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A tale of three greenway trails: user perceptions related to quality of life

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Abstract

Urban sprawl and renewed concern for the environment have helped create new policies and initiatives designed to enhance community quality of life. Among these are transportation enhancements mandated in ISTEA and TEA21. Funding through transportation enhancements has helped to spur the designation and development of greenway trails with the intent of fostering alternative transportation and generally making cities more livable. This paper presents research conducted on three greenway trails in Texas. The research was based on the human ecosystem concept and was intended to determine if and how such greenway facilities were contributing to quality of life and how people might perceive such contributions based on the way they used the trail (e.g. for transportation or recreation). Results indicated that most people used greenway trails for recreation but that trails differed in user types and activities based on location and policy. Users felt that these urban greenway trails were contributing most to community quality of life through resident health/fitness, the natural areas they provide, better land use and resident pride. They felt that they contributed least to diversifying industry, business development and access to shopping areas or public transportation. Those who used trails for transportation scored trails as contributing more toward reducing pollution, reducing transportation costs and providing better access to work than did those who used trails only for recreation. Implications for understanding use and users in the designation, design and development of urban greenway trails are discussed.

Keywords: Community ecosystem; Greenway trail; Livability; Quality of life; Recreation; Transportation enhancements

1. Introduction

The history of post-war community building in the United States has largely been a history of the outward expansion of urbanized areas. This expansion has resulted in a hierarchical road network at the top of which sits the limited-access highway down to the local street which is epitomized by dead end signs (Cervero and Gorham, 1995). Within this network, it has become more and more difficult to get around by any means other than the private automobile. Recently, however, environmental concerns and urban sprawl have led to trends in new urbanism and management based on more complex relationships between humans and their surroundings (e.g. ecosys-

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tem management). In the early 1990s The US Department of Transportation (USDOT) began to consider sweeping changes in transportation policy in response to these trends and in order to meet demands to help create a higher quality of life in communities while contributing to sustainability (defined here as a community's ability to develop and/or maintain a high quality of life in the present in a way that provides for the same in the future) through transportation alternatives other than the car.

Among other alternatives, bike/pedestrian facilities (e.g. multi-use trails) can be useful through contributions to mobility and access, reliability, social equity, the environment and ultimately to quality of life in a community. Thus, federal agencies, including the USDOT, the Federal Highway Administration (FHWA), and the Environmental Protection Agency (EPA) have recognized the benefits of integrating these facilities into multi-modal transportation systems in hopes of realizing communities in which a quality of life is enhanced and will be lasting i.e. be sustainable from one generation to the next. This recognition has been reflected in increased funding toward these facilities through the Transportation Enhancements (TE) and Congestion Mitigation and Air Quality (CMAQ) categories of the Intermodal Surface Transportation Efficiency Act (ISTEA) (Hardt, 1995). The Transportation Equity Act for the 21st century (TEA 21) which was recently passed by the US Congress continues in this direction.

Greenways have come to the forefront in urban planning largely due to these transportation programs as millions in federal spending has been directed at the development of trails within them. Although greenways are variously defined (Little, 1990; Hay, 1991; Smith, 1993; Searns, 1995) in urban areas they can be summarized as multiple objective, open space corridors that perform natural functions (Baschek and Brown, 1995) while offering desirable aesthetic qualities to humans (Shannon et al., 1995) as they recreate or commute along trails (Gobster, 1995). Greenway trails are especially appealing as transportation corridors because they are separated from the traffic of roadways thus providing enhanced safety and a sense of escape from the urban surroundings (Groom, 1990; Luymes and Tamminga, 1995). Greenway-based trails can help to meet quality of life objectives espoused in TE legislation by not only offering alternative transportation routes but by also providing access to nearby nature, opportunities to recreate, exercise and to interact face to face with others in the community. Because TE is still a relatively new program there have been few attempts to document and evaluate how it might meet quality of life objectives. The purpose of this study was to better understand the role that TE type trails located in greenways play in urban quality of life.

Traditionally, the effectiveness of transportation enhancement investments has been measured through criteria like average trip length; share of single occupancy vehicle (SOV) travel; energy consumption; and the generation of externalities like air pollution, greenhouse gas emissions, and the incidence of traffic accidents (e.g. Cambridge Systematics, 1994). Some researchers have suggested that additional criteria such as the share of transit, walking, bicycling, carpool, and other non-SOV modes should be included because they increase accessibility and opportunity, cost effectiveness, and social equity (e.g. Turner et al., 1996).

While these criteria have merits, they also have fundamental problems. First, there is no clearly defined conceptual basis used in selecting them. Without a clear conceptual basis, the criteria used reflect a 'laundry list'. Second, many of these measures require further clarification and refinement to be used practically. For example, accessibility and social equity are suggested as 'must' criteria. But the question of how transportation agencies can practically measure these constructs to better manage local transportation remains unsolved. Finally, most studies have used secondary data to measure the effectiveness of transportation enhancement investments (e.g. average travel speed, traffic volume, air quality, energy consumption). Although it may be meaningful to use secondary data to measure economic and environmental aspects of transportation investments, these data limit our understanding of the social psychological quality of the investment accrued to transportation facilities users.

2. Sustainable communities and quality of life

Some of the modern ideas related to sustainability began with Aldo Leopold, who raised concern for an environment's carrying capacity, or its ability to absorb human influence and still sustain all of its life forms and processes (Leopold, 1949). Later, Garrett Hardin helped to place that concern in the community context with his compelling tragedy of the commons (Hardin, 1968). Although no agreed upon definition exists, the term sustainability is generally defined as the effective use of natural, human, and technological resources to meet today's community needs without compromising the ability of future generations to meet their needs (The UN World Commission on Environment and Development, 1987). The concept and application of sustainability evolved further during UNCED's 1992 Earth Summit in Rio de Janeiro, where 120 nations agreed to an agenda for the actions needed to sustain global development into the 21st century. Agenda 21, as it was called, sparked the creation in 1993 of the President's Council on Sustainable Development (PCSD), whose work is intended in part to fulfill the United States' commitments. Within this context, a sustainable community can be defined broadly as one that seeks to provide and maintain a good quality of life for all its members.

The human ecosystem perspective (Bubolz et al., 1980; Force and Machlis, 1997; Machlis et al., 1997) suggests a way to enhance quality of life for community members. The perspective derives from a general ecological model in which organisms are regarded as interacting with one another. According to the general ecological model, the human ecosystem consists of a coherent system of biophysical and social factors (e.g. individual, family, community, social institutions, social order, culture, built environment, and natural environment), that are connected with each other in a hierarchical framework. Furthermore, the model acknowledges that factors are not static, but dynamic and reciprocal in that any part of an ecosystem influences or acts on any other part and is influenced or acted upon in return. For example, humans are dependent on their environment to satisfy needs and desires. In these efforts, humans transform their environment, and in a feedback process it, in turn, transforms them.

