

STREET TREE TRENDS IN KANSAS AND THE INFLUENCE OF COMMUNITY FACTORS

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Abstract. The purpose of this study was to examine trends in street trees of Kansas communities that participate in the Kansas Community Forestry Program and correlate factors in the community that may influence the status. Street tree inventory components analyzed included vigor according to condition class, monetary value, number of trees and species composition. Community factors relating to street tree programs were explored through a questionnaire. A study of street tree inventories from twenty-two communities revealed trends toward an increase in species diversity, an increase in the number of trees, and a decline in vigor. Monetary value increased and decreased in an equal number of communities.

Kansas was one of four pilot states across the nation selected in 1971 to establish at least 10 community forestry programs in the state. Technical assistance from the Department of Forestry at Kansas State University helped participating communities to establish local Tree Boards to develop and administer forestry programs for their communities. The program was designed to primarily assist small, rural communities where professional and financial resources are limited.

A tool used to evaluate and measure the status of street trees in communities is the street tree inventory. Basic information such as number of trees, species composition, condition class regarding vigor, and monetary value of plantings is gathered periodically by district foresters within the state. Street tree inventories have been recorded in 143 communities across the state since 1972, but only 22 communities have had two or more inventories.

A summary of information in communities that have been inventoried can identify trends and indicate whether the status of street trees is improving or not. Factors such as an increase in number, species diversity, monetary value, and vigor according to condition class would indicate improvement. Why the status is changing, for better or worse, requires examining the community from a different view. Natural factors such as insect and disease epidemics, temperature and

precipitation extremes, as well as natural disasters, can severely alter street tree populations. Road construction can have an adverse impact as well. These effects are usually observable and can directly impact street tree populations at the time of their occurrence.

Human activities, both positive and negative have a far reaching impact as well. They vary from individual acts of planting a tree to a community lacking any program to improve its street trees. Though individual acts should not be discounted, factors at the community level largely determine the status of street trees. Natural disasters may have an impact as well. Figure 1 illustrates factors that affect the status of street trees.

Identifying community factors that influence street tree status can aid communities in understanding the implications of their policies and programs, or the lack thereof. Identification of these factors paired with trends analyzed from inventories should enable communities and professionals to further organize their efforts for more effective results.

A recent estimate indicated that only seven percent of the cities in the United States had an effective community forestry program (1). Several factors were identified by Hanson as effectiveness indicators for assessing community forestry programs. These included:

1. A tree care agency or other persons responsible for tree care designated by ordinance or community leadership.
2. An annual budget generated from several sources.
3. A community tree resource managed and maintained.
4. Public and private trained arborists.
5. An existing tree ordinance.
6. Annual work plans pertaining to public tree care.
7. Development and utilization of a master plan

