

## NETWORK ANALYSIS: A NEW TOOL FOR RESOURCE MANAGERS<sup>1</sup>

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Resource managers manipulate ecosystems for direct or indirect human uses. Examples of relatively well studied resource management issues include familiar biological products such as: forests, ranges, fish and wildlife; or physical products such as air, water and soil. Until very recently, urban environments received much less scholarly attention. However, as Spurr (1969) notes "principles of ecosystem management apply to wilderness and to urban environments".

Within urban environments, it is people, and particularly children who are worthy of new scholarly attention. After all, why bother with long-term resource management, if we ignore the reality of life for today's urban children. They will inherit what ever future resources today's resource managers leave behind. The discussion of network analysis presented here is part of a larger study of nature and urban children, Allen (1977).

### WHAT IS NETWORK ANALYSIS?

Network analysis is a new technique to uncover and map information and communication links between two or more people using a particular natural resource. Older forms of network analysis trace inanimate linkages, for example, telephone wires, sewer pipes and transportation corridors. Other human network analyses are to uncover friendship networks, Moreno (1960), political coalitions, Boissevain and Mitchell (1973) community elites, Laumann and Pappi (1976), or urban families, Bott (1977) and Gans (1962).

For this study, the network analysis is based on measured personal associations of urban children, eight to thirteen years of

age. All three hundred sixty three children were located outdoors in close proximity to each other while using natural land resources within organized nature recreation, and environmental education programs. All programs serve children from metropolitan, New York, New Jersey and Connecticut. Ordinary, working class urban children, who actually use selected forest environments (parks, camps, nature centers or urban wildlands) are the focus of this study because they have large, accessible social networks. They are also numerous; therefore there are many more children to be served by a decreasing resource base. Moreover, interrelated issues of equity and resource scarcity put added burdens on resource managers and the tools and techniques of resource management.

### HOW DOES NETWORK ANALYSIS WORK HERE?

I started this study with a curiosity about the commonplace event of collecting large groups of urban reared children, and moving them to a park, nature center, camp or wildlands for the summer. These events have gone on for a variety of altruistic and youth management objectives for more than one hundred years starting with the newspaper fresh air funds and settlement house outings of Jane Addams.

This study used a series of forested sites with youth outdoor programs to study the role of nature in the lives of urban children. In the study, urban children, were observed over four summers and interviewed on location.

One component of the interview schedule was a sociogram. Respondants were asked to identify companions they would choose for a hike in the woods as an index of the type of association. They are also asked to classify their choices as: relatives, neighbors, school friends or just camp/program friends.

What was different about this study was

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that in addition to mapping the networks of reported associations, and classifying associates as to social distance a simple, unobtrusive way was devised to index the duration of the reported associations. This was done by superimposing the results of a content analysis of attendance records on to the sociograms previously classified according to kinship or associated more distant social links. Return rates were established by checking attendance lists for two consecutive years, to see who reappeared the second year.

It is estimated from the rate of other errors in attendance records that there was not more than a 2% error, since careful attendance checks are required for safety and funding reasons. However, occasionally in crowded urban day type programs a child not on the attendance list, but who knows the system from a previous year will sneak on a bus "going to the beach" or some other swimming hole.

There are at least three stages in any network analysis. Stage one is the network identification process - in this case, I selected youth outdoor programs of various sizes and types. All programs have similar goals, objectives, clients and environmental resources. Given the nature of the urban children, there are likely to be pre-existing networks worthy of analysis.

Stage two involves mapping identified networks. In this instance desk-top and computerized matrix methods were combined to show structural and functional relationships within existing social networks. Three important dimensions of stage two are keeping track of several hundred subjects, identifying returnees and cataloging pre-existing kinship, friendship, neighborhood and school groups.

Stage three is to understand the results of the network analysis. Here the key insights are derived from the comparison of a range of program types. One surprising finding is the extent of pre-existing networks embedded in these outdoor experiences. This is surprising because program managers act as if all users are new to each other and to the natural system resources.

