

# Assessing National Forest Visitors' Comprehension of International Symbols for Communicating Outdoor Recreation Messages

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**EXECUTIVE SUMMARY:** The purpose of this research was to evaluate recreationists' comprehension of International Symbols used on the Angeles and San Bernardino National Forests in southern California. Data were collected from 262 recreationists during the summer months 2002. Bilingual teams administered the survey using instruments available in English and Spanish. The 20 International Symbols used in the study included 13 from on-line sources and seven Forest-produced symbols. Each unique response for the symbols was coded for level of correctness by two independent coders using the International Standards Organization (ISO) standard adapted for this study. Judges placed responses into seven "levels of correctness" categories: 1) correct understanding of the symbol is certain; 2) correct understanding of the symbol is likely; 3) correct understanding of the symbol is marginally likely; 4) the meaning which is conveyed is the opposite to that intended; 5) the response is wrong; 6) the response given is "do not know"; and 7) no response is given. Any disagreement in coding was resolved by a third independent coder. The average age of respondents was 37 years, and the average number years of education was about 12. Most respondents were Latino, and most respondents were recreating with family and/or friends and were on a repeat visit to the site. Activities usually engaged in were picnicking, relaxing, hiking, and camping. Eleven of the 20 symbols in the study were considered well understood, with a high percentage of respondents correctly comprehending them. At least two-thirds of respondents were able to name the activity/facility/rule to which the symbol was referring [these symbols were for *Fishing, Swimming, Restrooms, Horse Trail, No Fireworks, Picnic Area, No Trucks, Hiking Trail, Camping (Tent), Drown Campfires*, and *Hikers*]. These require no further management action. Of the remaining nine symbols, three were moderately understood (fewer than two-thirds but more than one-third of the respondents correctly comprehended them), and six were misunderstood (fewer than one-third of respondents correctly comprehended them). The three moderately understood symbols probably need modification to clarify the intended message—perhaps these should be used only if there is accompanying text (these were *Off-road Vehicle Trail, Information*, and *Automobiles Permitted*). The six misunderstood symbols (*No Alcohol, No Charcoal Grills, Amphitheater, Carry Water Back to Site, Fish Hatchery* and *Conserve Water*) require major modification or discontinued use.

**KEYWORDS:** Communication, international symbols, outdoor recreation, race and ethnicity, recreation signs

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## Introduction

Managers of public lands rely on a limited number of tools to facilitate communication with their publics. Most of these tools are one-way communications or indirect public contacts that are accomplished through signs, posters, brochures, and maps. However, for many recreating groups, the strong preference is for two-way, face-to-face interactions (Chavez, 2001; Thapa, Graefe, & Absher, 2002). Not only is two-way communication preferred by recreationists, it also may be more effective. In Olson, Bowan, and Roth's study (1984; as cited in Thapa et al., 2002), brochures and direct personal contact were found to be more effective in increasing visitor knowledge when compared with signs.

While acknowledging the desire for and effectiveness of two-way communication, it must also be recognized that the personnel needs and expenses for these communications may be prohibitive (Thapa et al., 2002). According to Jubenville and Twilight (1993), cost efficiency dictates that on-site face-to-face interactions between the agency and visitors be concentrated in visitor centers. Signs may extend the geographical reach of visitor centers and are sometimes used as a substitute for the visitor center, especially in large recreation areas.

