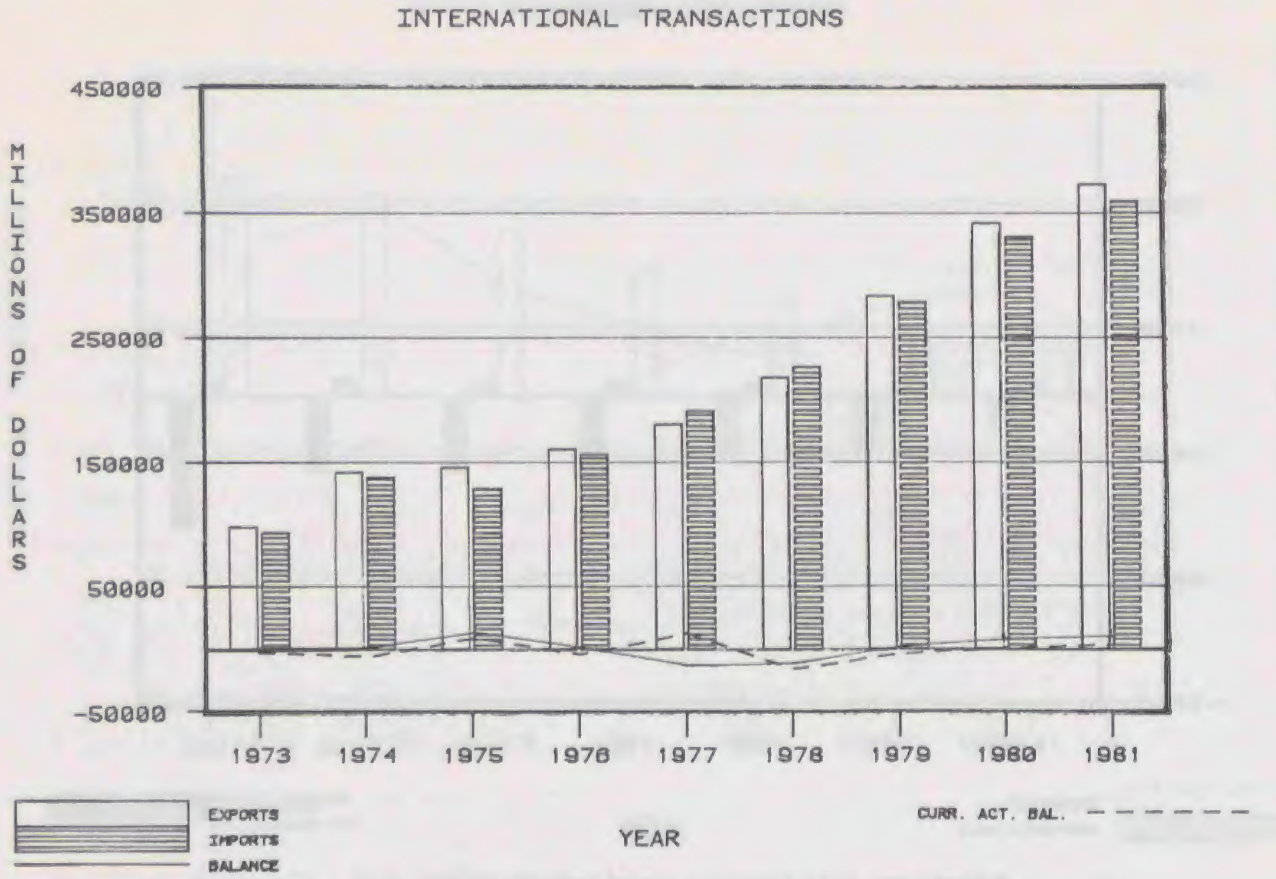

Figure 7. International balance of goods and services.

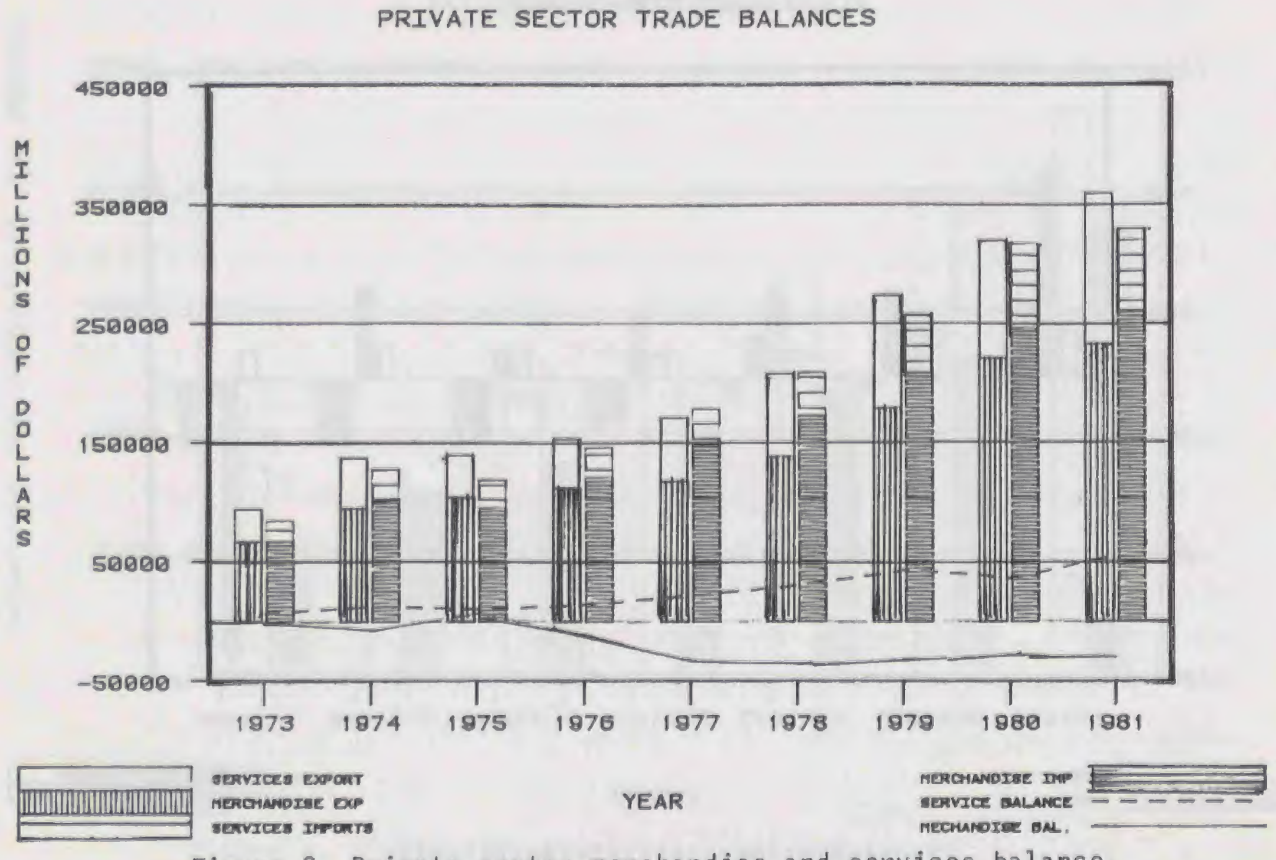

Figure 8. Private sector merchandise and services balance.

that the overall balance of goods and services has been positive. A recognition of the importance of services is reflected in U.S. Trade Representative Brock's seeking an extension of the General Agreement on Tariffs and Trade (GATT) to include trade in services at the November 1982 Geneva GATT meeting.

We have already seen that services have a very pronounced positive influence on the international balance, and that electronics has a positive influence on the trade balance. It is desirable to determine the influence of information services on the international balance. Alexander (1982) updated statistics presented by Barovick (1982) which estimate the foreign business of the U.S. services industries (see Table 6). Their estimates are for private sector business as shown in Figure 8, but are substantially greater than those presented in the U.S. International Transactions (published in the U.S. Survey of Current Business). As explained by Barovick, their analysis includes foreign business by local sales abroad done by affiliates of U.S. firms.

This rough aggregation of information-intensive services shows that they contribute significantly to exports (and amount to about 40% of all service exports). It is necessary to obtain better service and information area statistics in order to determine where Government might provide incentives to maximize these information service exports.

2.2.2 R&D Joint Ventures

United States semiconductor manufacturers have proposed developing cooperative R&D ventures (such as those supported by MITI in Japan). In February 1983, ten companies formed the Microelectronics & Computer Technology Corporation (MCC) for this purpose. At the urging of industry, several bills have been introduced in this Congress to lessen antitrust action against high-technology firms that engage in such joint R&D ventures in the United States (H.R. 108, H.R. 1952, S. 568, S. 737). United States semiconductor companies maintain a very aggressive program of international joint agreements and licensing, which transfers technology to foreign companies--particularly to Japan. (Research Managment, 1982b) In addition, U.S. companies transfer technology through technical conferences and the establishment of foreign based research, development, and manufacturing operations. Care must be taken not to inhibit creativity that comes from diverse thought.

TABLE 6. Foreign Business of U.S. Services Industries (1981)

	$Millions		
Receipts for exports, total	$ 32,246		
Travel	$ 12,168		
Passenger fares	2,991		
Other transportation	12,168		
Fees and royalties			
from affiliates	5,867	*	
from non-affiliates	1,386	*	
Other Private Services	5,940	**	
Income of foreign affiliates, total	$ 92,964		
Oil and gas field services	$ 6,454		
Petroleum tanker operations	9,576		
Pipeline transmission, oil and gas	1,823		
Finance, insurance, and real estate	20,703	*	
Banking	4,290	*	
Construction	20,889		
Wholesale and retail trade	5,196	*	
Transportation and communication	15,570	**	
Hotels and lodging	1,799		
Advertising	1,583	*	
Motion pictures, TV tape, and film	1,234	*	
Engineering, architecture, surveying	4,695	*	
Accounting	503	*	
Other personal and business services	5,678	**	
Total, exports plus affiliate's income	$128,210		
Information intensive services	$ 58,232		41% of total services

Notes:

* Information intensive services
** Assumed to be half information intensive goods vs services

The problem in foreign trade may not be the lack of American innovation through research (much of which is supported by the U.S. Government--particularly DOD), but the lack of techniques to compete in manufacturing. The need to maintain R&D strength through tax incentives is desirable. This is supported by H.R. 702 and H.R. 1887 in the current Congress, and by Vice President Bush's endorsement at the Spring 1983 Electronic Industries Association conference. However, it may be as important to develop tax incentives to stimulate creativity in the manufacturing processes. IBM has identified this problem, and is currently working with industry to find improved manufacturing techniques (Robinson, 1982).