#### A. Causes of Bonding

All groups change with time. Returnees slow the rate of change by adding stability and consistency to camp life. Network analysis aims to show why camp groups are cohesive and how group cohesion develops with the life history of individuals. The extent and type of pre-existing groups in camp include: kinship, neighborhood, and friendship groups which contribute to group cohesion and high

return rates. Camp programs for urban children mimic the life in small, intimate, rural communities during the last century.

The concept of social networks requires an explanation before a presentation of the findings. Networks are private and more or less permanent structures which bind individuals in complex lines of transportation and communication. Moreno (1960) likened social networks to a "container, a bed which carries and mingles its currents, however different their goals may be". Social networks are important because they carry rumors of sociological current. Because networks are private, it is hard to estimate where they reach, but in the case of nature programs for urban children, it is clear that the reputation of a program and its core staff influence the constancy of return rates. In Moreno's terms, networks are "the kitchens of public opinion. It is through these channels that people affect, educate or disintegrate one another. It is through these networks that suggestions are transmitted."

Moreno devised sociometric tests to examine social structures by measuring the attractions and repulsions between individuals within a group. Moreno cautioned that it is a difficult psychological problem to introduce a sociometric instrument into a small community since it may be painful or unpleasant for a particular individual to find out his position in the group. For the present studies, there was little resistance to a sociometric measure since that measure was only a small part of the total instrument. Preparation for the sociogram came through the rapport developed earlier in the interviews. There seemed to be a little consciousness or resistance among the children to the sociogram items. In both 1972 and 1974, at the end of the interview, each child was asked, in Question 31, "If you could choose three people from camp to go on a hike with you, who would you choose?" After the three choices, children were asked to classify the individual chosen as to whether they were: camp friends, workers at the camp, counselors, school friends, neighbors, or relatives.

The hand analysis of sociometric data consisted of drawing conventional sociograms with circles for individuals or squares for categories of individuals who were not actually interviewed. Returnees are marked by a double circle and dyads are shown by arrows. A dyad is a union of two people. Moreno indicates that the level of social group cohesion is high if the number of dyads is larger than one-half the membership, thus allowing for chains, triangles, stars, and more complex structures to form. By this definition, all the camps are cohesive social

groups.

Computerized analysis of the sociogram results consisted of constructing a matrix for all choosers and all chosen individuals. Each child was scored on the number of choices he or she made, and on the number of times he or she was chosen. The total number of crossovers by age, race, sex, counselor group, and type of choice; e.g., staff, camp friends, school friends, neighbors, relatives. The number of reciprocal and non-reciprocal choices was computed for the entire samples.

#### Kinship

At the Nature Center in 1972 there were eight pairs of siblings, four groups of three siblings, and one group of four siblings registered. This means that of thirty-two people, eleven had blood relatives in the program. There were three sets of two siblings, one set of a mother and two offspring, and one set of a mother and one offspring. Among the urban children registered, there were eighteen sets of two siblings, four sets of three siblings, and three sets of four siblings. Thus, sixty people, or 43 percent of the sample population, had a blood relative in the program.

At the YMCA/YWCA Camp in 1973 there were twenty-three sets of two brothers, three sets of three brothers, and one set of four brothers. There were twenty-nine sets of two sisters, five sets of three sisters, eleven two-member brother-sister combinations, one three-member combination, and two four-member combinations. In this case, 165 children, or over 19 percent of the 859 children registered, had a blood relative attending the program.