Symbol signs provide one option for achieving cost-effective, one-way communication. Research in transportation, occupational safety, consumer protection, and ergonomics evaluated the efficacy of symbol signs currently in use. Several studies have found overall comprehension of symbols to be poor (Collins, Lerner, & Pierman, 1982; Laux, Mayer, & Thompson, 1989; as cited by Davies, Haines, Norris, & Wilson, 1998; Davies, et al., 1998, Al-Madani & Al-Janahi, 2002). Only about half of the traffic regulatory and warning signs studied by Al-Madani and Al-Janahi (2002) were correctly identified by drivers surveyed. Davies et al. (1998) cited studies of pharmaceutical pictographs that failed to reach minimum comprehension standards in spite of design revisions. In addition to an overall lack of understanding of symbols, mistaking one symbol for another occurs with some frequency (Davies et al., 1998) and symbols with a directional feature integral to their design can convey contradictory messages (Whitaker & Sommer, 1986). For example, pictographs may be used with arrows to indicate directions to a facility such as an airport. The symbol for "airport" (an airplane silhouette) sometimes "flies" in the opposite direction of the arrow creating a conflict for drivers. Yet, the recreation

planning literature recommends the use of International Symbols (graphical symbols depicting ideas without words) as a tool for communication with visitors. Jubenville and Twilight (1993) suggested signing is used best as visitors travel through large recreation areas and recommend the use of International Symbols where possible. Hultsman, Cottrell, and Hultsman (1987) suggested using symbol signs stacked on a single post to communicate a variety of messages while reducing the number of sign installations required. Therefore, one-way communication in general, and International Symbols in particular, need to be evaluated in an outdoor recreation context.

While some research on public lands has examined one-way communication challenges (including those associated with using signs), and has offered suggestions to managers based on the research findings, it has focused on the use of multiple languages (Chavez, 2000) and back-translated materials when serving ethnically diverse visitor groups (Marin & Marin, 1991). The scant literature available on the evaluation of International Symbols in recreation areas includes two previous studies that evaluated International Symbols used by multiple public land management agencies. The first study, conducted in 2000, evaluated whether recreation visitors to the Angeles National Forest comprehended the meanings intended. While there was some correct comprehension of some symbols (particularly those indicative of accommodation and services), the general recreation symbols (such as the *Wading* and *Amphitheater* symbols) were least comprehended (Ward, 2001). A second study examined International Symbols used only for outdoor recreation. These were facility, general recreation, winter recreation, land recreation and water recreation categories of symbols. Results indicated that those who engaged in four or more activities on site correctly comprehended more symbols than those with lower activity levels. Overall, only 8 of the 20 symbols were correctly comprehended by 75 percent or more of the sample studied (Chavez, McCollum, & Knap, 2003).

The purpose of this research was to evaluate one particular form of indirect, non-personal communication on public lands—International Symbols. For this study, a random selection of symbols that are currently in use in these National Forests was examined rather than selecting International Symbols from the pool of all symbols available for use. The goals for this study were to: (1) evaluate the comprehension of International Symbols used on public lands (Fig. 1), and (2) to determine whether demographic variables affect the comprehension of these symbols.

## Methods

### *Study Sites*

Fourteen day-use sites were randomly selected from all developed picnic areas, general day-use areas, OHV staging areas, and trailhead sites across the Angeles and San Bernardino National Forests in southern

**Figure 1**  
**Evaluated Symbols from the San Bernadino and Angeles National Forests**  
**(MUTCD codes).**

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|                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|    |    |    |    |
| <i>Restrooms</i><br><i>RL-140</i>                                                   | <i>No Alcohol</i>                                                                   | <i>Conserve Water</i>                                                               | <i>Hiking Trail</i><br><i>RL-100</i>                                                |
|    |    |    |    |
| <i>No Trucks</i>                                                                    | <i>Fishing</i><br><i>RW-950</i>                                                     | <i>Hikers</i><br><i>RL-100</i>                                                      | <i>No Charcoal Grills</i>                                                           |
|    |    |    |    |
| <i>Fish Hatchery</i><br><i>RG-0500</i>                                              | <i>Dropped Campfires</i>                                                            | <i>Information</i><br><i>RG-100</i>                                                 | <i>Camping (Tent)</i><br><i>RM-010</i>                                              |
|  |  |  |  |
| <i>Picnic Area</i><br><i>RM-120</i>                                                 | <i>Automobiles Permitted</i><br><i>RG-010</i>                                       | <i>Swimming</i><br><i>RW-130</i>                                                    | <i>Off-Road Vehicle Trail</i><br><i>RL-140</i>                                      |
|  |  |  |  |
| <i>Horse Trail</i><br><i>RL-110</i>                                                 | <i>Amphibian</i><br><i>RL-010</i>                                                   | <i>No Firearms</i>                                                                  | <i>Carry Water Back to Site</i>                                                     |