2.2.3 Security vs Information Dissemination

The free flow of information within the research community is essential for maximum creativity and innovation. As stated by the American Academy for the Advancement of Science:

> "Science gets at the truth by a continuous process of self-examination which remedies omissions and corrects errors." (American Association for the Advancement of Science, 1975)

Industry imposes its own restrictions on transfer of information as deemed necessary to protect its commercial interests. The academic community feels strongly about the need for unrestricted flow of information. Almost everyone realizes both that there are times of international stress when R&D information flow must be restricted for purposes of national security, and that such restrictions impose some degree of restraint on creativity. The issue centers on the extent to which information should be suppressed by Government for the purpose of national security. This debate is carried on monthly in the science and engineering literature. In addition, there have been recent meetings between industry and Government representatives (including Dr. Keyworth, the Presidential Science Advisor) to discuss the issue, but with no resolution. Dr. Keyworth has expressed interest in the need for closer interaction between Government (particularly the Defense Department) and the private sector. This issue is far from being resolved.

2.3 New Considerations in Intellectual Property

In an information-oriented society, the nature of intellectual property rights are of great significance. Because of information's unique features, establishing and enforcing information property rights present the policy maker with some distinctive problems. Widespread allegations of information piracy are a sign that technology is turning our laws and customs, which protect intellectual property, into anachronisms. While Congress has been addressing the issue, the need for a clarification of public policy remains, especially concerning video and audio recording, and the protection of computer-related intellectual property. Some factors influencing intellectual-property policy include: (1) the conflict between the First Amendment and Intellectual Property Rights, (2) the lack of a clear moral mandate about who should own information, (3) public indifference toward "information theft" arising from the unique features of information, and (4) the purpose of establishing property rights in intellectual matters. This section explores these aspects of Intellectual Property Policy.

2.3.1 The Increasing Importance of Intellectual Property Rights

The establishment of property rights is one of the central mechanisms by which a society determines its nature. The organization of society, its potential for development, and the distribution of wealth and income among its members are all affected by this institution. What kind of property rights a society establishes determines to a large extent what that society is like, not only economically, but socially and politically as well. In countries based on a free-market economy, clearly defined and enforced private property rights are essential to the smooth and efficient functioning of society.

Information is playing an increasingly important role in our society. People are spending (and will continue to spend) a greater portion of their time doing such things as gathering facts, entertaining, being entertained, expressing ideas, borrowing ideas, acquiring knowledge, reading, writing, thinking, researching, and so on. All this involves working with information or ideas.[9] Tangible

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[9] These terms are used interchangeably here to refer in a general way to the variegated activities just mentioned.

physical goods are decreasing as the focus of our activities, and information is becoming the central good and resource of our society. (E.g. see Figure 1)

Because information is now replacing physical goods as the dominant commodity in our society, issues concerning property rights to information are becoming very important. How to distribute rights to information among its members is a crucial issue facing the information society. We can choose to define property rights in information in the next few decades in such a way as either to encourage or retard the development of the post-industrial society. Public policies concerning intellectual property rights will, to a large extent, determine what such a society is like.

2.3.2 Difficulties In Definition and Enforcement

It is exceedingly difficult to decide what kinds of property rights to information are appropriate. There are several reasons why it is especially difficult to determine what the appropriate nature and extent of property rights in information should be. First, the concepts, customs, and laws of property originated with physical property and hence are not easily or always appropriately extended to information. Second, information is an amorphous and nontangible good. It is hard to indentify information and separate it into discrete units to which one can assign exclusive rights. One can not easily quantify information or precisely determine its value, and hence it is hard to assign a price to it and trade it in the market.

Furthermore, it is extremely difficult to exclude other people from information. The ability we have as a society to control who has certain information--and who doesn't--is not only limited by our political values, but also by the very nature of information itself. Unlike physical goods, information can not be controlled simply by taking physical possession of it (or, rather, possession of its physical embodiment).

Consider the following example. I pick a bushel of apples from a tree. In this case, it is easy to identify what it is that I own and to separate it from what is owned by others. I can exclude other people from my apples simply by taking physical possession of them. I can easily break up my possession into units and sell them one at a time.

But if I develop a piece of information, the situation is rather different. Let us imagine that I have written a computer program. It may not be easy to identify exactly what it is that I own, for I may have written it with someone else, and I probably used ideas I had borrowed from other people's programs. I can easily exclude others from it, only if I keep it secret. Once I have divulged it, my ability to exclude others from it has been greatly diminished. If I sell an apple to my neighbor, I do not have to worry about everyone else in the community ending up with apples, thereby destroying the market for the rest of my apples. But if I sell my program to a neighbor, I do have that worry. Very quickly everyone in the community may have the program, and I will be left without a market. Not only is it hard to establish property rights in information, but it is harder still to prevent others from infringing those rights once they are established.

2.3.3 Alleged Widespread Piracy of Information

"Piracy" consists of gaining access to information without the permission of its creator. The majority of--if not virtually everybody in--our society has done something that owners of information would claim violated their intellectual property rights.

If you have done any of the following, you have violated--or have at least purportedly violated--someone's intellectual property rights. If you have taped music, either off records borrowed from friends, from the library, or off radio or T.V., it has been claimed that you are infringing another's intellectual property rights without paying proper compensation (Schrage, 1982). The recording industry attributes much of its recent decline to home taping of music. (Recording Industry Association of America, 1982) If you own a videocassette recorder and have taped T.V. shows in order to watch them at some other time, the movie industry claims you have violated copyright law (Valenti, 1983). There are bills before the current session of Congress which, while exempting home recording from copyright infringement, would insure that the consumer pays more for the taping equipment by requiring its manufacturers to pay a royalty to the movie industry.

If you receive cable or Pay T.V. and are not fully paying for it, you are infringing the rights of T.V. show owners. If you have copied more than one chapter of a book, or two or more articles by the same author, you have exceeded

the copying allowed under the doctrine of fair use. (U.S. House of Representatives, 1976, pp. 68-70) Borrowing another person's copyrighted computer program and using it on your computer is an unauthorized use of that program. (Immel, 1983) If you have ever quit your job with one company and gone to work for another, taking with you and then using specialized information you had learned or developed at the first company, there is a good chance that you have violated trade secret law. Those who have used a substantial number of another's words without proper acknowledgement in footnotes have infringed on the rights of the author who wrote them. One might doubt that there are many of us who live in contemporary U.S. society who have not engaged in at least one of these practices.

Instances of alleged piracy will continue to become more frequent. Advances in technology have exacerbated, and will continue to exacerbate, this problem. New information technologies, which have increased the ability to create and disseminate information, also have made it far easier for users of information to access it without the permission of its creator. In the future, such phenomena as photocopiers in the home and widespread personal-computer access to libraries and data bases will continue to present challenges to our system of intellectual property protection. Technology continues to turn the copyright, patent, and trade secret laws into anachronisms. It continues to call into question the adequacy of our customs concerning rights to nontangible goods.

2.3.4 Recent Legislative Concerns

There has been a good deal of legislative activity on intellectual property rights. Reviewing the legislative history of this subject can give one a good sense for the kind of intellectual property issues that attract enough attention to become questions of national policy.

In 1980, a law was passed that explicitly made computer programs appropriate subject matter for copyright. Public Law 96-517 also allows owners of programs to make an archival copy without infringing copyright. In 1981, Public Law 97-180 was passed. Known as the Piracy and Counterfeiting Amendments Act, it increased penalties for unauthorized mass duplication and selling of records and movies. Last year, Public Law 97-366 exempted veterans and fraternal groups from performance royalty payments to writers and musicians.

In the last session of Congress, numerous bills were introduced that addressed intellectual property rights. H.R. 4727 would have increased penalties for unauthorized reception of subscription telecommunications signals, thus subjecting individuals who own home satellite dishes to significant fines and imprisonment. The perennial bill aimed at establishing performance rights in sound recordings was introduced as H.R. 1805. Song writers have public performance rights that allow them to collect royalties when radio stations (and others) play their songs. Under current law, recording artists have no such rights. This bill would have given those who make records similar public performance rights.

The current 98th session of Congress has also been active in this area. Numerous bills have been introduced dealing with the issues behind the celebrated Sony Betamax case (decided January 17, 1984 by the Supreme Court). Bills H.R. 175 and S. 175 would exempt home tapers of T.V. shows from copyright infringement. Bills H.R. 1030 and S. 31 would also do this, but in addition, they would require manufac turers of video and audio tapes and recorders to compensate copyright owners through payment of a royalty. Questions involved in this issue include: (1) Is home taping of records, audio and video broadcasts, or video cassettes a violation of copyright or is it fair use? Perhaps more to the point, should these activities be considered acceptable or not? (2) What responsibility, if any, do the producers and distributors of video tape recorders have for this activity (if it should be ruled inappropriate)? (3) Should a tax be levied on tapes and recorders, which would go to the producers of the taped material? Wouldn't this be unfair to those who use these items in noninfringing ways? (4) Are there differences between the audio and video industries that could ground a distinction in policy between the two kinds of taping? Since this issue is one of public policy and not simply a legal question, perhaps the administration should take a firm stand on it.