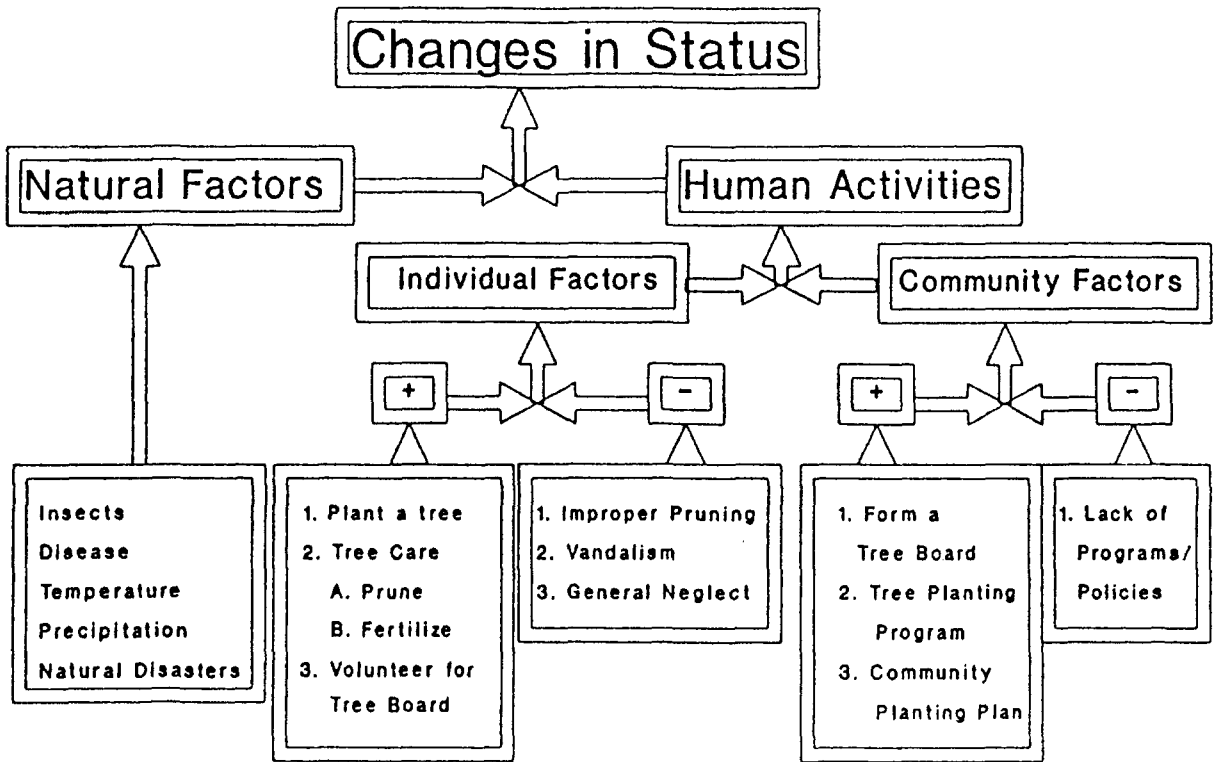


Figure 1. Factors that affect the status of street trees.

involving major elements of the city infrastructure.

8. Participation in new areas of growth and development.

9. Inventories of tree resources.

10. Educational outreach to the community.

11. Participation from citizens and leaders in initiating tree care programs.

12. Utilization of local medias for coverage of programs.

Additional factors may include:

13. Professional assistance in program development.

14. Endorsement of the community forestry program by the municipal government.

15. Administration of a community tree planting program.

16. A comprehensive long range work plan.

17. A community tree planting plan.

18. Use of a vacancy inventory to determine number of trees needed to reach full stocking level

(2).

Since many community forestry programs are largely dependent on volunteers, it is especially critical to identify factors that will facilitate a logical process in organizing and coordinating their activities. Some of these same factors may influence the status of street tree plantings as the result of an effective program.

Methodology

The purpose of this study was to examine the status of street trees in Kansas communities participating in the Kansas Community Forestry Program and to explore community factors influencing that status. The hypothesis is that community factors do influence the status of street tree populations. The diagrammatic model in Figure 2 illustrates the hypothesis and research design. In this study, the conceptual dependent variable is the status of street trees. Generally, is anticipated

that the status of street trees is improving in communities that participate in the Kansas Community Forestry Program. The conceptual independent variable for this study is the factors in the community that influence the status of street trees. The constructs of the independent variable are the seven community factors previously mentioned. They form an observable relationship with the constructs of the dependent variable, which include vigor according to condition class, monetary value, number of trees and species composition.

The data that were analyzed in sampling the status of street trees in Kansas communities that participate in the Kansas Community Forestry Program were obtained from street tree inventories conducted by district foresters of the Kansas State Forestry Division. The four components of data analyzed for each community included vigor according to condition class, monetary value by species and as a whole, number of trees by species and as a whole, and species composition as a percentage of the whole. Data were calculated for seventeen communities with two inventories, excluding monetary value. Data for five communities with three or more inventories were calculated, including monetary value as well. A total of twenty-two communities were used to determine street tree trends since the remaining communities have had only one inventory to date. Figure 3 illustrates the communities examined for street tree trends.

Community factors that may influence the status of street trees were explored through a questionnaire designed for city officials in those five communities that have had three inventories or more. An alternative questionnaire also designed for city officials sampled five communities that have never been inventoried to determine the extent of any organized community forestry program efforts. Five rural communities in south central Kansas were randomly chosen since the five communities with three inventories or more were rural as well. Data were gathered by interview and the results recorded for each community.