An implication of the human ecosystem perspective is that if a community is to be sustainable and provide a good quality of life, some equilibrium among all factors must be achieved and failing such equilibrium a community cannot reach or maintain an optimal level. This also implies that public programs and policies must be viewed in an integrated fashion. Accordingly, the policies on land use, the environment, housing, transportation, social services, and safety can no longer be treated as isolated issues. Beatley and Brower (1993), Geis and Kutzmark (1995), Yaro and Hiss (1996) and Beatley and Manning (1997) have all listed characteristics related to the quality of life needed to help sustain a community. They include: a diversity of housing, an end to sprawl, convenient access to mass transit, the widespread use of local products, the provision of a variety of opportunities for face-to-face encounters, sound economic bases, resident-led processes, fairness and equity, promoting a sense of place, creating new business that provide services or products that protect or restore the environment, and an expanded and strengthened constituency, to name only a few.

Previous studies on the human ecosystem perspective and sustainable communities provided the basis for a conceptual model which attempts to integrate these ideas in the context of urban trail facilities (Fig. 1). The model was developed in an attempt to recognize the basic relationships between component parts of a place in terms of its physical, social and economic realms. The model also indicates that quality of life is created by an ongoing interaction between community, environmental and economic qualities. The community of people represents social support networks through which its members communicate and participate in the life of their community. The physical environment of the community should exist in such a way as to support conviviality and to provide an environment that creates a healthy livable place. The community needs to be equitable: its members should be treated with fairness and justice, with their basic needs met and having equal economic opportunity.

As others have suggested (e.g. see Yaro and Hiss, 1996) an underlying premise of the model is that a sustainable community cannot be accomplished by focusing on just one of these three (economic, social, or environmental) aspects of the place. Put another way, facilities of any type, including trails, should be planned and designed for a balance among the economic, environmental, and social characteristics of an area so that its residents can lead healthy, productive, and enjoyable lives.

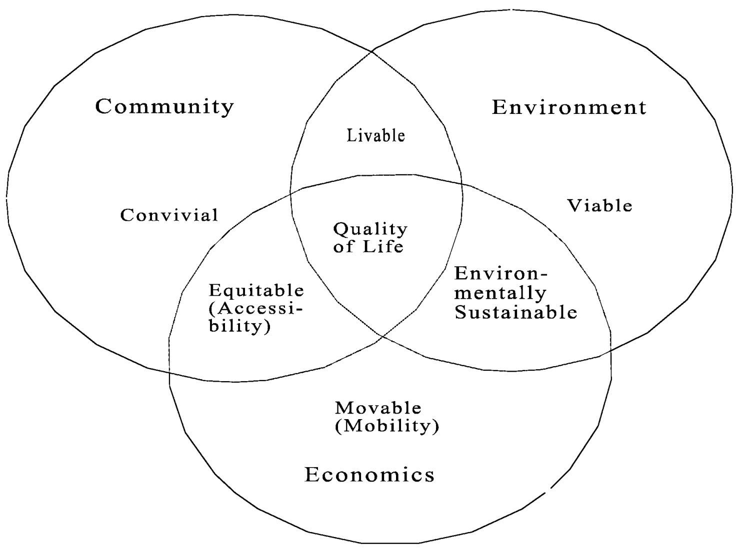


Fig. 1. A conceptual model of factors that contribute to community quality of life from a human ecological perspective.

2.1. Greenway trails and quality of life

Greenway-based trials are a part of a resource that has the potential to influence many quality of life factors. Greenway corridors are often cited as being desirable in urban environments because of their potential to clean water and sustain wildlife populations (Smith, 1993). Keeping floodplains open and able to handle stormwaters, maintaining wetlands, providing vegetative cover and food for wildlife all contribute to quality of life in humans, albeit somewhat periodically and often indirectly. However, those who use the trails located within the corridors are likely to realize direct quality of life benefits. In a study of greenway-based trails in and around Chicago Gobster (1995) found that, more than anything else, people liked the trail for its scenic beauty. Responses about 'nature', 'trees' and 'water bodies' were also among the top six characteristics that people liked about trail use (Gobster, 1995). Scott and Moore (1995) found that users of a greenway trail in Cleveland appreciated their trail most for opportunities to exercise, relax and appreciate nature, regardless of whether they were walking, skating, running or biking. The two largest benefits perceived by residents around greenway trails in an Oakland, California study were related to health/fitness and preservation of open space, while recreation, community pride and aesthetic beauty were next on the list (East Bay Regional Park District, 1998).

Social interaction is often suggested anecdotally as a community trail benefit. "Architect and commercial contractor Alex Cordero agrees, saying residents are much more likely to witness neighbors — wave, smile, and talk to each other — while they are taking a walk or a bike ride. Sociability between neighbors is reappearing in Henderson because they have a developing park and trail system" (Anon., 1998). Lee (1999) found that when greenway trail users were asked to provide events that occurred on the trail a majority of those described were social encounters. Many people specifically mentioned positive encounters with people engaged in different activities, or with families and noted that they often did exchange waves and smiles as a part of the event (Lee, 1999).

Less is known about the role that greenway trails play in 'recreation' on the one hand and 'transportation' on the other. Some studies put transportation use of urban trails as high as 75% of trips taken (Turner et al., 1996). In the Oakland trail study, cited above, 36% of trail users contacted on-site were engaged in a trip classified as transportation. In many trail-based studies recreation has been the assumed purpose and the transportation versus recreation dichotomy has not been addressed (e.g. Gobster, 1995; Scott and Moore, 1995). Few studies have examined how user attitudes might differ based on whether they used a trail for transportation, recreation or some mix of the two.

This study measured user perceptions to evaluate the effectiveness of greenway trails in terms of quality of life. We also examined if and how people who used trails for different purposes differed in their perceptions of a trail's contribution to quality of life. People's perceptions of how bicycle/pedestrian facilities influence their communities have powerful political implications. Understanding public perceptions about these facilities provides useful market information which can be employed to identify shortcomings in current facilities, to develop new facilities, to develop and justify planning strategies and/or evaluate usefulness in achieving agency objectives.

3. Methods

3.1. Study locations

For this study, three greenway trails in Texas (two in Houston and one in Austin) were selected as sites. Brays Bayou and Buffalo Bayou Trails were study sites in Houston and the Shoal Creek Trail was the Austin site (hereafter referred as BRT, BFT, and SCT, respectively). Research objectives dictated that we select trails that included a variety of activity types (e.g. bicycle, pedestrian) and trip types (e.g. commuting, recreational). After consulting with local authorities about trails in their jurisdictions, these three trails were selected because each included different activity and trip types. Another reason for selecting these trails was that they were typical of those funded through ISTEA/TEA21 enhancements and each of these three trails was slated for improvements through ISTEA funding in the near future.