Rental rights bills (H.R. 1027, H.R. 1029, S. 32, and S. 33) would give the right to rent a record or video cassette to the copyright owner. Current law gives this right to the person who owns the record or video cassette. (17 USC 109(a), 1976) The issue here is who should have the rental rights to a copy of a copyrighted work: the owner of the copyright or the owner of the particular copy of the work (the record or video cassette)? The issue arises because the video cassette retail market has been badly hurt by the video cassette rental market (understandably, since a cassette sells for $30-50 and rents for only $5). With

record rental stores springing up around the country, another blow may be inflicted on an already suffering recording industry, as well. It is not clear, however, why there needs to be legislation on this issue. Why couldn't the movie and recording industries sell their products with the stipulation that the rental rights are not being sold and continue to belong to the copyright owner?

Another bill, H.R. 1028, would give copyright protection to semiconductor chips. But this bill addresses only one small (though important) aspect of a major problem concerning the protection of computer-related intellectual property. Although the computer programs were specifically added to the subject matter of Federal copyright law in 1980 (P.L. 96-517), many claim that protection is still inadequate. One problem is that a program that can be legally protected as software (with copyright law) is only doubtfully so protectable when physically embodied in the computer, either as firmware or as hardware. (Apple v. Franklin, 1982; Apple v. Franklin, 1983) Patents are more likely to be the appropriate form of protection for such programs than are copyrights. But patent protection is notoriously difficult to achieve. It may be that computer programs physically embodied in a computer fall between the cracks of laws that protect intellectual property.

Even the ability to copyright computer software may not adequately protect it since copyright involves disclosure and people are then free to use the ideas disclosed (although not their concrete expression). Thus many in the computer industry have taken the route of trade secret to protect their intellectual products. But this method of protection has its own problems both from the perspective of society and the owner. The lack of disclosure can be seen as unfortunate from society's perspective since without disclosure there is no way to build on the achievements of others.

For the owner of the intellectual property, trade secret protection is not completely satisfactory either. It is a well-known fact about the computer industry that employees frequently leave a company in order to join another company or to start their own. When they leave, they often take with them a vast amount of useful and economically valuable information that was supposedly protected by trade secrets.

Given the key role computers will play in our society, it may be an important public policy goal to formulate clear and unambiguous laws for protection of computer-related property. Perhaps support of the Semiconductor Chip Protection Act of 1983 (H.R. 1028) is thus desirable. It may also be in the public interest to increase the penalties for pirating and counterfeiting computer software (see H.R. 6420 of the 97th Congress) as was done for record, tape, and films (P.L. 97-180).

Finally, cable copyright is once again an issue with, H.R. 1388 proposing full copyright liability on local cable companies that import and show distant T.V. signals. As can be seen from this survey, issues concerning intellectual property rights have been an important concern of Congress the last few years. The Copyright Act of 1976 certainly did not settle the issues in this area.

2.3.5 Public Policy Considerations

How should one decide what the appropriate public policies are for intellectual property? The following four considerations are important in evaluating disputes about intellectual property rights.

First Amendment and Intellectual Property Rights

There is a tension between principles underlying public policy concerning this issue. It is the tension between the First Amendment and intellectual property rights. On the one hand, the Constitution requires that we "Promote the Progress of Science and the useful Arts by securing for limited Times to Authors and Inventors the exclusive right to their respective Writings and Discoveries." (U.S. Const. art. I, Sec. 8, Cl 8, 1788) Congress has met this mandate with the patent and copyright statutes. But by giving the creators of information a limited monopoly in its use, we restrict the free flow of information (albeit for the sake of increasing the future flow of information). The copyright and patent monopolies give a power of partial censorship to the owner of intellectual property. On the other hand, the First Amendment to the Constitution declares that, Congress shall make no law abridging the Freedom of Speech or of the Press, thus indicating a strong preference for the free flow of information. Certainly the copyright and patent statutes restrict the freedom of speech and press to some extent.

Thus there are conflicting requirements within our country's political philosophy concerning the free flow of ideas. Public policy concerning intellectual property rights must aim at a delicate balance between the rights of the creators of information to control its use, and rights of the users of information to access it. Policies must not stress the rights of one group to the exclusion of the other.

The Moral Question

It is important to realize that the issue concerning the ownership of information is not only a legal question, but also a moral one. The problem is not simply that our present laws dealing with intellectual property are inadequate. The moral question of who should own a piece of information is often as difficult as the legal question of who does in fact own it. There are not obvious answers to questions about who has the moral rights to own certain information.

Consider the following question: Who should own broadcast music that I receive over my radio and that I am thinking about recording? There are at least five different candidates who could claim--with some legitimacy--that they have moral rights to this music. (1) I have good grounds for claiming rights to it. After all, I received it on a radio that I bought and own. I also had to listen to the commercials and do the work of recording it. (2) The radio station also has a legitimate claim to this music, for they bought the record, played it, and broadcast it over the air. (3) Certainly the musicians who played the music have some rights to it. (4) The record company who recorded, produced, and distributed the album would also seem to have a legitimate claim to this music. (5) We must not forget the song writers, for they wrote the music and the words.

This example shows that from the moral point of view it is often unclear who should have rights to information. Problems concerning intellectual property rights do not just result from inadequate laws for which there are obvious and clear improvements. Not only is it often unclear who does in fact own a piece of information, but it is often unclear who should own a piece of information. Since issues concerning intellectual property rights are not simply matters of law, they should not, for the most part, be decided in the courts. They are issues of public policy which Congress has an obligation to address squarely.

Unique Features of Information

Why are people much more willing to appropriate information without the consent of its owner than they are willing to steal physical goods? Some may answer cynically that people do so simply because they can get away with it. If stealing physical objects were as easy as stealing information with the new technologies, people would do the former just as much as they do the latter.

But there is something deeper here. Unauthorized taking of information does not feel like stealing. The reason is that information is not spatially delimited. Unlike physical objects, one person using information doesn't preclude others from using it as well. Any number of people can use information at the same time. Information is not used up when someone consumes it. Put in the language of economics, the marginal cost of information is zero. Since it costs nothing for others to have information,[10] it does not seem wrong to take it even though so doing may be against the wishes of its owner. (Think of sneaking in to watch a basketball game. It costs no one anything for me to watch it and hence it does not seem so wrong to do it.) Perhaps this is the reason why piracy is so widespread: People do not think it is wrong.

The fact that information is nonexclusive in this way, that the marginal cost of consuming it is zero, is an important factor for public policy with respect to intellectual property. It suggests that the exclusivity features normally associated with private property may not be appropriate with respect to information. If it costs nothing more for everyone to have something than for one person to have it--as is the case with information (leaving aside the cost of distribution)--it seems foolish from a social perspective to give exclusive rights to that good to an individual. Why should only one person enjoy a good when everyone else could also enjoy the same good?

In fact, in our society, private property rights to information are not as exclusive as are private property rights to physical objects. Federal copyright and patent protection for information are contingent on public disclosure. When

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[10] Of course there is an additional communication cost for each extra user. But the cost of the information itself, as opposed to its transmission cost, remains unchanged no matter how many people receive it.

protection is granted, the information is made available for public inspection at the Patent and Copyright offices. Thus our society gives some degree of protection to information creators while insuring that others in society can learn from and build upon these ideas. There may be other ways in which we as a society should also limit the exclusivity of intellectual property rights.

Purpose of Property Rights in Intellectual Matters

Why does society give property rights to information creators? There are two different kinds of reasons usually put forth to justify this practice. The relative importance one places on these alternative rationales for intellectual property rights is likely to affect the concrete decisions one makes concerning policy about such property.

One possible justification for these property rights is that information creators have moral rights to the fruits of their labor. According to this view, intellectual property rights are but the legal acknowledgement of moral rights the creators of information have to their creations. If I make something, I have a moral right to possess it. The law should thus give me a legal property right to it. Call this the "nonconsequential justification." If one holds that this is the primary reason for intellectual property rights, the focus of policy will be on the creators of information. Intellectual property rights are established to legally protect information creator's moral rights to their creations.

The inconsequential justification is to a certain extent implausible. It assumes that no one other than the information creator had any part in creating the intellectual good. But thought does not operate in a vacuum. Intellectual creation is not creation ex nihilo. Ideas are to a large extent the product of a certain time and culture. What I create intellectually or artistically is greatly influenced by my education, the society in which I live, and the world around me. In short, other people play a large role in shaping the intellectual worker's product. Hence there is an important sense in which the fruits of "their" labor are not simply the fruits of their labor alone. The society a creator lives in is a condition of the possibility of his or her creation. The creator thus does not have exclusive moral rights to the intellectual product. The society that nurtured and helped make him or her what he or she is also has some claims on it.

The inconsequential justification conflates the created object which makes a person deserving of a reward with what the reward should be. Intellectual workers who create something socially valuable certainly deserve something for their creative labor. But it is far from clear that what they deserve are property rights in the created product.

The other kind of justification of property rights in intellectual matters is one that is perhaps more often actually used in arguments supporting these property rights. This argument justifies giving property rights to information creators on the grounds that they are necessary as an incentive to stimulate the production of information. Call this the "consequential justification." The argument is that people would not create a desirable amount of information without the economic incentive of receiving property rights to that information. On these grounds, then, the ultimate goal of property rights in information is to encourage the creation and thus the widespread use and dissemination of information. Giving information creators property rights is a means to insure more information for the user. The reasoning behind this justification is somewhat paradoxical. Society gives certain of its members the right to restrict the dissemination of information--which is what a property right in information essentially is--for the purpose of increasing the dissemination of information.

The focus of intellectual property policy justified on this basis is on the benefits to society at large, and on the user of information in particular. Property rights are given to creators only insofar as they achieve the goal of benefitting the users of information. If one thinks this is the only (or primary) justification of property rights in information, then one will extend property rights to creators to the point at which so doing no longer increases the long-run dissemination of information, and no further. One will be suspicious of any extension of property rights which is not clearly needed as an incentive for the production of information.

If this is the only rationale behind intellectual property rights, then any property rights information creators have that are not necessary as incentives will be unjustified. The search for alternative incentives for the creation of information that do not directly constrain its flow (as do property rights) will take on a

good deal of importance.[11] These alternatives will be preferred insofar as they provide equally powerful incentives for the creation of information. For a policy that furthers its own goal without at the same time hindering the goal will, of course, be preferable.