Results

The communities participating in the study were organized into three groups. The first group con-

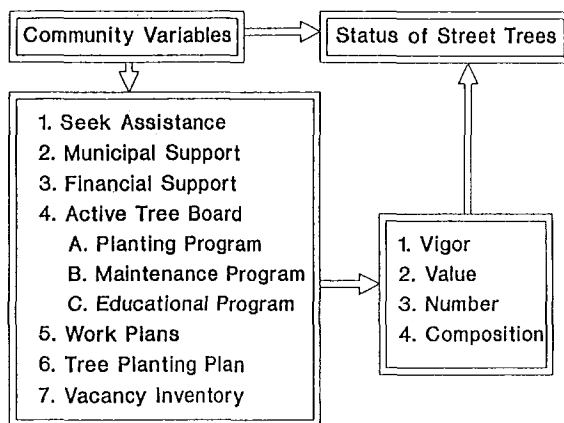


Figure 2. Diagrammatic model of research design.

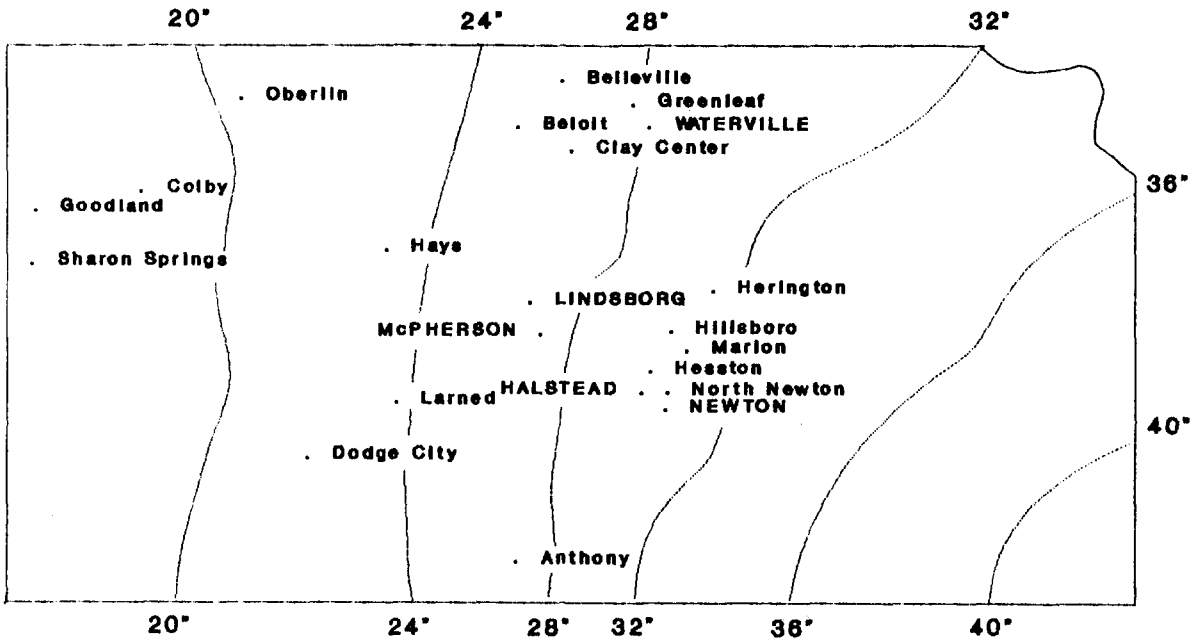
sisted of seventeen communities with two street tree inventories. A second group of five communities had at least three inventories and a third group of five communities had never been inventoried. The last two groups participated in the survey pertaining to the influence of community factors on street tree trends. Table 1, the composite results charts, allows examination of street tree and community factor data on an individual and collective basis.

Street tree trends. Street tree data were examined for twenty-two communities inventoried at least twice. Data from those communities with three inventories or more were derived from comparing the first and most recent inventories. Results were:

1. Thirteen communities in the study increased the number of street trees; nine decreased (Table 1). A slight trend toward an increased number of trees appears to be emerging.

2. Seven communities had a decrease in the number of species that comprised over ten percent of the total street tree population, two had an increase, and thirteen remained unchanged (Table 1). While the majority of communities remain unchanged, there is a trend toward reducing the number of species that comprise over ten percent of the total street tree population. The implication of this trend is toward increased species diversity.