Each of the trails is located along a riparian greenway. The BRT is located along the Brays Bayou, the BFT along the Buffalo Bayou and the SCT along Shoal Creek (Figs. 2–4). The Brays Bayou greenway was somewhat different from those associated with the other two trails. The Brays Bayou has been channeled and lined with concrete. Generally, there is less vegetation along Brays than along Buffalo Bayou or Shoal Creek. The streams associated with the BFT and SCT are more natural in appearance and do not have concrete linings though some structural alterations exist along each. Topography varies among these trails in much the same way. The BRT is relatively flat as it follows the shoulder of the bayou. The BFT and SCT trails are both more undulating as they move through different terrain closer to and away from the creeks they follow.

3.2. Survey procedures

In order to accomplish the purpose of this study, a two-stage survey was conducted from June–August 1998. First of all, an on-site survey was conducted on the three trails during June 1998. Users of each trail were sampled on three consecutive days (Thursday–Saturday) of a given week and trail users were intercepted between 7 a.m. and 7 p.m. daily. On each trail, one intercept point was selected in the trail's mid-section. A table was set up at the intercept point and signs were placed down the trail in both directions indicating that a trail study was in progress. An attempt was made to invite every user who passed the intercept point to take part in the survey. Approximately 80% of those passing the table agreed to participate. The one-page on-site survey was administered to these people. At the end of this survey, trail users were asked to furnish their names and addresses if they were willing to participate in a more detailed mail-back survey. A total of 1004 trail users filled out the on-site survey and 889 (88.5%) provided their names and addresses for the mail-back survey.

The mail-back questionnaire was sent to all 889 trail users who agreed to participate. This mailing included a cover letter explaining the purpose of the study, along with a postage paid, self-addressed envelope. A slightly modified total design method (Dillman, 1978) was used to administer surveys. A reminder postcard was sent to non-respondents 10 days after the initial mailing. Two weeks after the card a second questionnaire, reminder letter and post paid return envelope were mailed to any whom had not yet responded. The final return rates for each trail were: 217 from the BRT (63%), 169 from the SCT (62%), and 182 from the BFT (67%). All together, a total of 568 trail users responded to the mail (off-site) portion of survey for a response rate of 64%.

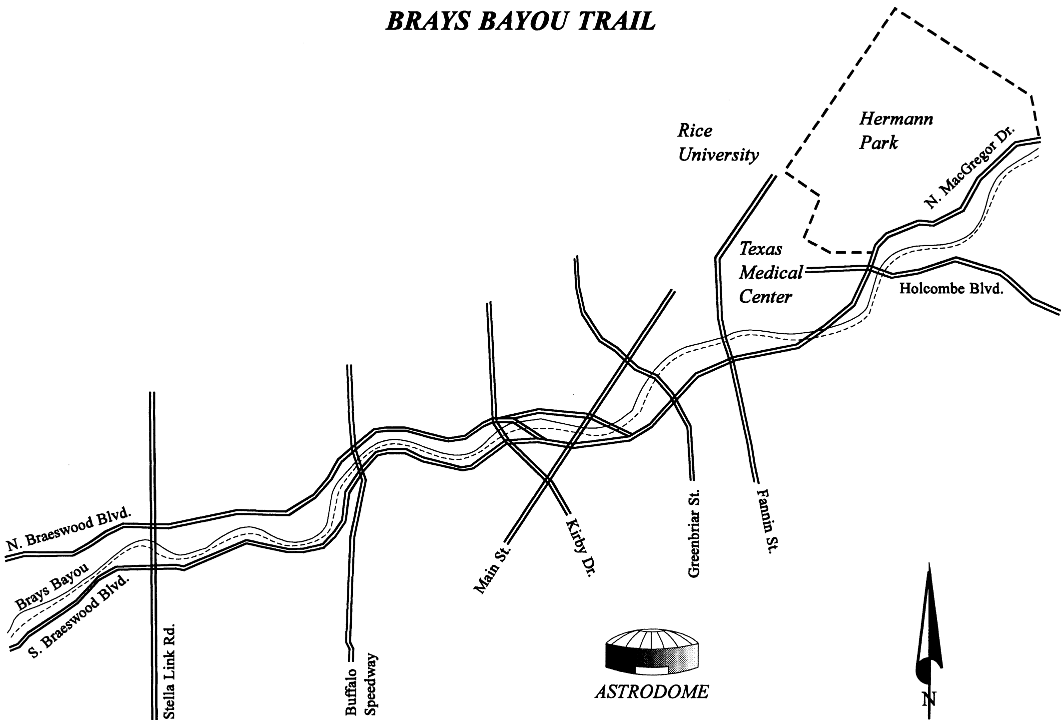


Fig. 2. Schematic depicting the Brays Bayou greenway trail alignment in Houston, TX.

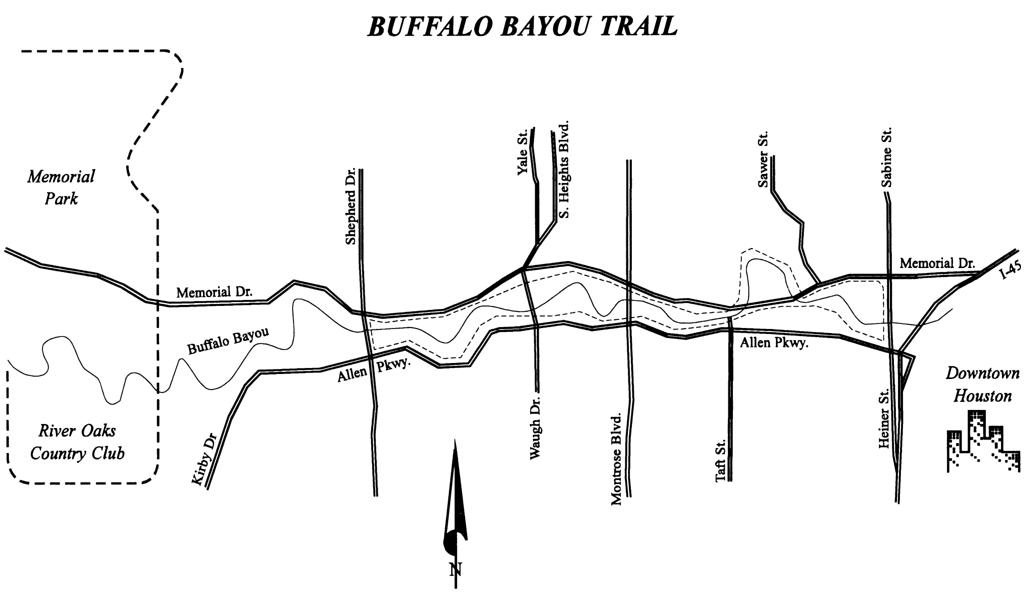


Fig. 3. Schematic depicting the Buffalo Bayou trail alignment in Houston, TX.