There may be better ways to encourage the production and dissemination of intellectual goods than the method of granting intellectual property rights, giving creators the right to restrict the dissemination and use of information. Public policy should put more effort into finding those incentives for the creation and dissemination of information which are not counterproductive--as are property rights in the created information.

One can see the rationale behind intellectual property rights either as the legal acknowledgement of preexisting moral rights of information creators, or as devices to further the social goal of increased dissemination and use of information. Which of these two the policy maker takes as the fundamental justification behind intellectual property will determine whether it is the information user or creator who will be the focus of intellectual property policy.

It would be hard to overestimate the significance of intellectual property policy for the post-industrial, information-oriented society. Allegations of widespread domestic and international piracy are a symptom of an impending crisis in a system of private intellectual property designed for another era. Congress and the Executive Branch will have to give the courts and society clearer guidance on these matters. Given the new technological era we now are in, a fundamental rethinking and reshaping of our society's policies and customs dealing with intellectual property may be required.

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[11] For example, such incentives could be monetary, or they could involve public recognition and gratitude.

3. CONCLUSIONS

The purpose of this report is not to resolve issues, but to provide an initial introductory step in a project to formulate domestic and international information policy. Nor does the report provide a comprehensive agenda. (For other issues see e.g. Yurow, 1981 and Horton, 1982.) It does, however, suggest a holistic approach to the development of information policy; the assumption being that the synergism created by the new information opportunities is an integral part of the economy and the society.

Intelligence is the unique characteristic of the human being. Information policy is not only concerned with the expanding opportunity to handle the quantity called information, for example through the new telecommunications and computer technologies. but it is concerned with the opportunity for man to explore and extend his intellectual capabilities.

There are many challenges that must be addressed as governments formulate information policy directions. The concentration at the present time is on establishing viable positions in the international marketplace for new information products. In contrast to manufacturing, the development of information services is not so much determined by how nature has distributed natural resources throughout the globe, or even by the cost of labor, but rather the ability of a country to develop its intellectual creativity.

Each nation must resolve information policy issues in terms consistent with its own political philosophy and values. The United States is currently facing a range of seemingly independent information issues at the present time. Education is certainly an important issue, not only for the development of the new technology, but so that the Nation in general will have the opportunity to take advantage of the resultant capabilities and point the direction for market demand. The United States appears to have maintained leadership in critical information technology research. It has, however, had some difficulty in maintaining a price competitive advantage of information oriented goods in the international marketplace.

We are just beginning to examine the issues concerning the character of information itself. Today these are centered on the rights associated with what is called intellectual property--primarily copyright and patents. These include concerns about the domestic and international respect for such protections, and the piracy of comunications signals stimulated by the current ease of reproduction of electronic signals. The tensions that are yet to be resolved include the conflict between the First Amendment freedoms, property rights, and privacy.

In 1968, the United States took a first step in information policy development by setting the stage for opening up communications to meet the diverse information requirements that it was felt would inevitably evolve. (Rostow, 1968) The need for new policies to accommodate new opportunties in the creation of intellectural property was recognized in the 1976 revision to the Copyright Act, and the continual need for modification since then.

The choice exists at this time either to address specific information policy issues in the context in which they arise, or to attempt to set a broader framework for their evaluation, as was done for telecommunications in 1968. In either case, information policy will continue to be an important component in the Nation's economic and social development.

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15. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Today, three-quarters of the U.S. employment and one-half of the Gross National Product (GNP) are associated with services. In 1981, services employment predominated, for the first time, over both agriculture and manufacturing, even in the Third World countries. The increasing importance of services to the economy and the society has been stimulated by the greater availability of information and communications products. This report presents the initial analysis of a project devoted to formulation of national information policy as necessary to accommodate the new opportunities presented by advanced information technologies, and the impact on the economy and society. After defining the meaning of information policy, the report discusses current issues concerning domestic industry growth, maintaining international leadership, and new considerations regarding intellectual property.

16. Key Words *(Alphabetical order, separated by semicolons)*

economic development; education; information policy; intellectual property; international trade; research and development; services economy; telecommunications policy

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NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

TELECOMMUNICATIONS CHRONOLOGY

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GENERAL HISTORY

1839 Samuel Morse successfully completed experiments to transmit coded messages via the telegraph.

1842 First commercial use of telegraph. Patent for telegraph offered to U.S. government for $10,000--government refuses.

1847 Post Office sold telegraph operations.

1947 Fifty competing companies established, including New York and Mississippi Valley Printing Telegraph Company.

1856 Western Union Telegraph Co. formed from the New York and Mississippi Co. and others.

1876 Telephone invented and patent issued to Bell Patent Association.

1877 Western Electric entered into competition with Bell System.

1878 Bell Telephone Company patent infringement case against Western Union.

1879 Bell/Western Union case settled with Western Union withdrawing from telephone industry and Bell withdrawing from public message telegraph business.

1880 American Bell Telephone Company operated long lines and licensed 185 local operating companies.

1880 American Bell brought 600 patent infringement suits resulting in failure of local competitors in this decade.

1881 Postal Telegraph Co. established.

1881 Bell acquired Western Electric from Western Union to manufacture communications apparatus.

1893 Bell patents expire (Bell's initial advantage in face of new competition is its intercity links).

1896 Wireless telegraph invented.

1903 Ownership of telephone plant 50% AT&T (3.1 million stations), 50% independents (3 million stations).

1907 J. P. Morgan assumes control of Bell--brings Theodore Vail in to mange the company again (Morgan and Vail shared the conviction that telephone service should be provided by one national monopoly).

1907 AT&T continues, in most cases, to refuse to interconnect competitors (the independent telephone companies). This hurts the independents by depriving them of access to AT&T's growing toll network as well as

access for their customers to some cities and areas served solely by Bell. An early effort in 1899 by the independents to build their own toll network was frustrated by J. P. Morgan who cut off credit for the project.

AT&T pursues aggressive expansion policies. When an independent got into financial trouble, Morgan would use his power to cut off the struggling competitor's credit--Vail would then make an offer to buy the independent out--the independent had little alternative but to sell.

1910 AT&T takes over Western Union Telegraph.

Mann-Elkins Act strengthens control of the Interstate Commerce Commission over wire and radio communications.

By 1910, most states included telephone and telegraph services among those regulated by their public utility commissions.

1912 Ownership of telephone plant 75% AT&T, 25% independents.

1913 Public outcry over AT&T-WU deal leads to the Kingsbury Commitment to end AT&T's external expansion. Commitment: 1) AT&T divests itself of Western Union and agrees to stay out of the telegraph business, 2) AT&T agrees not to take over any more independents without the approval of the ICC, and 3) AT&T agrees to interconnect its system with independents.

Postmaster General Burleson calls for the nationalization of telephone and telegraph (called at the time "postalization").

1918 After much debate, the government assumes control of the communications network for the duration of World War I. After the war, and in the spirit of Harding's "return to normalcy" pledge, AT&T resumes private control and ownership of its network.

1921 Willis-Graham Act speaks to structure and regulation of communications industry; patterned after the 1913 Kingsbury Commitment.

1922 Hall Memorandum reiterated AT&T's committment to avoid acquisitions of competing companies, except in special cases.

1924 Bell Telephone Laboratories established.

1929 Postal Telegraph Company failed.

1934 Creation of the FCC to regulate radio and wire communications.

1935 P.H. Walker opens a thorough investigation of the telcos--particularly AT&T. Premature release of the report on AT&T exposes confusion over costs and pricing. Report is deferred by advent of World War II.

1949 After the war there is a return to the questioning of AT&T's activities culminating in the filing of an antitrust suit against AT&T. The suit

asks for divestitute of Western Electric and splitting AT&T into three companies.

1949 AT&T takes over management of Los Alamos Project--Sandia.

Antitrust case moves slowly through political and judicial obstacles.

1953 Attorney general under President Eisenhower looks for way to settle with AT&T.

1956 Out-of-court settlement of antitrust case includes: 1) AT&T does not have to divest itself of Western Electric, 2) Western Electric will limit sales to AT&T operating companies, and 3) AT&T will limit its operations to telephony--stay out of radio, motion pictures, television, etc.

1965 E. W. Henry of FCC calls for new investigation of AT&T, but investigation is never finished because of clashes between AT&T Chairman Kappel and FCC Commissioner Henry.

1974 Justice Department files antitrust case against AT&T citing anti-competitive behavior with respect to new entrants in the specilized common carrier and terminal interconnection industries.

1979 Communications Act rewrite introduced into the House (H.R. 3333) and Senate (S. 611 and S. 622).

1980 Communications Act rewrite introduced into the House (H.R. 6121) and Senate (S. 2827).

1983 Justice Department endorses AT&T reorganization plan (March).

AT&T HISTORY

1885 Theordore Vail was president of AT&T from 1885 to 1887 (see 1907).

1893 Competition began with the expiration of Alexander Graham Bell's patent on the telephone.

1902 License contracts with Bell operating companies implemented.

1907 Theodore Vail was again AT&T president from 1907 to 1919.

1910 AT&T bought 30% of Western Union's stock; Theodore Vail was president of Western Union from 1910 to 1914.

1913 ICC issued Uniform System of Accounts for telephone companies.

1913 Kingsbury commitment established, where AT&T agreed to interconnect with other telphone companies, to stop buying other telephone companies, to allow other telephone comanies to use Bell system toll service, and to sell its Western Union stock.

1914 AT&T sold its Western Union stock.

1922 AT&T established a radio station, which it sold in 1926.

1925 Bell laboratories established.

1927 AT&T-owned telephones were sold to the Operating Companies.

1928 Western Electric sold Graybar Electric Co., which merchandised electrical supplies; this represented AT&T's commitment to devote itself solely to communications.

1930 Bell System purchased Teletype Corp.; inauguration of TWX service the same year.

1949 Antitrust suit filed by the U.S. Department of Justice against AT&T.

1951 FCC approved Bell's acquisition of the Western Union telephone business in Pacific Co.'s area, as well as the sale of Western Union of Pacific Co.'s telegram business.