Changes in vigor were studied according to condition class. The "good" category represents healthy, vigorous trees with no apparent signs of insect, disease or mechanical injury. Their form is



COMMUNITIES EXAMINED FOR TRENDS

All capital letters designates three inventories or more.

Lower case letters designates two inventories.

Dotted Lines Denote Precipitation Zones



Figure 3. Communities examined for street tree trends.

representative of the species. "Fair" indicates trees that are in average condition. They may need some corrective pruning or repair and may lack desirable form characteristic of the species. They may show minor insect, disease or physiological problems. "Poor" indicates trees that are in a general state of decline. They may show severe insect, disease, or mechanical injury, but death is not imminent. They may require major repair or renovation. "Dead/dying" indicates trees that are dead or where death is imminent (2).

3a. Nine communities increased the "good" category pertaining to vigor by condition class; twelve decreased and one was not available. 3b. Nine communities increased the "fair" category; twelve decreased and one was not available. Currently, the general movement is a decline from "good" to "fair." 3c. Eleven communities increased the "poor" category; eight decreased, two were

unchanged, and one was not available. 3d. Eight communities increased the "dead/dying" category, eleven decreased, two were unchanged, and one was not available (Table 1). The decreases to "dead/dying" can likely be attributed to the death or removal of these trees.

4. Monetary value of street trees was calculated for the four communities with three inventories or more; data for the fifth were unavailable. Two communities increased in monetary value; two decreased (Table 1). Only one of the communities with an increase in monetary value actually had an increase in the number of trees. The marginal increase in monetary value for the other community is due to only a marginal decrease in the number of trees, coupled with an increase in the size of the overall street tree population inventoried over a period of twelve years.

Trends within individual communities are easier

Composite Results

STREET TREE DATA	PROGRAM CITIES					NON-PROGRAM CITIES					ADDITIONAL PROGRAM CITIES																	
	1	2	3	4	5	1	2	3	4	5	AN	BL	BT	CC	CO	DC	GO	GR	HY	HE	HI	HB	LA	MA	NN	OB	SB	
1. NUMBER OF STREET TREES	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽
2. PERCENT OF TOTAL TREES BY SPECIES (Above 10% Live)	▽	△	NC	▽	▽	▽	▽	▽	▽	▽	NO	NO	▽	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
3. QUALITY OF STREET TREES																												
GOOD	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	
FAIR	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	
POOR	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	▽	
DEAD/ DYING	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	△	
4. MONETARY VALUE OF STREET TREES	△	△	△	△	△	△	△	△	△	△	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
5. SPECIES DIVERSITY	△	△	△	△	△	△	△	△	△	△	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
COMMUNITY FACTORS																												
1. EXISTING STREET TREE PROGRAM ?	Y	Y	Y	Y	Y	N	Y	N	N	Y																		
2. PERCEIVE THE NEED FOR A PROGRAM ?	-	-	-	-	-	N	N	Y	Y	Y																		
3. ASSISTANCE IN PROGRAM DEVELOPMENT ?	Y	Y	Y	Y	Y	N	N	Y	Y	Y																		
4. PROFESSIONAL RESOURCES IN COMMUNITY ?	Y	Y	Y	Y	Y	N	N	N	N	N																		
5. PRIORITY OF STREET TREE PROGRAM	B	H	L	B	B	-	-	-	-	-																		
6. PUBLIC PERCEPTION OF STREET TREES	P	P	P	P	P	NS	NS	P	NS	NS																		
7. ANNUAL BUDGET FOR STREET TREES	1	1	4	3	3	N	1	N	N	1																		
8. EXISTING STREET TREE ORDINANCE ?	Y	Y	Y	Y	Y	N	N	N	N	Y																		
9. EXISTING TREE BOARD ?	Y	Y	Y	Y	Y	N	I	N	N	I																		
10. STREET TREE PLANTING PROGRAM ?	Y	Y	Y	Y	Y	N	N	N	N	N																		
11. STREET TREE MAINTENANCE PROGRAM ?	Y	N	Y	Y	N	N	N	N	N	N																		
12. PUBLIC INFORMATION PROGRAM ?	Y	Y	Y	Y	Y	N	N	N	N	N																		
13. DEAD TREE REMOVAL PROGRAM ?	Y	N	Y	N	Y	N	N	N	N	Y																		
14. ANNUAL WORK PLAN ?	Y	Y	Y	Y	Y	N	N	N	N	N																		
15. LONG RANGE WORK PLAN ?	N	Y	Y	N	Y	N	N	N	N	N																		
16. COMMUNITY STREET TREE PLANTING PLAN ?	N	Y	N	N	N	N	N	N	N	N																		
17. STREET TREE VACANCY INVENTORY ?	Y	Y	N	N	N	N	N	N	N	N																		