Composite attendance figures provided by the Scout Program do not contain information on the number of siblings attending camp together. Occasionally, relatives attend camp together. Two percent of sociogram choices were for relatives. At the Resident Camp Program in 1973 there were twenty-five sets of two same-sex siblings, and two sets of three same-sex siblings. There were also fifteen sets of opposite-sex siblings in pairs, and two sets of three-member brother-sister combinations. This means that ninety-two people, or nearly 38 percent of the 245 registered children had one or more blood siblings in the program. In short, when urban children go to natural environments in organized groups, many of them bring their existing social networks with them. When they return home, camp experiences have high story-telling value. Shared experiences, pleasant or unpleasant, bind groups together into larger social networks or a web of group affiliation. Table 1 summarizes the extent

TABLE I

Results of Network Analysis  
Showing Pre-Existing Networks

| Program<br>Type    | % of Children<br>with 1 or more<br>Sibling Present | Total 1972-73<br>Registration |
|--------------------|----------------------------------------------------|-------------------------------|
| Nature Center      | 44%                                                | 72                            |
| Museum Program     | 43%                                                | 60                            |
| Day Camp           | 19%                                                | 859                           |
| Neighborhood House | 59%                                                | 295                           |
| Scout Camps        | 38%                                                | 245                           |

of pre-existing networks.

Kinship groups are highlighted in the sociogram in Figure 1. Siblings and cousins present are marked with R for relative. Such blood relationships among children are not immediately obvious because children are scattered across the campsite, and they may have different last names on attendance lists. Therefore, asking a child to categorize choices is very useful.

#### Neighborhood

These groups were the most conspicuous at the close-knit Neighborhood House Camp. Reported neighbors are shown in Figure 2, along with a high number of returnees. Neighbors were also evident in Nature Center and YMCA/YWCA camps. Neighbors were less frequent in the Scout Camps and Private Camp because these programs draw from a wider geographic area. When neighbors attend camp together, camps become an important extension of urban neighborhoods, and like neighborhoods, are "the place where children are brought up to become members of their own society".

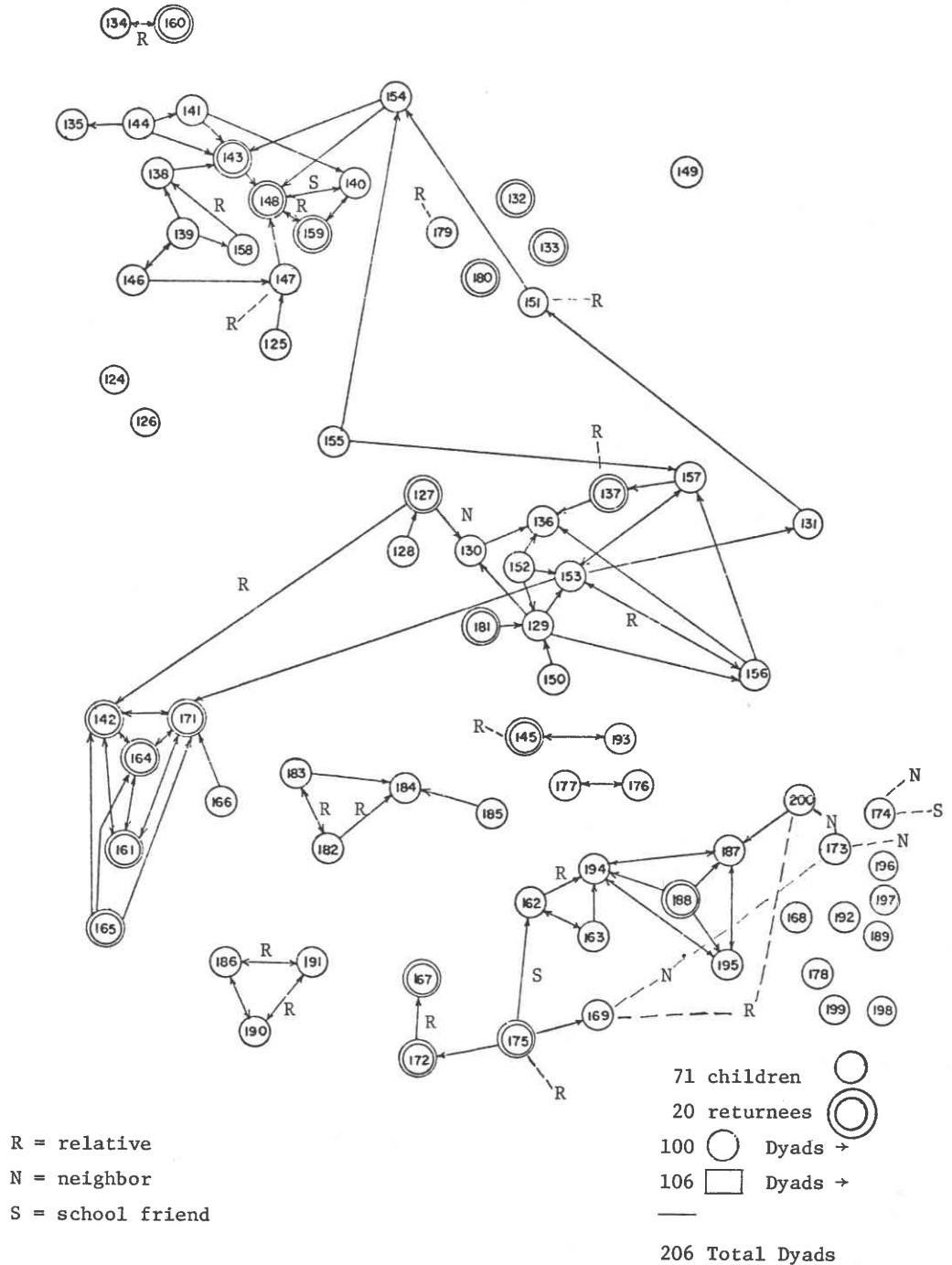
Neighbors live in proximity, by definition, and this may "necessitate many contacts of human beings and cause inurement to and intimate knowledge of one another". This knowledge is transposed to camp, and it affects the children. Neighbors also communicate sentiments and opinions about returning to camp together.