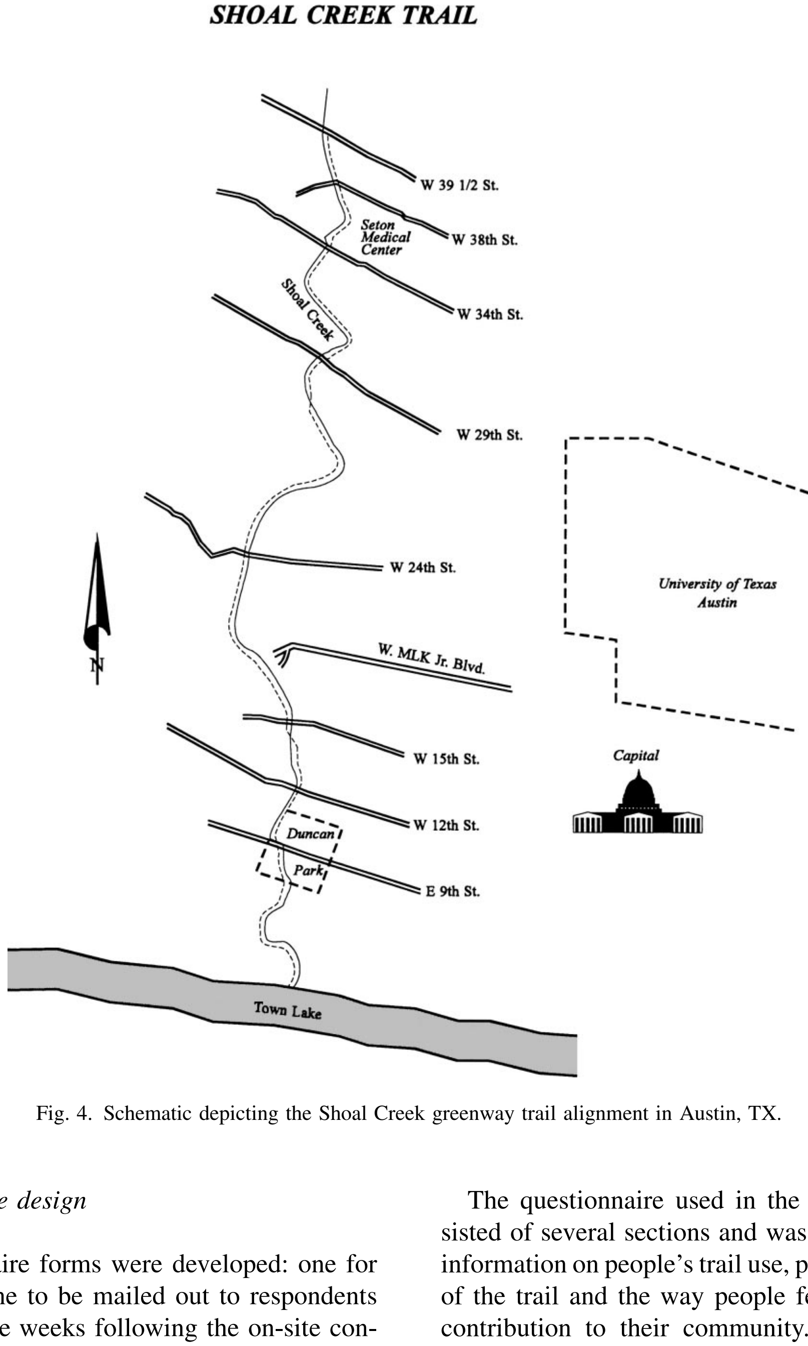


Fig. 4. Schematic depicting the Shoal Creek greenway trail alignment in Austin, TX.

3.3. Questionnaire design

Two questionnaire forms were developed: one for on-site use and one to be mailed out to respondents and returned in the weeks following the on-site contact. The questionnaire used for on-site interviews included questions about basic aspects of trail use behavior (e.g. people's origin and destination of travel, length of time spent on trail for this trip, who they were using the trail with, mode of travel and impressions of the trail).

The questionnaire used in the postal survey consisted of several sections and was designed to gather information on people's trail use, perceived conditions of the trail and the way people felt about the trail's contribution to their community. The model mentioned previously guided the selection of items to measure quality of life concerns applicable to greenway trails. Twenty items were selected and adopted from literature related to quality of life (Bubolz et al., 1980; Abbey and Andrews, 1984; Horley and Little, 1985; O'Brien and Ayidiya, 1991; Wagner, 1995;

Feldt, 1996) and sustainable communities (Newbrough, 1995; Banister, 1996; Allen, 1997; Litman, 1997). Some examples include: having access to public transportation, the amount of pollution, social interaction among residents, diversity in the types of industry, and level of economic development.

Respondents were asked to provide their perceptions twice regarding these items. First, respondents were asked to rate the importance of each item (on a five-point Likert type scale, 1: very unimportant, 5: very important) to their community's quality of life in general. Then they were asked to score (on a five-point Likert type scale, 1: poorly to 5: extremely well) how they perceived their trail to contribute to each quality of life item. Questioning people about both the importance of characteristics and their performance (in this case measured as 'contribution') allowed for a more complete evaluation of their relevance.

3.4. Data analysis

Data were analyzed using descriptive statistics, and an importance-contribution analysis (ICA) was used to examine how trails might influence community quality of life. Mean values for importance and contribution provided plot points for an ICA grid. Importance scores were placed on the horizontal (x) axis and contribution scores were placed on the vertical (y) axis. Interpreting the importance-contribution grid into action is fairly straightforward. Each of four quadrants in the grid represents considerations for planning and management. Issues of importance to trail users, and those to which trails contribute well, will fall into the upper right quadrant of the grid. Greenway planners and managers can point to these items as 'QOL performers'. These items act as indicators of how the trail is best meeting QOL concerns. Items that are seen as important to QOL, but to which the trail dose not contribute, fall into the lower right part of the grid. These items may require attention in future planning and management efforts if the trail is to meet full potential. Items in this area might be labeled 'QOL priorities'. Issues of low importance, but to which the trail is seen as contributing well would fall in the upper left quadrant and might be considered 'QOL windfall'. Finally, some items may be perceived as unimportant and also receive a low contribution score. Based on user perceptions, these items are apparently of little to no concern and the fact that trails do not contribute may not matter much. These items would fall in the lower left part of the grid and might be labeled 'QOL inconsequentials'. Lastly, trail users were grouped based on how they normally used their trail and a one-way analysis of variance was then used to determine if differences existed in their perceptions of QOL.