AN = Anthony BL = Belleville BT = Beloit CC = Clay Center CO = Colby DC = Dodge City GO = Goodland GR = Greenleaf HA = Hays
 HE = Herington HI = Hillsboro HB = Heeston LA = Larned MA = Marion NN = North Newton OB = Oberlin SB = Sharon Springs

△ = INCREASE
 ▽ = DECREASE
 Y = YES
 N = NO
 B = SIMILAR TO OTHER MUNICIPAL PROGRAMS
 H = HIGHER THAN OTHER MUNICIPAL PROGRAMS
 L = LOWER THAN OTHER MUNICIPAL PROGRAMS
 I = INACTIVE
 P = POSITIVE
 1 = \$0 - \$5,000/YEAR
 2 = \$5,000 - \$10,000/YEAR
 3 = \$10,000 - \$50,000/YEAR
 4 = OVER \$50,000/YEAR
 NO = NO CHANGE
 NA = NOT AVAILABLE

Table 1. Composite results.

to recognize after examining the four components of vigor. Though these patterns are varied from one community to the next, there appears to be a general decline in vigor across the state. Many small, rural communities are faced with maturing street tree populations. Dutch elm disease eliminated many of the trees, but there is still a sizeable portion remaining that needs increased attention. Small communities are often unprepared to meet this demand. They are challenged to replace those trees that die, in addition to addressing maintenance issues.

Community factors. Two groups of five communities were examined for community factors that influence street tree trends. One group had three street tree inventories or more, while the other group had never been inventoried. Questionnaires were employed to examine community factors for both groups. Substantial differences in community factors and attitudes were found pertaining to street trees. The results were:

Existing Street tree Program and the Perceived Need for a Program. Eight out of ten communities recognized a need for a street tree program, but only five had an active program. The five communities that have been inventoried have a program.

Only three of the five in the non-inventoried group recognized a need (Lines 1 and 2 under Community Factors in Table 1).

Assistance in Program Development. Six communities perceived the need or had received assistance outside of the community in program development; two didn't perceive the need and two weren't sure. The five communities in the inventoried group responded positively. Two in the non-inventoried group didn't perceive a need and two weren't sure (Line 3 under Community Factors in Table 1).

Professional Resources in the Community. Five communities had professional resources in the community for program development; five didn't. The five communities were the inventoried group (Line 4 under Community Factors in Table 1).

Priority within the Street Tree Program. One of the program communities ranked their street program as having higher priority than other community programs; three communities ranked their programs as having similar priority as other community programs; one community ranked their program as having lower priority (Line 5 under Community Factors in Table 1).

Public Perception of Street Trees. Six com-

munities believed street trees were perceived by the public as having a positive influence on the community; the other four weren't sure. The five communities in the inventoried group responded positively. Four of the five non-inventoried group weren't sure (Line 6 under Community Factors in Table 1).

Annual Budget for Street Trees. Seven communities had a budget for street tree improvements; three didn't. All five communities in the inventoried group had a budget (Line 7 under Community Factors in Table 1).

Existing Street Tree Ordinance. Seven communities had street tree ordinances; three didn't. All five communities in the inventoried group had an ordinance, while two of the non-inventoried group did as well (Line 8 under Community Factors in Table 1).

Existing Tree Board. Seven communities had tree boards, but only five of them were active. The five communities in the inventoried group were active (Line 9 under Community Factors in Table 1).

Street Tree Planting Program. Five communities had a street tree planting program; five didn't. The five communities were the inventoried group (Line 10 under Community Factors in Table 1).

Street Tree Maintenance Program. Three communities had a street tree maintenance program; seven didn't. These three communities were in the inventoried group (Line 11 under Community Factors in Table 1).