#### Friendship

This bond "comes most easily into existence when crafts or callings are the same or of similar nature". Friendship, though independent from neighborhood and kinship, requires "easy and frequent meetings". Friend-

Figure 1

YMCA/WYCA PROGRAM SOCIOGRAMS WITH RETURNEES AND KIN GROUPS (R)



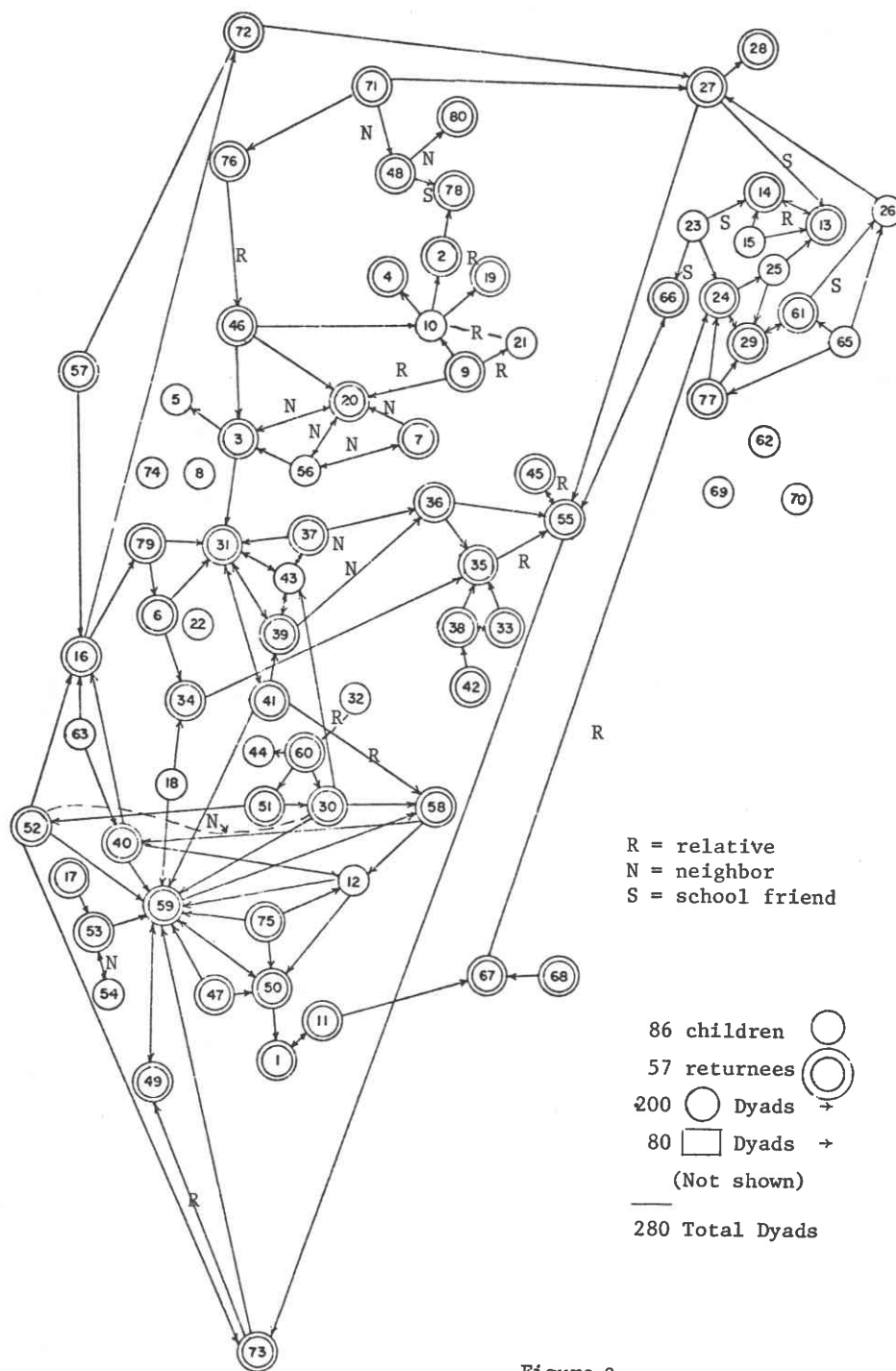