4. Results

4.1. User characteristics

The average age of respondents was 42 years. Users of BRT were older (46.3 years) than users of SCT (37.7 years) or users of BFT (40.3 years) F=27.17, p<0.001. Overall, approximately 27% of respondents were female but the three trails differed from SCT with 48% female to BRT with 38% and BFT with only 24% being female (χ^2=22.17, p<0.001). Almost 90% of trail users were of northern European decent (white) while those of Mexican or African decent, combined made up <10% of the total. These distinctions are important in Texas, and the United States, where the later groups are in the minority and the equity of their access to public facilities and services is a concern. Trail users in this sample were well educated. Over 85% had a college degree and 46% had a graduate or professional degree. Income levels reflected this high level of education as 45% of all respondents indicated that their annual income was greater than or equal to US$ 80,000. These skewed demographic variables suggest a need to look more closely at socio-cultural 'equity' on urban trails.

In terms of trail use, about three fourths of respondents indicated that they used their trail for recreation 100% of the time. Another 20% reported that they used the trail for both commuting and recreation (mixed use). Less than 7% used the trail predominantly for commuting. However, Fig. 5 indicates that the three trails differed in how they were used in terms of trip types. A higher proportion of respondents from BRT used the trail primarily for commuting purposes while BFT users were higher in their recreational use. SCT respondents were more likely to use their trail for both recreation and transportation (χ^2=18.6, p<0.001). Fig. 6 indicates that BRT users were also

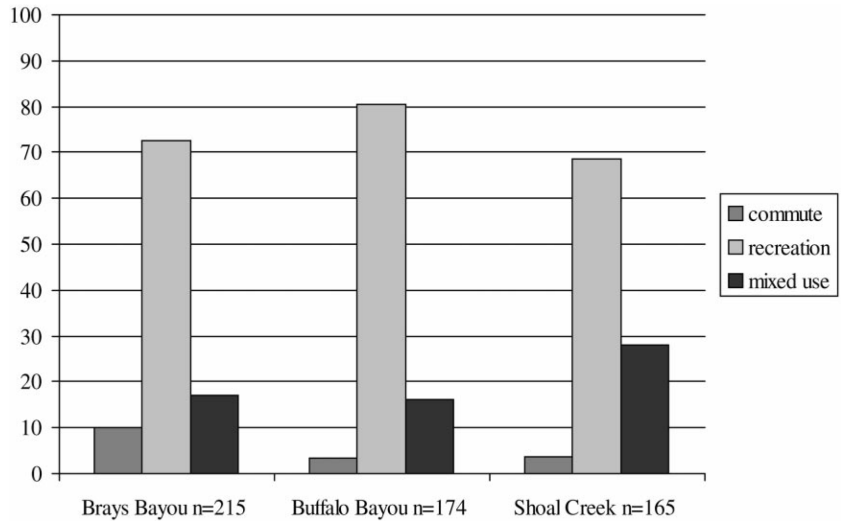


Fig. 5. Percentages of respondents who indicated that they used the greenway trail to commute only, for recreation only or that they mixed the two types of use (on an annual basis), n=554.

more likely to only use a bike to travel the trail while BFT users were more likely to be running and SCT users were more likely to be walking (χ^2=136, p<0.001). A final difference between the way the three trails were being used is evident in Fig. 7. The BRT was most likely to be used by people who were alone while colleagues were more likely to be using the BFT together and the SCT had the highest proportions of people on the trail with family/friends and pets (χ^2=122, p<0.000).

4.2. Perceived contributions of greenway trails to quality of life

Table 1 shows the importance that trail users put on 20 characteristics related to community quality of

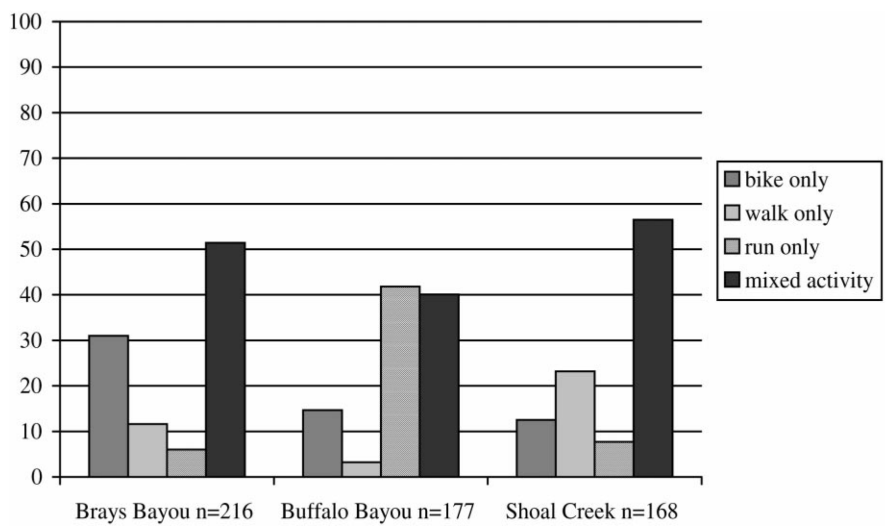


Fig. 6. Percentages of respondents who indicated that they used the greenway trail for bicycling, walking or running activity exclusively or that they mixed their activity use (on an annual basis), n=561.

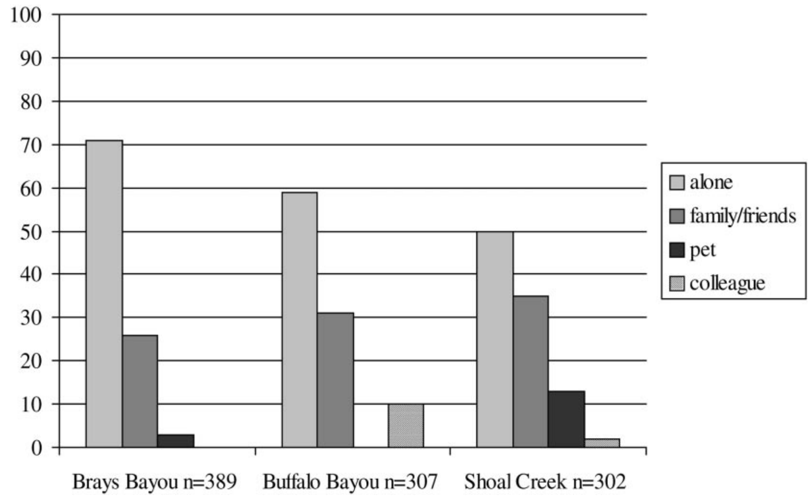


Fig. 7. Percentages of respondents who used the greenway trail alone, with family/friends, pets or a colleague (at time of on-site intercept), n=998.