1956 Consent Decree entered into between AT&T and U.S. Department of Justice in settlement of the antitrust suit with the conditions that 1) Western Electric is not to be separated from AT&T, 2) Western Electric would be confined to manufacturing equipment bought by the Bell System (except for defense work), 3) Bell would not engage in business other than common carrier and "incidental operations," and 4) Bell would grant nonexclusive licenses and related technical information to any applicant on fair terms.

1956 Picturephone experiments announced.

1959 Marketing department established at AT&T.

1962 Radio paging approved on a developmental basis.

1962 COMSAT established.

1964 AT&T purchased COMSAT stock.

1964 Picturephone service inaugurated.

1965 FCC Common Carrier Bureau recommended that TWX be sold to Western Union.

1966 AT&T decided not to appeal the adverse court ruling concerning its Telpak rates.

1966 AT&T decided to buy out the few remaining minority shares of Western Union.

1969 AT&T agreed to sell TWX to Western Union.

1970 FCC approved AT&T's sale of TWX to Western Union.

1970 Joint COMSAT/AT&T proposal announced.

1970 The FCC began reevaluating AT&T's allowable rate of return in Docket CC 79-63.

1971 Western Union acquired TWX.

1973 AT&T agreed to $15 million in back pay and $23 million in raises for women and minorities, although this was not to be treated as an admission of illegal discrimination.

1973 AT&T announced it would sell its COMSAT stock; FCC had made this, plus removal of AT&T directors form COMSAT's board, as conditiions of AT&T use of COMSAT facilities (Domsat decision).

1974 Department of Justice antitrust suit against AT&T (Nov).

1981 The FCC increased AT&T's allowable rate of return on interstate and foreign service to 12.75%, thus giving AT&T an overall rate increase of 16 percent on MTS and private lines, and 10.5% increase on WATS service (Docket 79-63).

TRANSMISSION AND SPECIALIZED SERVICES

1945 Microwave transmission technology developed through the invention and application of the Klystron tube during WW II.

1945 Western Union establishes new experimental microwave route.

1945 AT&T attempts to preempt competitor efforts to develop new applications for microwave technology for long lines carriage as it shifts to microwave from coaxial transmission.

1949 AT&T eliminates all other microwave systems by refusing to interconnect, thus becoming monopolist in microwave transmission.

1950 AT&T develops TD-2 microwave system after four years of intensive work.

1951 In response to FCC vs. RCA case (1945), Supreme Court states that competition is desirable only when beneficial.

1951 First application to the FCC for CATV-private microwave system.

1952 Development of applications of microwave technology has significantly declined.

1955 FCC approves first application for private microwave system for relay of television broadcasts to CATV system.

1957 Several non-common carriers apply for frequencies to operate their own radio relay system. This precipitated the "Above 890" FCC docket 11866.

1958 Western Union expanded microwave and Telex services.

1959 In FCC Docket 11866, the FCC removed restrictions on private ownership of microwave radio systems. "Above 890" decision.

1960 In response to "Above 890" decision, Bell plans to market WATS, WADS, TELPAK, and TWX.

1960 AT&T introduces TELPAK with large savings for large volume users to counter competition from private microwave.

1961 Non-Bell manufacturers of equipment oppose low TELPAK rates as exclusionary, while large volume customers defend TELPAK service.

1962 FCC decision to permit interconnection of customer-owned and telephone company facilities at both ends of a through circuit for emergency calls and at one end for calls related to the safety or reliability of railroad service.

1962 FCC begins review of Bell's impact on Western Union public message business.

1963 MCI filed with the FCC a "Certificate of Convenience and Necessity" for authroiztion to construct Chicago-St. Louis common carrier microwave system (Dec).

1964 FCC commences evaluation of cross-subsidization of AT&T's TELPAK service.

1965 FCC decides that Western Union Public Message Service is desirable for the public interest, and therefore moves to restructure AT&T rates and services so as not to induce any further deterioration in services.

1965 Western Union refused to provide private long line service to Bunker Ramo for its Telequote IV service.

1966 FCC sets MCI application hearing (Feb).

1966 FCC initiates computer inquiry into effects of data processing on telecommunications.

1967 FCC hearings on MCI application. Interested parties discuss issues of cream skimming and pricing according to fully allocated costs (Spring).

1967 FCC hearing examiner issues Initial Decision approving MCI's application. Established carriers appeal to the full Commission (Oct).

1968 Oral argument before full Commission on MCI application (April).

1968 University Computing, wanting to enter common carrier microwave field, acquired a California microwave (CATV) company, and sought to purchase a substantial portion of Western Union.

1968 Interdata Communications, Inc. filed with the FCC for authroization to construct MCI-like microwave system between New York City and Washington, D.C.

1968 President's Task Force on Communications Policy submits report endorsing Specialized Common Carrier concept (Dec).

1969* The FCC granted permission for St. Louis to Chicago trial of Specialized Common Carrier service. MCI offered a range of flexible low-cost services, origninally involving 590 stations (Aug).

1969 Established carriers petition FCC to reconsider its MCI decision (Sept).

1969 AT&T's TELPAK service continues to provide low rate of return because of "underpricing", but removal of cross-subsidy is blocked by large group of customers with large volume requirements.

1969 AT&T permits sharing of voice-grade and telegraph-grade private-line services--a service previously proposed by MCI (Feb).

1969 AT&T announces Series 11,000 wide-band private-line services designed to compete with MCI (March).

1969 Data Transmission Company (DATRAN), a subsidiary of University Computing Company, filed application for nationwide common carrier system using digital microwave and computer switching designed for data transmission. Initial system would involve 244 microwave stations, and would use a combination of 11 GHz frequencies and multipair cable for local loop service (Nov).

1970 FCC denies established carriers' petitions for reconsideration of its MCI decision (Jan).

1970 A total of 1,713 microwave relay station applications are on file with the FCC for Specialized Common Carriers. These covered more than 40 separate, but often overlapping and competiting routes, generally following the pattern of the MCI application (June).

1970 FCC bars telecommuncations entry into data processing.

1970 UCC's Data Transmission Corp. responds to MCI with application for a switched, all-digital network dedicated exclusively to data transmission.

1970 Nine more firms file Specialized Carrier applications (Feb-March).

1970 AT&T appeals FCC's MCI decisison to the U.S. Court of Appeals (D.C. circuit (March).

1970 MCI files with FCC to modify its construction permits for the Chicago to St. Louis system by increasing its capacity (March).

1970 Twenty-one more firms (including 7 MCI affiliates) file Specialized Carrier applications (April-June).

1970 FCC issues Notice of Inquiry and Proposed Rule-Making (Docket 18920) regarding specialized carriers (July).

1970 FCC receives comments and reply comments from over 150 interested parties in Docket 18920 (Oct-Dec).

1970 AT&T announces construction of all digital switched network--a concept similar to DATRAN's, to be ready by 1973-74. (Nov).

1971 FCC hears oral argument in Docket 18920 (Jan).

1971 FCC issues First Report and Order in Docket 18920, granted competitive entry to the market for voice and data private line services to companies classified as Specialized Common Carriers, claiming that market entry would improve the quality of services benefiting the public through competition (May). The FCC issues a Further Notice of Inquiry regarding the allocation of frequencies for local distribution and quality and reliability of service (June).

1971 AT&T and Western Union withdraw their court appeals of the FCC's 1969 MCI decision (July).

1971 FCC receives comments from interested parties regarding local distribution and quality of service (Aug).

1971 AT&T sells TWX network to Western Union; Western Union becomes common carrier for both Telex and TWX.

1971 The FCC grants construction permits to Interdata Communications, Inc. for Specialized Carrier service between New York City and Washington, D.C.

1972 MCI files its first tariff and begins Specialized Carrier service between Chicago and St. Louis (Jan).

1972 FCC reinstitutes Phase II of Docket 19129, an investigation into Bell's relationships with Western Electric (Jan).

1972 The FCC grants construction permits to DATRAN for the Western half (from Palo Alto, Calif., to Houston, Texas) of its network.

1972 The FCC grants construction permits to extend MCI system from Chicago to New York City.

1972 The FCC grants construction permits to other Specialized Carrier applicants including Nebraska Consolidated Communications Corp., Western Tele-Communications, Inc., MCI Michigan, Inc., MCI new England, Inc., MCI St. Louis-Texas, Inc., and West Texas Microwave company.

1972 AT&T begins discussions with users to develop new private line pricing schedules.

1972 Western Union Telegraph files tariff almost identical to that by MCI for Chicago to St. Louis services (March).

1972 AT&T files for digital data system between New York, Boston, Chicago, Philadelphia and Washington (Oct).

1973 AT&T requests permission to file new private line tariffs designed to reduce prices on routes competitive with Specialized carriers, and to increase them on noncompetitive routes (Feb).

1973 AT&T requests permission to allow hybrid data vendors (Value Added Carriers). Seven companies indicate interest in becoming same (Feb).

1973 The FCC in Docket 16979 (Computer Inquiry I) determined that neither local nor remote access data processing were subject to FCC jurisdiction, but decided that hybrid communications services and message switching services were under its jurisdiction. They also ruled that communications carriers may not offer data processing services except through a separated affiliate.

1973 In Docket 16979 the FCC created a new class of communications carrier, the value-added carrier, authorized to provide a combination of communications services and data processing services. These carriers lease transmission facilities from various communications common carriers and provide added value in the form of such things as reduced error rate, speed and code conversion, message switching, etc.

1973 NARUC appeals to U.S. Court of Appeals to review FCC decision in favor of Specialized Carriers (April).

1973 AT&T withdraws series 11,000 offering (May).

1973 NARUC files notice of investigation into Economic and Service Impact of Competition (Nov).

1973 AT&T files Hi-Lo tariff to be effective January 1974 (Nov).

1974 FCC requests and obtains from AT&T 90-day postponement in effective date of Hi-Lo tariff (Jan).

1974 AT&T files tariff 267 for Dataphone Digital Service (DDS) to provide private line data service except to other carriers--to be effective in May (March).