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California. The Angeles National Forest covers over 650,000 acres and is within a one-hour drive of the Los Angeles metropolitan area. This Forest is one of the most heavily used in the nation. Developed sites on the Forest frequently exceed their design capacity during weekends of high use (summer and winter). General Forest sites are often so crowded as to be termed "concentrated dispersed use" sites (Stickers, 1983). The San Bernardino National Forest covers about 820,000 acres within San Bernardino and Riverside Counties. Of this area, about 162,000 acres are in private, county, state and other federal agency ownership. The Forest lies within a two-hour driving distance of more than 22 million residents of southern California.

Both the Angeles and San Bernardino National Forests qualify as "Urban National Forests;" that is, they are located within 50 miles of populations greater than one million people (Chavez, 2001). Unique challenges for these Forests include intense recreation use, day-use emphasis, urban development adjacent to the Forest, and the need for complex information strategies due to language, cultural, and class diversity (Hartley, 1986).

#### *Instrument Development*

The 20 International Symbols included in the survey instrument were randomly drawn from two pools of symbols - privately designed signs for wide-scale use in natural resource settings, and signs produced by the sample Forests themselves. Only International Symbols being used on the Forests were selected for inclusion in this study. The "professionally produced" International Symbols are commonly used in many recreation settings. These symbols are available on-line and through catalogs (such as ROCAL, Inc. and Carsonite International), and commonly represent information important to recreationists (e.g., *Restrooms, Information*), or recreation opportunities available on the Forests (e.g., *Hiking, Fishing*). "Forest-produced" symbols were created by the Forests to serve special signing needs that are not met by commercial sources (most were regulatory in nature, such as *No alcohol*). Thus, the pool of symbols available for selection included 18 from the on-line sources (the Manual on Uniform Traffic Control Devices [MUTCD] codes for these are listed as appropriate in Fig. 1) and 10 Forest-produced symbols. Twenty of the 28 symbols were randomly selected for inclusion in the study (13 from on-line sources and 7 Forest-produced). The instrument contained color depictions of the International Symbols arranged in a four-column array. There was space for open-ended comments beside each symbol. For comprehension tests, such as that reported herein, it is important to place the symbols into context (Davies et al., 1998; ISO, 2001), which was done by contacting recreation visitors at sites where the tested symbols are in use. Socio-demographic (age, gender, years of education completed, race/ethnicity) and Forest-use questions (previous visit to the site, previous visit to any mountain/forest, usual activities engaged in on forestlands, and recreating group type) questions appeared on the last page of the instrument.

### *Sampling and Data Collection*

Data were collected from 262 recreationists (response rate = 54%) at the National Forest day-use sites on randomly selected weekend days throughout summer 2002 (June 29 - September 15). All visitors (age 18 or over) on site were asked for their voluntary participation in the face-to-face interview by bilingual research teams from California State University, San Bernardino. Respondents were assured confidentiality of their responses. Respondents were shown the survey instrument and were asked to provide an interpretation for each symbol. All of the open-ended answers for the symbols and the socio-demographic/Forest use information were recorded by the interviewer on the survey form, and the respondents were thanked for their participation. Over half of the respondents were interviewed in English (62%), with 38 percent interviewed in Spanish.

### *Data Analysis*

Standards for correctness of response were adapted from those used by the International Standards Organization (ISO) for pictograms used in public information symbols (Davies, et al., 1998). ISO is a worldwide federation of national standards bodies (ISO, 2001). The purpose of the ISO standard is to ensure that graphical symbols (visually perceptible figures with a particular meaning used to transmit information independently of language) and signs using graphical symbols are readily understood (ISO, 2001).