Table 1
The level of importance that users of three greenway trails placed on quality of life characteristics[a]

Quality of life item	Overall sample			Brays Bayou			Shoal Creek			Buffalo Bayou		
	Mean	S.D.	Rank	Mean	S.D.	Rank	Mean	S.D.	Rank	Mean	S.D.	Rank
Having natural areas present	4.75	0.49	1	4.65	0.56	1	4.91	0.29	1	4.72	0.50	1
Having access to public transportation	3.44	1.23	17	3.42	1.17	18	3.54	1.23	16	3.37	1.31	17
The amount of pollution	4.64	0.60	2	4.60	0.60	2	4.80	0.43	2	4.53	0.70	2
New business development	3.31	1.12	20	3.26	1.11	19	3.26	1.15	20	3.40	1.11	16
Opportunity to use transportation other than cars	3.90	1.09	10	3.89	1.07	12	4.05	1.05	9	3.78	1.14	12
Access to places for shopping	3.45	1.11	16	3.61	1.03	15	3.38	1.09	18	3.31	1.19	19
Social interaction among residents	3.75	0.97	13	3.76	0.94	14	3.98	0.86	12	3.53	1.05	14
The health and fitness of people who live there	4.19	0.85	8	4.19	0.82	7	4.25	0.78	8	4.13	0.93	6
Amount of time spent traveling to shopping areas	3.37	1.03	18	3.45	1.00	17	3.35	0.98	19	3.29	1.11	20
Accessibility to work places/schools	3.89	0.99	11	3.93	0.97	9	3.93	0.87	13	3.80	1.13	10
Cost of transportation	3.64	1.60	15	3.57	0.96	16	3.65	0.98	15	3.72	2.46	13
Amount of pride residents take in their community	4.38	0.69	4	4.39	0.62	3	4.47	0.67	5	4.29	0.78	4
Amount of time spent traveling to work	3.97	0.97	9	3.91	1.00	10	4.02	0.80	10	3.98	1.08	9
Diversity in the types of industry	3.37	1.00	18	3.25	1.03	20	3.51	0.87	17	3.37	10.5	17
Accessibility to recreational opportunities	4.39	0.72	3	4.32	0.76	4	4.49	0.65	4	4.39	0.73	3
The pattern of land use	4.20	0.83	7	4.22	0.73	6	4.30	0.81	7	4.08	0.94	8
Equity among different types of residents	3.75	1.00	13	3.77	0.95	13	3.99	0.88	11	3.49	1.09	15
Places for wildlife to live	4.23	0.87	6	4.13	0.87	8	4.50	0.74	3	4.10	0.91	7
Level of economic growth	3.81	0.86	12	3.90	0.79	11	3.70	0.88	14	3.80	0.92	10
Features that give the community a unique identity	4.31	0.78	5	4.25	0.77	5	4.43	0.64	6	4.27	0.91	5

[a] Mean values were calculated based on a five-point scale where 1: very unimportant, 2: unimportant, 3: neither, 4: important, 5: very important.

life. Overall, respondents indicated that the things most important to their community's quality of life were the presence of natural areas, amount of pollution, accessible recreation, residents' pride in their community, community identity, places for wildlife to live, and land use patterns. Each of these characteristics was scored over 4.3 on a five-point scale (between 'important' and 'very important'). On the other hand, such things as new business development, access to and time spent shopping, diversity in types of industry in the community, and access to public transportation were perceived to be the five least important characteristics (mean scores were <3.5 on a five-point scale). Generally, respondents from each trail perceived these characteristics similarly in their levels of importance. Shoal Creek users ranked a few items differently from people using Buffalo and Brays Bayou. For example, they seemed to have a stronger feeling about 'places for wildlife to live' and ranked it third most important compared to rankings of seventh and eight for BFT and BRT users respectively. Shoal Creek users also seem to have felt that 'level of economic growth' was less important to quality of life based on their lower score and ranking.

As shown in Table 2, respondents indicated that trails have contributed most to community quality of life through health and fitness, the provision of natural areas, accessible recreation, land use patterns, pride in the community, and community identity (mean scores were >4.1 on a five-point scale). Trail users generally perceived that their greenway trails did not contribute much to quality of life through new business development, access to shopping, diversity of industry, and time spent commuting (mean scores were <3.0 on a five-point scale). Again, feelings about the contributions that trails made to quality of life were almost identical regardless of location, though some variations in rank order of these items did occur. Among the 20 items, BRT users ranked their trail as contributing to "opportunities to use transportation other than a car" higher than either SCT or BFT. This may reflect the higher level of 'pure' commuters that used this trail (see Fig. 5). BRT users also ranked their

Table 2
The level of contribution that users of three greenway trails felt the trails made toward quality of life[a]

Quality of life item	Overall sample			Brays Bayou			Shoal Creek			Buffalo Bayou		
	Mean	S.D.	Rank	Mean	S.D.	Rank	Mean	S.D.	Rank	Mean	S.D.	Rank
Natural areas present	4.38	0.70	2	4.14	0.76	2	4.57	0.67	1	4.50	0.56	1
Access to public transportation	3.18	0.79	15	3.29	0.81	15	3.20	0.76	15	3.01	0.79	15
Amount of pollution	3.55	0.94	11	3.53	0.89	10	3.71	0.92	11	3.41	0.99	12
New business development	2.89	0.77	19	2.86	0.81	20	2.85	0.74	19	2.96	0.74	18
Opportunity for other transportation use	3.87	0.95	8	3.99	0.87	6	3.97	0.92	8	3.61	1.03	9
Accessibility to shopping areas	3.00	0.82	17	3.21	0.82	16	2.99	0.81	17	2.74	0.74	20
Social interaction among residents	3.90	0.79	7	3.87	0.74	8	4.15	0.72	7	3.69	0.84	8
Conditions of people's health and fitness	4.48	0.56	1	4.47	0.57	1	4.53	0.57	2	4.46	0.52	2
Time spent for shopping	2.89	0.75	19	2.96	0.75	18	2.85	0.81	19	2.85	0.71	19
Accessibility to work/school	3.38	0.91	13	3.48	0.90	12	3.38	0.90	13	3.27	0.94	13
Cost of transportation	3.21	0.90	14	3.31	0.85	14	3.27	0.91	14	3.03	0.93	14
Residents' pride in community	4.14	0.77	5	4.03	0.76	5	4.35	0.74	6	4.06	0.78	5
Time spent on commuting	3.08	0.82	16	3.16	0.79	17	3.03	0.83	16	3.01	0.85	15
Diversity in types of industry	2.95	0.80	18	2.93	0.82	19	2.94	0.82	18	2.99	0.75	17
Accessibility to recreation	4.33	0.70	3	4.16	0.76	4	4.53	0.57	2	4.33	0.69	3
Land use patterns	4.27	0.70	4	4.14	0.68	2	4.48	0.66	4	4.23	0.71	4
Equity among different residents	3.74	0.86	10	3.75	0.79	9	3.91	0.92	9	3.56	0.84	10
Place for wildlife	3.78	0.96	9	3.52	1.04	11	3.91	0.96	9	3.98	0.80	7
Economic growth	3.49	0.84	12	3.40	0.85	13	3.52	0.81	12	3.56	0.85	10
Features contributing to community identity	4.12	0.79	6	3.97	0.78	7	4.43	0.61	5	4.02	0.87	6