1974 MCI files lawsuit against AT&T for violation of Sherman Antitrust Act charging AT&T with "monopolizing the business and data communications market" (April).

1974 AT&T files countersuit against MCI charging violation of antitrust laws by continued "attempts to monopolize the private line market" (April).

1974 AT&T puts 1-5 coaxial cable system in service providing 108,000 circuits from Pittsburgh to St. Louis (April).

1974 DATRAN files interstate tariffs to compete with AT&T's DDS offering (April).

1974 WTCI gets FCC approval to construct microwave stations at eighteen cities linking Denver to Omaha (April).

1974 United Video sells microwave systems (Dallas to St. Louis) to Southern Pacific. Southern Pacific begins talks on acquisition of United Video (April).

1974 FCC requests 90 days and obtains AT&T agreement to 60 days postponement in effective date of Hi-Lo tariff (April).

1974 FCC issues Final Order on Docket 19896 concerning Bell System Tariff Offerings of local distribution facilities for use by other common carriers. Order directed AT&T to furnish local distribution systems to competing carriers in the same fashion as they do to AT&T Long Lines (April).

1974 FCC announces Notice of Inquiry in the matter of Economic Implications and Interrelationships Arising from Policies and Practices Relating to Customer Interconnection, Jurisdictional Separations, and Rate Structures (Docket 20003) (April).

1974 FCC approves Southern Pacific's plan to provide national service from New York to Los Angeles via leased satellite channels (May).

1974 Southern Pacific files with FCC to provide "sub-minute" nationwide facsimile service (May).

1974 AT&T and FCC file briefs with U.S. Third Circuit Court of Appeals in Philadelphia regarding Docket 19896 ruling directing the provision of local distribution (June).

1974 AT&T refuses third FCC request for postponement of Hi-Lo tariff--becomes effective in June (June).

1974 MCI and Southern Pacific file updated tariffs as competitive response to AT&T's Hi-Lo offering (June).

1976 The FCC in Docket 20097 ("Resale") removed existing restrictions against the resale and shared use by customers of private line facilities, and determined that there was no regulatory distinction between Specialized Common Carriers, Value-Added Carriers, and other communications brokers.

1976 The FCC rejected the AT&T WATS tariff.

1976 FCC established Computer Inquiry II (Docket 20828) to consider the use of computers by common carriers in providing communications or data processing services (July).

1976 The FCC in Docket 18128 ordered fully ditributed cost (FDC) method to be used for costing of competitive services.

1977 In the FCC Execunet Decision, MCI is allowed to provide switched public telephone service and previously monopolized long distance markets are opened to competition.

1977 The FCC rejected the AT&T WATS replacement tariff.

1978 U.S. Court of Appeals Execunet decision.

1978 The FCC issued a notice of inquiry, Docket CC 78-72, to investigate access charges, and establish a Federal-State Joint Board to recommend changes to the separations manual by which local telephone companies are reimbursed for interstate services.

1979 FCC ended Western Union's monopoly in telegrams.

1979 The FCC issued Docket CC 79-54 for establishment of a new WATS tariff.

1979 The FCC issued a Notice of Inquiry, Docket CC 79-245, to prescribe a new fully distributed cost manual for AT&T in accordance with the criteria of Docket 18128 (September).

1979 The FCC issued Docket CC 79-246 for restructuring AT&T's Multi-Schedual Private Line rates so that "like" services will employ the same method to determine rates (September).

1979 The FCC issued a Notice of Inquiry, Docket CC 79-52, to deregulate 'non-dominant' or competitive carriers including specialized and satellite carriers, so that market forces would control prices and reduce regulatory restrictions (September).

1980 AT&T in response to Docket CC 79-246, submitted a proposed restructuring of its private line tariffs to consolidate its 26 offerings into 6 (January).

1980 The FCC prescribed an interim cost manual in Docket CC 79-245 that required AT&T to separate revenues, expenses, and investment for MTS, WATS, and private line services (January).

1980 The FCC issued a Supplemental Notice of Inquiry in Docket CC 78-72 to evaluate replacing toll separations payments by access charges to reimburse local carriers for use of exchange facilities. Only MTS/SATS and "like" services (e.g., Execunet and Sprint) services contribute to local exchange costs (April).

1980 The FCC established Docket CC 80-176 to consider the sharing or resale of international services (April).

1980 The FCC, in Docket 20828, issued a report and order which divided all network services into "basic" (transmission) and "enhanced" (including computer processing applications) service. "Enhanced services were

deregulated, and AT&T and GTE were allowed to provide such services only through a separate unregulated subsidiary. Costomer premises equipment was deregulated, and telephone companies must, bu March 1, 1982, remove all such equipment from their rate base (April).

1980 The FCC issued a Third Supplemental Notice regarding Docket 78-72 resolving the MTS/WATS entry policy for Alaska (August).

1980 The FCC in effect adopted a first report and order that removed much regulation from 'non-dominant' carriers where specialized common carriers and resellers are classified as 'non-dominant' carriers. It reached the legal conclusion that it has the power to forebear from traditional Title II regulation (August).

1980 AT&T filed a new WATS tariff where outward WATS and 900 Service would have a monthly access charge and a declining usage charge (September).

1980 The Federal-State Joint Board held its first meeting to establish operating procedures (November).

1980 The FCC, in Docket CC 79-245, added a fourth category for exchange network facilities for interstate access (ENFIA).

1980 Concerning Docket 20828, the FCC released GTE from the requirement to form a separate subsidiary to provide customer premise equipment and enhanced services, and specified that CPE installed under state tariffs before the deregulation deadline would remain in the telco rate base for a transitional period (December).

1980 The FCC, in Docket CC 80-702, issued a Notice of Inquiry to determine whether AT&T can offer protocol or code conversion in the core network except through a separate subsidiary (December).

1981 AT&T petitioned the FCC to reconsider its "bifurcated" approach to deregulation in Docket 20828, and to deregulate all CPE at the same time (February).

1981 AT&T submitted a revised WATS tariff, which the FCC let become effective June 1, 1981 (May).

1981 New usage-sensitive WATS tariff and provisions for sharing and resale of the service (Docket CC 79-54) became effective (June).

1981 The FCC reaffirmed its initial decision in Docket 20828, extended the CPE deadline to January 1, 1983, and ruled that the Bell operating Companies and fully separate subsidiaries may provide installation and maintenance to business customers on a shared basis (October).

1981 The FCC issued a Further Notice concerning the Uniform System of Accounts Docket 78-196, establishing a Telecommunications Industry Advisory Group (TIAG) to evaluate the Uniform System of Accounts (October).

1981 The Federal-State Joint Board approved removal of customer premises equipment from the separations process at a prescribed rate (November).

1981 AT&T presented a capitalization plan to the FCC for its subsidiary, the Advanced Communications Service (November).

1981 AT&T filed revised tariffs for MTS, WATS and private line services to equalize the earnings at 13 percent (December).

1982 The FCC approved the proposals of the Federal-State Joint Board (February).

1982 MCI requested the U.S. Court of Appeals to review the FCC approval of the Federal-State Joint Board proposals in Docket CC 80-286 (March).

1982 The FCC Administrative law judge issued an initial decision in Phase I of the Telex/TWX rate case that: users were subsidizing almost all of Western Union's remaining service, the rate sturcture was discriminatory, and the cost to provide interconnection services for international carriers was about 25 percent less than for other customers (March).

1982 The FCC extended ENFIA (Docket CC 78-371) for 2 years (April).

1982 MCI challenged the FCC interim cost manual Docket CC 70-245, but it was upheld by the U.S. Court of Appeals (April).

1982 In conjunction with Docket CC 80-765, the FCC adopted an order to evaluate unifying the public switched network rate structure (April).

1982 MCI requested the U.S. Court of Appeals to require that AT&T provide Exchange access to other Common carriers (OCC's) at the same rates available to other AT&T customers (May).

1982 The FCC issued a Fourth Supplemental Notice in relation to access charge Docket CC 78-72, which proposed four possible plans, two of them involve charging the customer directly for access to the network in contrast to charging the long-distance carriers through the toll settlements procedures or the ENFIA tariffs (May).

1982 The U.S. Court of Apoeals vacated the "like" services decision concerning similarities in WATS and MTS services, and returned the issue to the FCC for futher inquiry (June).

1982 The FCC issued a Further Notice of Proposed Rulemaking in Docket 79-252, and a Second Report and Order to eliminate all Section 214 and tariff requirements for terrestrial resellers not affiliated with dominant carriers. That is, to remove all rate of return common carrier regulations from all services except MTS/WATS and private line service offered jointly by AT&T and independent telephone companies and Telex/TWX service offered by Western Union (July).

1982 The FCC prescribed a new ENFIA formula with rates 50 percent higher (September).

1982 The FCC continued its investigation of the lawfulness of AT&T's WATS tariff (October).

1982 The U.S. Court of Appeals struck down all legal challenges to FCC Docket 20828, the Computer Inquiry II (November).

1982 The Federal-State Joint Board requested comments on separations options (November).

1982 The FCC adopted a plan in Docket 78-72 to provide that local exchange customers, both residential and business, pay a flat and usage-based access charges, and exchange carriers also pay a charge for certain non-traffic sensitive facilities (December).

1983 The FCC issued a Memorandum Opinion and Order on Docket 78-72 altering its December 1982 decision, and providing a 6 year transistional period where residential subscribers will pay $2.00 per line per month in 1984, $3.00 in 1985, and $4.00 in 1986 as the maximum flat charge, and businesses will pay $6.00 during this time. A $25 per month surcharge was also imposed on the closed end of interstate WATS, FX, OPS and tie lines terminating in customer switching equipment since these facilities could be used to originate or terminate long distance calls (August).

1983 The FCC issued a further order conderning Docket 79-252, which eliminated all regulatory requirements for specialized common carriers, resellers affiliated with domestic telephone companies, and domestic satellite carriers (October).