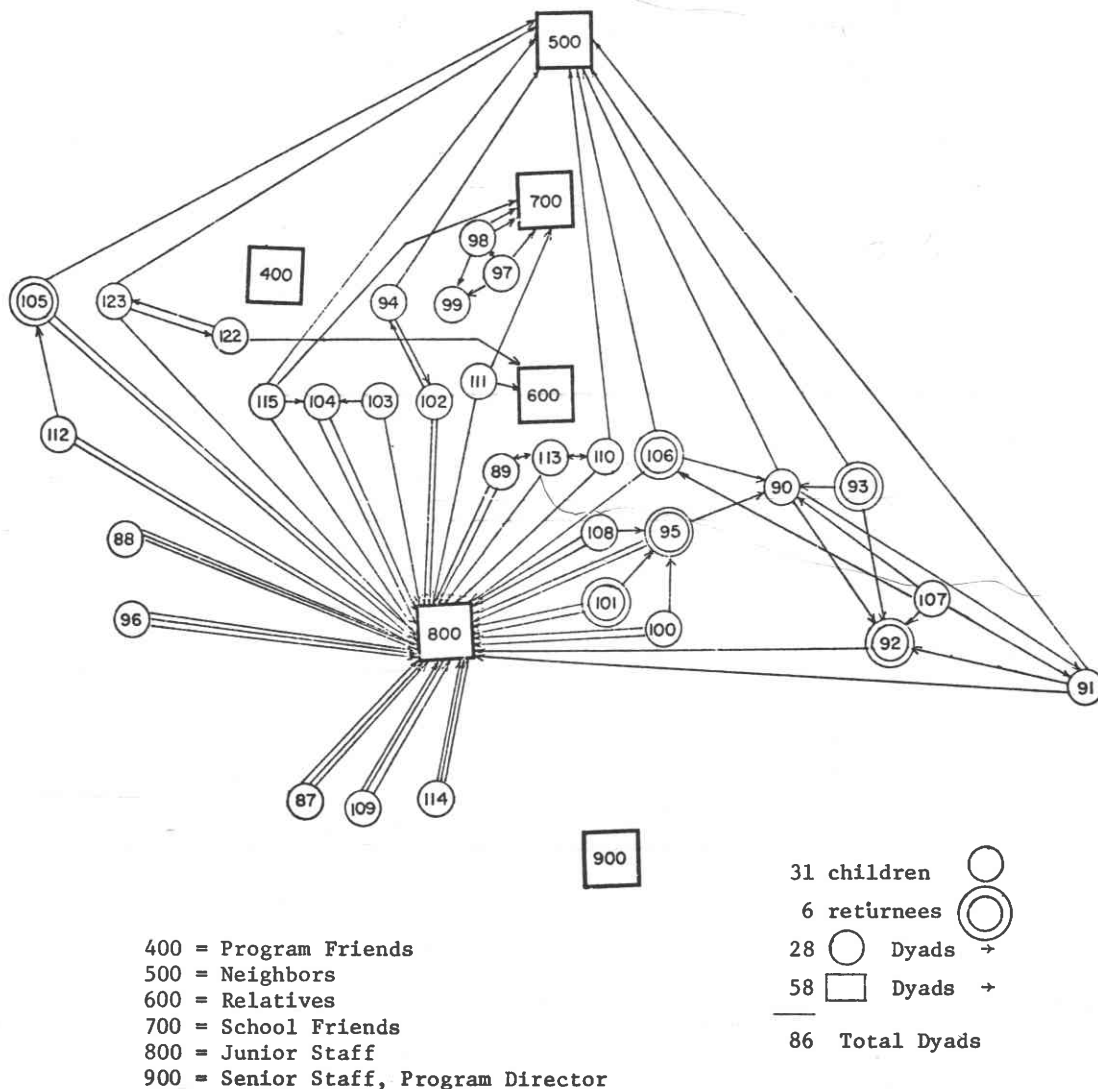
Figure 2

NEIGHBORHOOD HOUSE CAMP SOCIOGRAM WITH  
RETURNNEES AND NEIGHBOR GROUPS - N

ship among children or junior staff and children is conspicuously illustrated in Figures 2 and 3.

dren. This homogeneity in social background could account for such strong friendship bonds.