[a] Mean values were calculated based on a five-point scale where 1: poorly, 2: fairly well, 3: well, 4: very well, 5: extremely well.

trail lower in terms of the contributions it might make to 'places for wildlife to live'. As indicated previously, the BRT was a less vegetated greenway corridor and had a concrete lined stream channel along its length. These physical differences may have contributed to a lower ranking of the area as wildlife habitat.

Quality of life characteristics were plotted based on both the importance people placed on them and how well they felt trails contributed to the community quality of life. Plotted points represent the characteristics listed in Tables 1 and 2. Quadrants were devised using the midpoint in the two response scales. Fig. 8 includes visual plots for the three trails and indicates that most of the quality of life characteristics were perceived both as important and that the greenway trails were perceived as contributing well to quality of life in those ways. That is, the items are almost all located in the upper right quadrant as 'QOL performers'. An examination of the spatial pattern of plots for each trail suggests that certain characteristics clustered into good, better and best categories of performers. The BFT plot in Fig. 8 provides the best example of this. Access to transportation, shopping and the development of business or industry were generally seen as least important and as receiving the lowest contribution. These items received scores that could still be interpreted as good. But, when placed in the mix with other items they might also be considered QOL inconsequentials in order to focus energy elsewhere. Social interaction, commuting and access to work/school along with equity and economic growth fell in the better, or middle, range. Respondents seemed to feel that these items were very important to QOL and that their trails also contributed to them very well. Finally, QOL characteristics like the presence of natural areas, community pride and identity, people's health and fitness and places for wildlife represented the best of the 'QOL performers'. These characteristics were seen as extremely important and as receiving the highest contributions from these greenway trails. Across all three trails, one characteristic, pollution, stood out as different. Respondents from each trail scored it as extremely important to quality of life ranking it just behind presence of natural areas. But it scored relatively low in the perceived contribution that trails made for an item of such high importance.

4.3. The relationship between perceived contributions and use of a trail

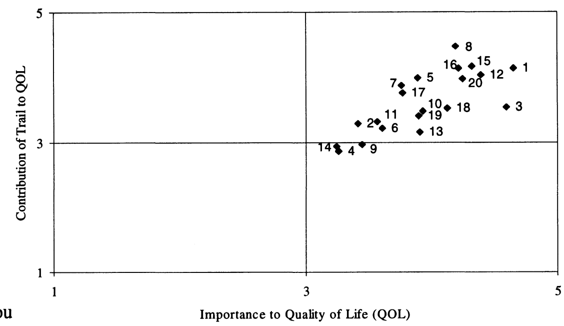
Commuters, recreationists and mixed users differed significantly in the way they scored their trails' contributions on 10 of the 20 quality of life items. Table 3 shows that differences existed in the ways these groups perceived contributions to transportation related items and to community pride and identity items. In particular, commuters perceived that greenway trails made greater contributions to reducing pollution, providing alternatives to cars, reducing the cost of transportation and time spent getting to work or to shops. People who used their trail for both commuting and recreation indicated greater contributions to social interactions among residents and to community identity. Recreational users perceived that trails contributed less to each of these 10 characteristics than did the other two groups.

5. Discussion

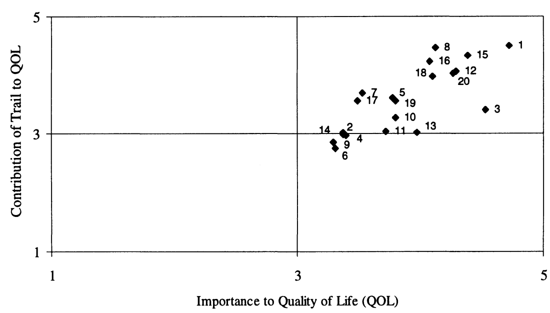
5.1. Three urban trails, three different use patterns

Greenway trails, like roads, are used in different ways and for different reasons. Different activities and trip types characterized the three trails in this study with one receiving more use from commuting bicyclists, another from colleagues recreating (especially running) together and the third from people walking their pets. It is likely that the location of these greenways within their respective communities, the character of the trail and management policies all influenced these use patterns. Time spent on-site inventorying site characteristics and interviewing trail users suggested that the Brays Bayou greenway received more use from commuters because it connected neighborhoods to a university and a major health sciences complex. The Brays trail may have been especially conducive to cycling because it was relatively straight, paved and had grade separations at many major intersections. These characteristics made it a relatively fast and safe trail for cyclists. Connections between the Buffalo Bayou greenway and downtown Houston made it an attractive place for colleagues who work in the downtown area to run together over the lunch hour. The Buffalo Bayou greenway may be serving to enhance relationships

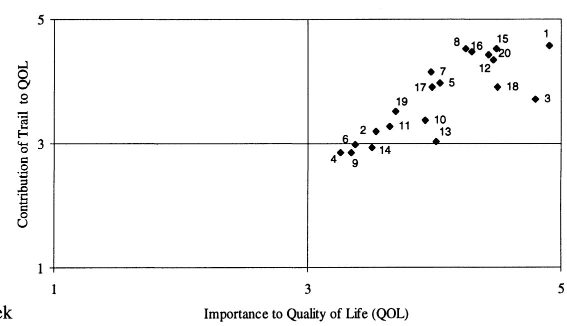
1: natural area present	11 : cost of transportation
2 : access to public transportation	12 : residents' pride on community
3 : amount of pollution	13 : time spent on commuting
4 : new business development	14 : diversity in types of industry
5 : opportunity for other transportation	15 : accessibility to recreation
6 : accessibility to shopping areas	16 : land use patterns
7 : social interaction among residents	17 : equity among different residents
8 : conditions of people's health and fitness	18 : place for wildlife
9 : time spent on shopping	19 : economic growth
10 : accessibility to work/school	20 : features contributing to community identity



Brays Bayou
(BRT)



Buffalo Bayou
(BFT)



Shoal Creek
(SCT)

Fig. 8. Importance-contribution grids for three greenway trials in Texas showing the relative importance of quality of life characteristics in a community and how much trial users felt trials contributed to those characteristics.