Public Information Program. Five communities had a street tree public information; five didn't. These five communities were in the inventoried group (Line 12 under Community Factors in Table 1).

Dead Tree Removal Program. Four communities had had a dead tree removal program for street trees; six didn't. Three of the four communities were in the inventoried group (Line 13 under Community Factors in Table 1).

Annual Work Plan. Five communities had annual work plans for street tree improvements; five didn't. These five communities were in the inventoried group (Line 14 under Community Factors in Table 1).

Long Range Work Plan. Three communities had

a long range work plan for street tree improvements; seven didn't. These three communities were in the inventoried group (Line 15 under Community Factors in Table 1).

Community Planting Plan. One communities had a street tree planting plan; nine didn't. The only community was in the inventoried group (Line 16 under Community Factors in Table 1).

Street Tree Vacancy Inventory. Two communities have conducted vacancy inventories; eight haven't. Both were in the inventoried group (Line 17 under Community Factors in Table 1).

Table 1, the composite results chart, illustrates how the program and non-program groups responded to the questionnaire. The differences in community factors between the two groups are clearly evident. Virtually all five communities in the groups that had been inventoried responded positively to the community factors surveyed. The group of communities that had never been inventoried largely responded in a negative manner to the factors surveyed. This sample would indicate that these communities have no organized effort for planning or measuring their street tree populations. In this instance, it is inevitable that street tree populations will decline in terms of numbers, vigor, and species diversity.

Conclusions

Street tree trends. The examination of street tree data from twenty-two communities reveals some notable trends emerging. While the number of street tree plantings is increasing in over half of the communities studied, there is a continuing need to increase the number of plantings. Dutch elm disease resulted in a dramatic loss to street tree populations that occurred in a relatively short period of time. Communities have been challenged to recover from the effects. Limited budgets and labor are particularly critical in small, rural communities. Minimal planting must offset mortality every year just to remain even. Substantial net increase is a long term goal that requires annual and long range planning.

Vigor varies among communities, but it appears there is a trend toward reduced vigor. Generally, good and fair categories decreased, poor increased, and dead/dying decreased. This

pattern indicates a general decline. Mature street trees represent an aging resource that requires additional strategies for effective management. The dramatic loss in numbers of street trees from Dutch elm disease prompted communities to focus their efforts during the last twenty years on replacement planting. Though replacement of street trees is a continuing concern, the results of this study indicate a growing need for maintenance activities. While this represents an additional strain on street tree budgets, increased maintenance activities would extend the life of an aging resource until new plantings become established. Potential public injury and liability could be reduced as well.

The results of Dutch elm disease demonstrated the need for species diversity in a healthy street tree population. The response from many communities has been encouraging in this regard. Noticeable trends toward species diversity were apparent in most communities, except those with a substantial reduction in the number of trees. In a few instances, even these communities showed marked species diversity. This favorable trend demonstrates the impact education and public information programs can have. It is a major step in the right direction. However, optimism must be tempered by the fact that a few species continue to be overplanted.

Community factors. Examination of the ten communities evaluated for factors influencing street tree trends reveals two distinct responses. Based on the survey, communities tend to have an organized program with several components or no program at all.

Correlating street tree trends with community factors is difficult based solely upon the results of the study. Communities with organized programs revealed mixed results in their street tree data. Some measurements of their street tree populations are improving, while others are deteriorating. One exception was that all five communities showed a marked increase in species diversity. Though it is difficult to identify strong correlations between street tree trends and community factors, it appears that an organized program with several components must be in place for several years before any improvements become significantly evident.

Several explanations could account for the mixed results from those communities with established programs. Limited budgets and labor are especially critical in small, rural communities. These will be ongoing concerns in the future. Some communities have more access to professional resources for planning. A common denominator of all these programs is that they are typically governed by a lay board. Effective leadership can be a limitation for some of these programs.

If it is difficult to identify and correlate trends in street trees with existing community forestry programs, it is impossible in those without programs and inventories. Random, windshield observations in these communities often revealed several instances of entire city blocks with virtually no street trees or excessive numbers of only a few species. The absence of a street tree inventory and lack of an organized program indicate that street tree populations in these communities are being left to evolve on their own, with a resulting state of decline.