Figure 3  
MUSEUM PROGRAM SOCIOGRAM WITH RETURNEES AND OTHER GROUPS



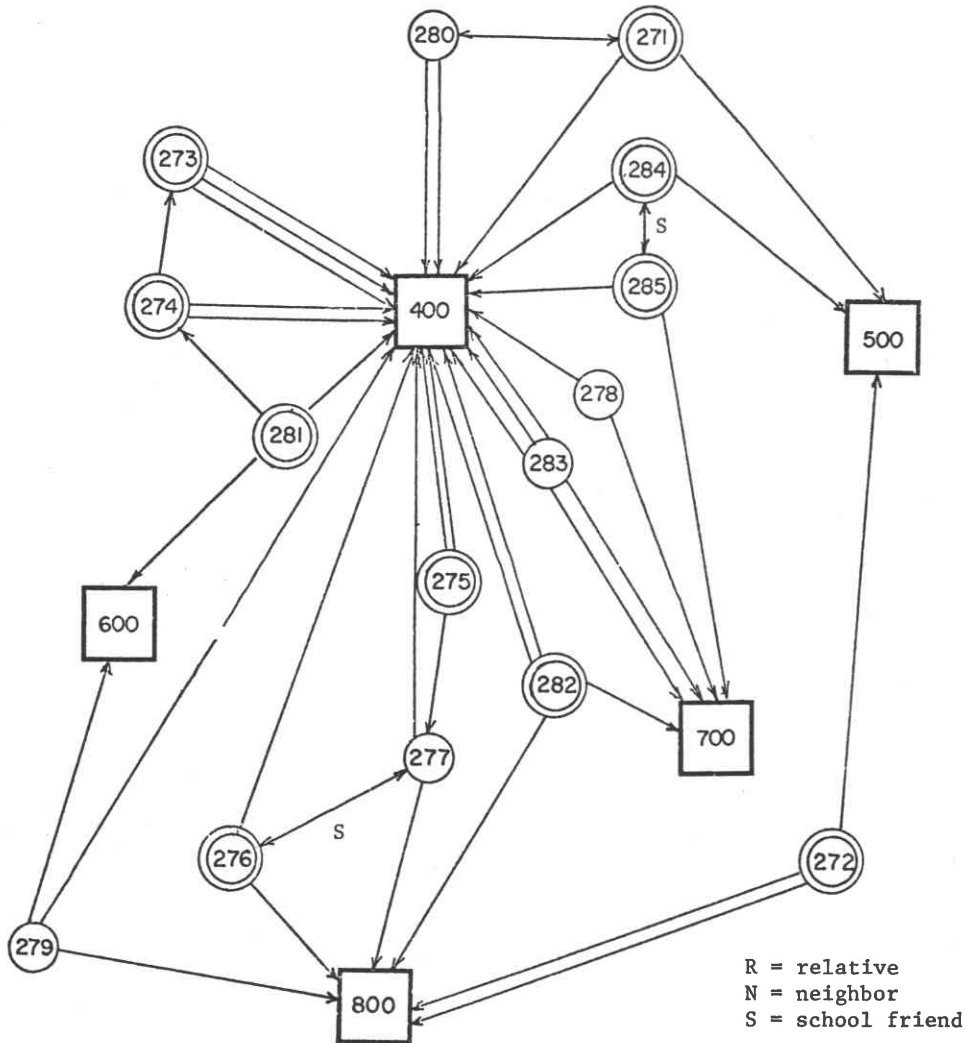
At the Museum Program, forty-two choices were made for junior staff from a total of eighty-six total dyads. There are several possible explanations. Since choices were made on three separate days, in three separate locations, a response groove is unlikely. The task for this sociogram was hiking, and many of these urban children are inexperienced in the woods, so it would be logical to choose companions who have been hiking there before. Finally, unlike most camps where junior staff are predominantly from a higher social class, these junior staff were mainly from the same social, racial, and ethnic groups as the chil-

At the Scout Camps, friendships were conspicuous without reference to kinship or neighborhood groups as illustrated in Figure 4. This finding is consistent with the mission of scouting.

In summary, although kinship extensions are generally dissolved in modern urban families, nature oriented, children's camps may serve as surrogate extended families. Outdoor programs show higher levels of group cohesion because they incorporate preexisting kinship and neighborhood groups. Friendship groups and returnees add further cohesiveness

Figure 4

SOCIOGRAM FOR SCOUT CAMP C  
WITH RETURNEES AND FRIENDSHIP GROUPS



400 = Program Friends  
500 = Neighbors  
600 = Relatives  
700 = School Friends  
800 = Junior Staff  
900 = Senior Staff, Program Director

15 children ○  
10 returnees ○○  
9 ○ Dyads →  
38 □ Dyads →  
47 Total Dyads

to groups of children in natural environments.