1983 The FCC issued a Notice of Inquiry, Docket 83-1147, to determine how AT&T will be regulated in the future (October).

1983 The FCC delayed the effective date of the access charges in Docket 78-72 from January 1 to April 3, 1984 (October).

1983 AT&T filed new WATS and private line tariffs in response to the Commission's Access Charge Order, and in response to Docket 80-765 (October).

1983 The FCC overturned its initial decision on the Telex/TWX rate case, Docket 78-97, stating that Western Union's rates were reasonable in relation to costs, and removing the rate of return ceiling because of competition due to the new industry structure (October).

1984 The FCC intends to pospone access charges for residental and single-line business customers until June 1985 (March).

EQUIPMENT INTERCONNECT

1921 Hush-A-Phone first manufactured.

1955 FCC ruled against Hush-A-Phone.

1956 U.S. Court of Appeals in "Hush-A-Phone vs. United States" required that regulation be "just and reasonable", and found tariffs were more restrictive than necessary to preserve "quality of service."

1959 Carter Electronics introduced accoustically inductively coupling device for interconnection of the base station of a private communications system.

1964 Bell and GTE warn customers that Carterfone violates FCC tariffs.

1964 Western Union Telegraph Co. began diversification into data processing services with objective of creating a "national information utility."

1965 Bell initiates a policy of allowing private-owned interconnect equipment to leased lines.

1965 Equipment emerges from small firms for sale to lessors of Bell lines.

1965 Carter Electronics initiates anti-trust action against AT&T and GTE. Court refers case to FCC for jurisdiction; 3500 Carterfones have been sold since introduction in 1959.

1965 Bunker-Ramo Corp. attempts to add message-switching features to its computer-based stock-quotation service, and is rebuffed by AT&T and Western Union, who refuse to funish circuits for such a "communication" activity by a noncarrier.

1966 IBM suggest to FCC that a "primary business test" guideline for determining whether to regulate a data-processing and/or message-switching service.

1966 Two international carriers, ITT Worldcom and RCA Globcom, disagree about whether their new competitive message-switching services should be tariffed as communications activities.

1966 FCC issues Notice of Inquiry (Computer Inquiry), asking broad range of questions concerning computer-communications policy.

1967 FCC hearing examiner approves Carterfone use and orders modification of tariffs. Approval is appealed to FCC board who ruled that tariffs prohibiting against attachment and interconnection are unlawful. They said that if there is "a need and demand" for a system which is "privately beneficial without being publicly detrimental", then tariffs cannot exclude it--contending that the burden of justifying restrictive tariffs is on the carriers.

1967 Bell' initial post-Carterfone action is to propose tariff changes that permit use of a very narrowly defined class of devices.

1968 AT&T and GTE appeal of Carterfone decision is settled out of court.

1968 FCC issues Carterfone decision in Docket 16942, removing tariff restrictions that barred interconnection of customer equipment to the telephone network, and resolving one of the issues in the computer inquiry (June).

1968 Comments filed with the FCC by over 60 interested parties, including carriers, computer firms, users, and government agencies.

1968 President Johnson's Task Force on Communications Policy issues a report generally supporting the positions taken by the computer-industry in their response to the FCC inquiry.

1968 AT&T files new tariffs for foreign attachments specifying an AT&T supplied interface device must be used and rented. AT&T wants exemption of "network control signalling" apparatus. Tariff goes into effect without formal FCC review.

1969 AT&T permits sharing ("joint use") of its telegraph-grade and voice-grade private-line channels, as requested by respondents in the inquiry, thus partially resolving a second issue in the inquiry.

1969 FCC issues Report and Further Notice, soliciting comments on the SRI study. Respondents' comments reiterate previously expressed positions, adding little to the FCC's understanding of the issues.

1969 FCC issues MCI decision, approving first specialized common carrier. This action was motivated in part by the complaints of computer-inquiry respondents about the inadequacy of existing data-communications services.

1969 Data Transmission Co. (Datran) files an application with the FCC for a nationwide, digital common-carrier network incorporating features requested by computer-inquiry respondents.

1970 FCC issues Tentative Decision, proposing resolution of the remaining issues in the inquiry.

1970 FCC hears oral arguments--presentations to the Commission by some 20 interested parties.

1971 FCC issues Final Decision and Order.

1972 FCC denies petitions for reconsideration submitted by several parties.

1972 With significant growth in private interconnect businesses, Bell files new tariff with the FCC requiring Bell-provided interfaces to insure safety and integrity of the common carrier system.

1975 The FCC issued the First order establishing equipment registration program for all types of interconnect equipment except PBX, KTS, Main extensions, and Coin Telephones (Docket 19528).

1976 AT&T wins stay on allowing tie-in with outside gear. The FCC had ruled in April that customers could attach equipment without using an AT&T protective coupler.

1977 The FCC issued a Final Decision and Order in Docket 19129 allowing costs associated with station connections to be placed on the ratepayer.

1978 In Docket 19528, the FCC Third Order added PBX, KTS, and single line telephone instruments to the terminal equipment registration program. The program establishes technical standards for connecting terminal equipment from any supplier, if registered with the FCC, through standard plugs and jacks, thus eliminating telephone company-provided arrangements.

1979 The FCC issued a Notice of Proposed Rulemaking concerning deregulation of inside wiring, Docket 79-105 (August).

1981 The FCC issued a Report and Order concerning Docket 79-105 concerning treatment of inside wiring and CPE equipment (March).

1981 The FCC issued a Notice of Proposed Rulemaking and Notice of Inquiry, Docket 81-216, to include all customer premises equipment and wiring in part 68 registration rules (April).

1981 The FCC issued a Further Notice of Inquiry concerning Docket 79-105 requesting comments on full detariffing and deregulation of station connection costs (May).

1981 The FCC adopted a Notice of Inquiry, Docket CC 81-893, to determine procedures for removing embedded customer premises equipment from tariffs (December).

1982 The FCC released the NOI of Docket CC 81-893 providing suggestions for CPE equipment (April).

1982 The FCC issued a second Notice of Rulemaking in Docket CC 81-893 to establish a demarcation point for customer owned inside wiring where telcos could still offer such wiring under tariff (November).

1983 In regard to Docket 81-893, the FCC ordered the Bell System's embedded base of CPE to be detariffed as of January 1, 1984, and transferred to AT&T Information Systems (November).

1983 The FCC established a Notice of Inquiry, Docket 83-115, to determine if the divested Bell Operating Companies should be required to establish separate subsidiaries to sell CPE as required by the Computer II order (February).

1983 The FCC issued an order concerning Docket 83-115 relaxing the separate subsidiary requirement for the BOC's (November).

DOMESTIC SATELLITES

1957 Sputnik I launched by USSR--the world's first satellite.

1962 Congress passes Communications Satellite Act, providing for establishment of a new privately owned corporation, Communications Satellite Corporation (COMSAT), to serve as the U.S. entity in international satellite communications.

1962 AT&T recommends "random orbital" satellite system, which is more capital intensive than alternative "fixed orbital systems."

1963 Hughes Aircraft shows relative superiority of satellite system using "synchronous orbit."

1963 Syncom launched by NASA--the first geostationary synchronous satellite.

1964 International Telecommunications Satellite Consortium (INTELSAT) formed to create international satellite communications network.

1965 Early Bird launched--the first commercial-communications satellite and the beginning of the INTELSAT network.

1965 American Broadcasting Company, Inc. (ABC) submits proposal to the FCC for a domestic TV-distribution satellite. COMSAT opposes proposal claiming Congressional consent for satellite systems.

1966 FCC opens inquiry on domestic satellites, and asks broad policy questions regarding establishment of systems by nongovernment entities.

1966 Ford Foundation submits counterproposal for a multipurpose domestic satellite, with profits to be used to support educational television.

1967 COMSAT proposes "pilot demonstartion program," with two satellites to be operated by COMSAT as trustee until FCC decides ownership issue.

1967 President Johnson appoints Task Force on Communications Policy to study domestic satellites and other issues; FCC suspends action in its domestic satellite inquiry pending receipt of Task Force recommendations.

1968 COMSAT and NCTA propose plans to FCC for six-channel satellite service for CATV, but no FCC action is taken on proposal.

1968 President's Task Force submits report recommending approval of a single "pilot" domestic satellite program, with COMSAT having primary responsibility.

1969 General Electric Company proposes domestic satellite concept using time-division multiple-access (TDMA) techniques to provide new and expanded services.

1969 As FCC prepares to approve a pilot domestic system substantially as recommended by President Johnson's Task Force, the White House requests a delay until President Nixon's staff can study the matter and submit recommendations.

1970 White House sends memo to FCC urging approval of all financially and technically qualified applicants for common-carrier or private domestic satellite systems--instead of a single pilot system as contemplated by FCC.

1970 FCC announced "open door" policy on domestic satellites (April).

1970 AT&T and COMSAT file plan for joint operation of domestic satellite system--raises anti-trust questions.

1971 FCC institutes "open skies" policy and asks any company to apply for entry in domestic satellite system. FCC receives eight applications for satellite systems.

1971 FCC receives comments and reply comments form the applicants and other interested parties regarding the eight applications.

1971 NASA performs technical evaluation of the applications for the FCC.

1972 FCC's Common Carrier Bureau recommends policy of "limited open entry," consolidating in a common space segment those applicants proposing use of the same satellite technolgy.

1972 Oral argument before the Commission regarding the Bureau's recommendations.

1972 FCC issues ruling permitting qualified applicants to provide domestic communications-satellite service, but restricts the market that AT&T, COMSAT, and GTE satellite systems are authorized to serve.

1980 The FCC issued a Notice of Inquiry, Docket CC 80-170, to change the policy to restrict Comsat to providing service only to other common carriers (May).

1982 The FCC issued an order in Docket CC 80-170 which allowed Comsat to provide service (August).

1982 The International Record Carriers (IRC's) appealed the FCC's order in Docket CC 80-170 to the U.S. Court of Appeals (August).