Recommendations

The results of this study indicate that different strategies are needed for working with communities, based upon their record of street tree management. Those communities with organized programs should be encouraged to continue to develop their programs qualitatively, expanding and elevating the level of their activities.

In some communities, it is difficult to generate enough interest to form a Tree Board and find members willing to serve. One reason may be that potential volunteers feel they lack the technical knowledge to direct such activities. Conversely, a well meaning, but misinformed individual can have an adverse impact as well. The development of management tools directed to assist lay personnel could address these factors that may limit the effectiveness of tree boards.

One management tool that records existing street tree characteristics is the street tree inventory. Numbers and types of species, size, age, vigor, and monetary value are commonly calculated and recorded. This type of inventory constructs a picture of what exists. Annual and long

range plans are usually formulated based on this information. In most communities, additional management tools are missing that could assist lay board members in planning.

A street tree vacancy inventory could complement the street tree inventory by giving a total picture of the current status of street trees. It would identify a specific number of trees that need to be planted, record locations and identify vacancy distribution patterns on a map. Species to be avoided in future plantings could also be noted. Annual and long range plans could be enhanced by targeting a specific number of trees and locations each year to reach the number of trees needed for full stocking potential.

A second management tool that would assist lay board members is a community street tree planting plan, where feasible. This could aid in assuring species and age diversity in street tree populations. It could also provide the opportunity for incorporating site design features as well. Another aspect of both of these management tools is that they would provide continuity to the program as board members change. Aside from orienting new members more quickly, a planting plan would enhance long range planning by providing an identified objective that would not be a susceptible to deviation by changing board members over a period of time. Additional management tools need to be developed in the future to enhance the effectiveness of limited budgets, labor and lay board efforts.

Besides devising management tools to assist lay board members, developing an extensive maintenance plan would enhance the quality of existing street tree programs. As mentioned earlier, the focus of the activities of many communities has been centered around planting, while maintenance is often overlooked. Maintenance activities may include pruning/dead wood removal, fertilizing, preventing/treating structural damage and insect/disease control. Pruning is probably the most noticeable and important of all maintenance activities (3). Scheduling and targeting areas for annual pruning would be a logical start for those communities lacking a maintenance program. It would reduce future problems in a

preventative manner and address current ones through corrective intervention.

Professionals including landscape architects, foresters, horticulturists, arborists, and other disciplines contribute in various capacities to the quality of the urban forest. Their roles vary and occasionally overlap, but the unique perspective that each discipline offers provides a diversified approach to street tree management. Their combined effort to provide leadership will continue to be necessary to face the challenges confronting the urban forest of the future.

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Résumé. Le Community Forestry Program (Programme forestier communautaire) a été créé en 1971 pour améliorer les plantations d'arbres de rues au Kansas. L'objectif de cette étude était d'examiner les tendances dans les communautés participant au programme et de corréliser ces facteurs dans les communautés qui peuvent influencer les orientations. Les facteurs communautaires étaient examinés au-travers d'un questionnaire. Une étude sur 22 communautés révélait une augmentation de la diversité en espèces et un déclin de leur vigueur. Les tendances reliées au nombre d'arbres et leur valeur monétaire n'étaient pas identifiées. Il apparaît qu'un programme organisé doit être mis en place pour de nombreuses années avant que des améliorations deviennent facilement évidentes.

Zusammenfassung. 1971 entwickelte man das Community Forest Program, um die Anflanzung von Strassenbäumen in Kansas zu verbessern. Ziel dieser Studie war es, die Entwicklung in den am Programm beteiligten Gemeinden zu verfolgen und diejenigen Faktoren der einzelnen Gemeinden, die die Entwicklung bedingen, miteinander zu verknüpfen. Diese Faktoren wurden anhand einer Umfrage ermittelt. Einer Studie in 22 Gemeinden zeigte eine Zunahme der Artenvielfalt und eine Abnahme der Vitalität. Es konnte kein Trend festgestellt werden, der im Zusammenhang mit der Anzahl oder den materiellen Wert der Bäume steht. Es wurde deutlich, daß ein organisiertes Programm erst mehrere Jahre lang durchgeführt werden muß, bevor Verbesserungen klar ersichtlich werden.