### B. Development of Group Cohesion

How does group cohesion develop in the milieu of children's outdoor programs? Research on returnees suggests that some inter-related factors are important. This is not the simplest explanation, but it best encompasses the evidence. Burch (1971) notes "habitat-societal interactions do not fall into a neat deterministic pattern".

### Natural Environments

First, a defined natural territory served as a focus for group interactions and a substrate for group cohesion. Coincidentally, in the Museum Program where territory is borrowed and only in use temporarily, return rates were much lower. None of the natural environments are unique or pristine, but all are available to large number of children. There is enthusiasm and obvious pride in ownership or exclusive use of natural areas, even if use is temporary. However, outside camp preferences for nature per se were rarely mentioned by this sample of children. Six percent of leisure preferences away from camp and 7 percent of preferences within the program were classified as nature-related.

Note that nature means the physical environment or acts having to do with natural scenery, birds, trees, flowers, etc. The Latin root word natura means born, and there are many connotations besides physical environments. Burch writes perceptively of different meanings people give to nature:

The habitats of human societies are not solely the function of ecosystem characteristics. Rather nature is always composed within a specific frame of motive and expectations.... and these selective perceptions determine whether the nonhuman environment will become a resource, a taboo, or remain unseen.

Networks analyses such as the ones in Figure 1-4 reflect the cohesiveness of social groups where many neighbors, school friends and kin-groups co-exist and use resources together. A high number of returnees and a return rate of 35% typify this neighborhood house group.

The highest return rates were found in a year-round nature center. Children walk to the nature center and the return rate is over 48%, although there is a smaller total group size and hence more individualized attention.

Incidentally, where children are picked by schools in an effort to equitably distri-

bute a scarce resource, return rates dropped to a little over 6%. Where there is more time in a program over a longer time frame, say 3-5 years, there is a much higher adoption of resource management related careers in later life. Therefore, one of the most subtle but significant long-term outcomes of exposing urban children to nature related resource systems is the nurturing of resource based values and conservation aesthetics. Whether the programs create such values de novo is not clear, but the nurturing function is far more critical.

### WHY IS NETWORK ANALYSIS USEFUL IN RESOURCE MANAGEMENT?

Network analysis is useful in resource management because it helps to clarify the following key elements of the human/resource complex:

- the final demand for recreation resources desired by a given society or social group;
- the spatial pattern of resources, potential resources and resource users (both current and future users);
- the quality of the resource related experience;
- the carrying capacity and reuse potential of resources;
- the resource costs and human impacts generated as a byproduct of very intense resource use;
- the interrelationships of resource users to ordinary natural environmental processes and transformations of the resource base with use;
- ambient conditions of overall environmental quality;
- final health, safety and environmental protection measures associated with the use of the land and associated physical and biological resources;
- impacts of resource use pattern changes on plants, animals or people;
- responses of individual elements in the resource use complex;
- local, regional and national governmental and institutional arrangements tied to the resource use patterns; and,
- strategies for implementing changes in

the quality of the resource and the management of future resources in times of increasing resource scarcity.

This approach to resource management is patterned after Bower, (1977).

#### WHERE DO WE GO FROM HERE?

In a time of declining or stable births, when there are fewer eight to thirteen year olds to be served, resource managers can logically expand the ages and life cycle stages served and/or improve the quality and service given existing populations now served.

The first is a competitive approach, while the second is more cooperative in orientation.

Either approach is better if network analysis is done, at least implicitly. By measuring the user trends, beyond one annual cycle and from year to the next, resource managers can become alerted to the stability elements in the resource complex, eg. returnees enhance the quality of predictability and regularity in this resource complex. In this case, there are indications that lengthy pleasant experiences carry forward into earlier choices and throughout the life cycle into maturity.

However, it is a mistake to believe that the transfer along networks is automatic or always positive.

Dislike for forest resources are conveyed just as efficiently as positive preferences. If we are to better manage dwindling resources, it must be with a careful regard for existing networks of resource users.

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