Table 3
Analysis of variance of the perceived contributions that trails made to quality of life characteristics among three greenway trail user groups, n=527

Quality of life characteristic	Commuters mean[a]	Mixed users mean	Recreationists mean	F value[b]
Opportunity to use transport other than car	4.79 a	4.35 b	3.64 c	49.11**
Reduced transport costs	4.29 a	3.41 b	3.02 c	43.67**
Reduced pollution	4.24 a	3.57 b	3.46 b	12.38**
Community identity	4.22 ab	4.33 a	4.06 b	5.38**
Better access to work or school	4.05 a	3.69 b	3.22 c	22.27**
Positive social interactions	3.84 ab	4.10 a	3.85 b	3.98*
Reduced travel time to work	3.81 a	3.38 b	2.91 c	29.91**
Access to shopping	3.34 a	3.16 a	2.92 b	6.96**
Travel time to shop	3.06	3.07	2.82	4.48*

[a] Mean values are based on a five-point scale from 1: poorly to 5: extremely well; means that do not share the same letter are significantly different at the 0.05 level.

[b] Significance levels among groups are shown as: ** denotes p<0.01 and * denotes p<0.05.

through the opportunities for recreational exercise that it provides to professionals who work in connecting areas. Finally, people walking pets characterized Austin's Shoal Creek greenway. Shoal Creek trail policy allows unleashed pets for a portion of the trail's length. Many users who like to exercise and socialize through an activity that includes pets used this section of the trail. Shoal Creek also had the greatest percentage of mixed trip users (people who commute and recreate). The SCT ran from the downtown area through a large park, near a major university and on into mixed residential and commercial areas. The fact that adjacent land use was varied may have provided adjacent residents with access to a corridor that was both attractive for recreation and one that linked them to useful destinations.

While the three trails differed in the types of use they received it appeared that the types of connections each offered played a large role in the use pattern. Connections are often touted as a key, if not the key, greenway characteristic. Connectivity is a critical functional characteristic for water, flora, fauna and people in greenway environments. Access to the greenway through good connections from work to home and connections among trail segments through grade separations at intersecting roadways help determine intensity and types of trail use.

5.2. Greenway trails and livability

Trail users felt that their greenway trails contributed to quality of life mostly through what they contributed to the natural and social environments in their communities. The model in Fig. 1 suggests that QOL is composed of at least three major variables in a community. The community of people (social environment), the environment (physical surroundings) and the economy (jobs, income, transfer of goods) overlap to create a quality of life for individuals and the community as a whole. Results here suggest that greenway trails are contributing most to quality of life through what the model represents as 'livability', in this case the interaction between a community and the environment. In a recent nationwide survey, conducted with state and local officials, the American Institute of Architects found that the availability of parks, and other open spaces, and urban sprawl were major policy issues in defining community 'livability' (American Institute of Architects, 1999). Respondents in this Texas study appeared to value greenways trails for their support of the social and physical environments more than the economic environment. Urban greenway trails might best be thought of as quasi-natural park and open space environments that provide places for daily recreation and alternative transportation options while encouraging positive face to face interaction with other people. They also provide 'nearby nature', a respite and escape from the hard surfaces and noise levels of surrounding roadways and other development while providing a chance to see interesting flora and fauna. This type of human experience, be it during recreation or a commute to work, makes a place more enjoyable to live in, i.e. 'livable'.

The emotions evoked by a place can be indicators of livability and people's quality of life. Lee (1999) found that greenway trail users undergo changes in emotion during recreational trail use and that as users encountered the physical and social surroundings their emotions generally became more positive.

Greenway trails appeared to perform well in their contributions to almost all QOL items in this study. This is good from the standpoint of justifying greenway designation and trail development. The clustering of good, better and best 'performers' suggests that planners and managers can gain insight through such an analysis prior to development. If planners inventory adjacent land us, alignment, grade separations and trail types in existing greenways and then analyze that information in conjunction with the perceptions of current users, results can indicate where trails might be strengthened by design and/or where better user education is needed to meet project goals.

5.3. Understanding stakeholders

The differences in the ways these trails were used recounts the need to inventory who is using (or is likely to use) a trail, and why, as a part of the planning process for trail renovations or the installation of a new trail. User input up front can help alleviate the need to fix ill-conceived designs or management policies. While the user input in this study was not design or management specific it did indicate that people would value design and management that promotes natural values, social interaction, recreational fitness and better land use patterns.

Stakeholder groups associated with greenway trails are not homogeneous. They may have axes to grind on issues ranging from design of the trail's tread to wildlife habitat or user safety. Often a strong or dominant stakeholder group drives the planning process and the resulting changes in the resource reflect their values. Greenway trails are no different from civic centers, libraries or athletic parks in this regard. The high proportions of recreational users on trails in this study indicate that planning processes could be dominated by the recreation 'voice'. Attitudes toward what trails contribute were clearly different between commuters, recreationists and those who used the trail for both. Differing attitudes are important to understand if trails are to maximize their utility as QOL enhancements. If resources and time are limited, as is often the case, greenway planners may be best served by obtaining input from people who use trails for several purposes (the mixed-use group). In this study these people appeared to have a more balanced 'middle of the road' understanding of how trails can contribute to the community. These users perceived that trails made strong contributions to reducing transportation costs and accessing local destinations because they, at least occasionally, used the trail for transportation. The fact that this group used trails for several reasons may have also lead to their stronger feelings about the way that greenways contributed to a community's identity and to positive social interactions among users.

ISTEA-based trail projects have a strong emphasis on meeting transportation objectives. In this study such projects appeared to be meeting a host of objectives not normally associated with transportation (e.g. fitness, recreation, seeing nature, social interaction). However, these are exactly the objectives that 'transportation enhancements' should be striving to meet. Greenway trails may assist in meeting traditional transportation efficiency concerns by moving people from point a to b quickly and conveniently and they may mitigate some congestion on roadways in the process. However, to their users, their real virtue appears to be in the opportunities they provide for people to use different modes of travel to enhance human experiences. Enhanced human experiences can increase livability, thus, contributing to quality of life, in the communities where such trails exist.

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