1983 The FCC granted Comsat permanent authority to serve non-carriers (January).

1983 AT&T launched Telstar 3, the first of 3 wholly owned and operated AT&T communications satellites (July).

LAND MOBILE

1921 Detroit Police begin using first mobile telephone service.

1927 Radio Act created a five-member Federal Radio Commission with regulatory powers over radio.

1929 The FRC made three frequencies (above the AM broadcast band) available to mobile radio.

1934 Title III of Communications Act covered radio services, including mobile radio (May).

1945 FCC Docket 6651 recognized several mobile radio services (for bus, radio, truck and taxi) and requested the assignment of 20 channels in VHF and 10 in UHF; AT&T requested exclusive allocation of channels for common carrier mobile radio (May).

1946 First commercial mobile service was introduced by the Bell System in Saint Louis in the 150 MHz band.

1949 FCC Docket 8658 (13 FCC 1190, 1949) allocated a family of frequencies for the development of common carrier mobile radio systems by "enterprises other than existing telephone companies" (April).

1949 FCC Docket 8976 contained AT&T proposal for the development of a high-capacity, land mobile communications system in the 470-500 MHz band. (This band was ultimately allocated to TV; in 1968, 19 years later, the FCC decided that such a communications system might be desirable.)

1956 AT&T proposed a 75 MHz bandwidth mobile system in the 800 MHz band.

1957 FCC established an inquiry to consider the allocation of nongovernment frequencies in the spectrum between 25 and 890 MHz (April).

1958 FCC Docket No. 11991 established the Business Radio Service (June). (This was a recognition by the FCC of the congestion in certain radio channels; in fact, volunteer frequency coordinating committees had been formed by the businesses to help manage the congestion problem.)

1959 FCC conducted a hearing on above for 14 days (June).

1962 All-Channel TV Receiver Act (76 Stat. 150) required all TV sets manufactured thereafter to be equipped to receive UHF signals. (Act to become effective in 1964.) (This Act encouraged entry of additional stations in a largely vacant UHF spectrum. From the viewpoint of broadcasting it would appear to be a competitive policy; however, from LMR's viewpoint, it was protectionist in reinforcing the UHF portion of the spectrum for TV uses.)

1964 FCC Report and Order, 39 FCC 595, acknowledged the important contribution of land mobile service to the economy and acknowledged that there was a need for relief in the land mobile frequencies, but resisted efforts to allocate additional spectrum. The Advisory Committee for the Land Mobile Radio Services (AC/LMRS) was established and directed by the FCC to make a thorough study of possible solutions to the frequency problems affecting LMRS (March). (The FCC observed that "the reallocation of UHF... was at least worthy of consideration in 1957 but certain measures taken since then give us reason to expect that these developments... will provide the impetus for expanded use of the frequencies allocated to UHF" (39 FCC at 595).)

1964 Memorandum Opinion and Order (39 FCC 608, Docket 11997) reaffirmed the FCC's commitment to an 82-channel TV system and supported the conclusion that major reallocation of spectrum for land mobile would not be consistent with that objective (May).

1964 The Iproved Mobile Telephone Service (IMTS) was introduced to allow customers to do their own dialing, and eliminating push-to-talk operation.

1966 As part of the Philadelphia TV Broadcasting Company case, the FCC maintained that, although CATV systems were somewhat hybrid in nature, they were more appropriately adjuncts to the nation's broadcasting system than a form of common carrier (359 F2d 282, 1966).

1967 Confronted with the seemingly nonviable UHF system and a continuing demand for land mobile services, the FCC announced that it was beginning to study the feasibility of reassigning certain UHF channels to land mobile (April). (On the one hand, UHF stations increasing slowly (about 10% annually), were characterized by small audiences, low revenues, and inferior programming. In fact, the UHF stations, as a group, lost money in 1965, 1966, 1967 (FCC Annual Reports). On the other hand, the AC/LMRS, after a 2-year study, had concluded that an allocation of additional frequency spectrum was the only way adequately to relieve the LMRS problem.)

1967 Land Mobile Relief Committee was formed to study the impact of various outright frequency reallocations (from UHF TV channels) (May).

1968 Report of LMRC Committee conclusions: 1) Reassignment of UHF channels 14-20 would dislocate a substantial number of authorized or established UHF stations (at $100,000 per station); 2) reallocation of UHF channels 70-83 (900 MHz band) would dislocate only two actual UHF assignments, but necessary equipment and systems might require years of development; and 3) while broadcast interests had been awarded 87% of the nongovernment spectrum below 960 MHz, LMR had been given only 4.4%.

1968 FCC Notice of Inquiry opened Docket 18261 which proposed sharing by land mobile and TV of two of the seven channels 14-20 (470-512 MHz) within 50 miles of the centers of the 10 largest metropolitan areas of the United States. (In 1968, a 450-470 channel-splitting proceeding was

concluded after 7 years of study, making available 165 new channels for mobile use.)

1968 FCC Notice of Inquiry opened Docket 18262 to consider reallocation of 115 MHz (equivalent to 19 TV channels) of spectrum in the 806-960 MHz band for joint use by common carrier and private land mobile.

1970 First Report and Order in Dockets 18261 and 18262 stated that development of common carrier band allocations in Docket 19626 "will be limited to wireline telephone companies, inasmuch as radio common carriers will be given accomodations in the frequency bands being treated in Docket 18261." It allocated 806-881 MHz to these telephone companies and 881-902 and 928-947 to the private mobile user.

1971 Second Report and Order in Docket 18261 addressed technical problems, including frequency assignments, channel spacing and loading requirements (June).

1971 Second Memorandum Opinion and Order (Docket 18262) reaffirmed the FCC commitment of 75 MHz to common carriers and removed the restriction that limited development of the 806-881 MHz band to wireline carriers (August).

1972 Third Report and Order in Docket 18261 allocated 12 MHz at the lower end of the UHF-TV band to land mobile on a shared basis in each of the 10 largest cities (July 1972).

1973 OTP report indicated that a major barrier to adequate frequencies for land mobile was the dominance of TV in lightly used, below 1,000 MHz spectrum.

1973 Fourth Report and Order in Docket 18261 adjusted channelling plans for specific cities (Nov).

1974 Second Report and Order in Docket 18262 divided the reallocated 900 MHz band spectrum on the basis of the type of system employed rather than the type of service provided. The allocation for a high-capacity cellular system was reduced form 75 MHz to 40 MHz, and the 40 MHz for trunked and conventional systems was reduced to 30 MHz, permitting eligible users to choose either technology. A new class of services called Special Mobile Radio Services (SMRS) was created (May).

1974 Fifth Report and Order in Docket 18261 provided further channelling adjustments (July).

1975 Memorandum Opinion and Order in Docket 18262 addressed the criticism against the Second Report and Order. It opened cellular system development to RCC's as well as to wireline carriers (March).

1975 The U.S. Court of Appeals stayed the effective date of the Second Report and Order at the request of the National Association of Radiotelephone Systems (May).

1975 The U.S. Court of Appeals said the FCC could issue licenses in the 900 MHz region for private and cellular land mobile communications systems but forbade the operation of SMRS until review of briefs and oral arguments (July).

1975 Illionis Bell filed an application with the FCC for development of a high-capacity cellular system in the Chicago area.

1977 License granted for Chicago system to the American Radio Telephone Service (ARTS).

1978 Experimental service begins in Chicago with 2000 customers.

1979 The FCC established Docket CC 79-188 in response to Xerox's request to allocate 10.6 GHz spectrum for electronic message services using cellular radio for local distribution within metropolitan areas to customers' premises; a service to be called Xerox Telecommunications Network (XTEN) (January).

1979 The FCC reopened certain issues from Docket 18262 in Docket CC 79-318; particularly proposing allocating 20 MHz to each of two carriers to provide cellular services in competition, and to limit the role of wireline carriers in distribution of cellular service (through separate subsidiaries) (November).

1979 The FCC in Docket CC 79-318 eliminated the separate subsidiary requirement for all wireline carriers except AT&T (December).

1980 The FCC issued an Inquiry and Proposed Rulemaking for cellular service, emphasizing the need to expedite the process.

1980 AT&T created the Advanced Mobile Phone Service (AMPS) to develop and market cellular service nationwide.

1981 The FCC adopted a Report and Order in Docket CC 79-188 to reallocate 90 MHz of 10.6 GHz spectrum for digital termination systems (January).

1982 The U.S. Department of Justice and other parties challenged the FCC's order concerning cellular mobile radio service, Docket CC 79-318 (May).

1982 The FCC, on reconsideration, created competition in land mobile by dividing each of the 90 largest markets into 2 licenses--wireline and nonwireline.

1982 The FCC received 52 applications from wireline carriers for cellular mobile systems in the top 30 markets and 142 applications from non-wireline carriers (June).

1982 The FCC approved the first applications for "extended" and "limited" systems under Docket CC 79-188. Xerox had abandoned its XTEN proposal in 1981 (July).

1982 The FCC granted the first construction permit to AT&T's Advanced Mobile Phone Service, Inc., for the Chicago system (October).

1982 The FCC received 400 applications for moble systems in the second 30 markets (November).

1983 The FCC received an additional 560 applications for the 61 to 90 markets. The FCC approved the Ameritech system in Chicago ad the first U.S. comercial cellular service (March).

INTERNATIONAL CARRIERS

1980 The FCC initiated Docket CC 80-632 to reevaluate prohibiting AT&T from providing international record services (October).

1981 Congress passed the Record Carrier Competition Act to free Western Union to provide international record services, and to allow international record carriers to provide domestic service (December).

1982 The FCC established Docket CC 82-122 to prescribe an interconnection agreement between international record and domestic carriers (February).

1982 The FCC prescribed an interim agreement that would provide a 15% discount to IRC's for interconnection (April).

1982 Western Union and the IRC's filed interconnection tariffs (May).

1982 The FCC rejected carrier interconnection tariffs (June).

1982 The FCC decided, in Docket CC 80-623, that AT&T should be permitted to provide international record services (December).

1983 The FCC modified its interim order on Docket 82-122 to permit carriers to develop their own agreements on compenstation for interconnecting services (March).