In evaluating correctness of public information signs, ISO Standard 9186 uses seven categories into which judges may place responses (Davies et al., 1998). The adapted seven categories used for this study were: 1) correct understanding of the symbol is certain; 2) correct understanding of the symbol is likely; 3) correct understanding of the symbol is marginally likely; 4) the meaning which is conveyed is the opposite to that intended; 5) the response is wrong; 6) the response given is "do not know"; and 7) no response is given. For this study, each response for the symbols was coded for level of correctness by two independent coders using this adapted ISO standard. Any disagreement in coding was resolved by a third independent coder.

The ISO standard of understanding requires 66 percent of responses in categories 1 (correct understanding of the symbol is certain), 2 (correct understanding of the symbol is likely), or 3 (correct understanding of the symbol is marginally likely; ISO, 2001). Thus for this study, comprehension of International Symbols was categorized as well-understood (i.e., at least 66% of responses received were placed in one of the first three coding categories), moderately understood (i.e., between 35% and 65% of responses received were placed in one of the first three coding categories), or misunderstood (i.e., 34% and fewer of responses received were placed in one of the first three coding categories; Table 1).

**Table 1**  
**Comprehension Categorization Protocol (Adapted from ISO Standards)**

| <b>Level of Comprehension</b> | <b>Percentage of Correct Responses<br/>(response codes 1-3)</b> | <b>Percentage of Incorrect Responses<br/>(response codes 4-7)</b> |
|-------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Well-understood</b>        | 66-100%                                                         | 0-34%                                                             |
| <b>Moderately understood</b>  | 35-65%                                                          | 35-65%                                                            |
| <b>Misunderstood</b>          | 0-34%                                                           | 66-100%                                                           |

Based on socio-demographic and Forest use data, characteristics categories were created for analyses (see Table 2). Chi-Square and t-test comparisons were conducted to examine differences in comprehension of the symbols in this study. Only statistically significant ( $p < .05$ ) results for the subgroups are reported.

**Table 2**  
**Characteristic Groupings or Analysis of  
Socio-Demographic and Forest Use Data**

| <b>Variable</b>                | <b><i>n</i></b> | <b>Percent</b> |
|--------------------------------|-----------------|----------------|
| <b>Ethnicity</b>               |                 |                |
| Latino                         | 170             | 65             |
| Non-Latino                     | 87              | 33             |
| <b>Education</b>               |                 |                |
| High School or Less            | 142             | 54             |
| Some College or Degree         | 120             | 46             |
| <b>Age</b>                     |                 |                |
| Under 36                       | 134             | 51             |
| 36 and Older                   | 128             | 49             |
| <b>Number of Activities</b>    |                 |                |
| 2 or Fewer                     | 137             | 52             |
| 3 or More                      | 125             | 48             |
| <b>Site Visitation History</b> |                 |                |
| First-time Visitor             | 94              | 36             |
| Repeat Visitor                 | 167             | 64             |
| <b>Site Type</b>               |                 |                |
| Day-use                        | 152             | 58             |
| Picnic Area                    | 110             | 42             |

## Results

### *Respondent Characteristics*

Approximately half of all respondents were male (52%), and the median age was 36.7 years (Table 3). Slightly fewer than half of the respondents (46%) had some college education. The largest racial/cultural group was Latino (included Hispanic, Latino, Chicano, Central American, and Mexican respondents; 57%), followed by White (28%).

**Table 3**  
**Socio-demographic and Forest Use Characteristics in Percent (n =262)**

| <b>Socio-demographic Variables</b>               | <b>Percent</b> |
|--------------------------------------------------|----------------|
| <b>Gender</b>                                    |                |
| Male                                             | 52             |
| Female                                           | 48             |
| <b>Age</b>                                       |                |
| 18 -20                                           | 7              |
| 21-30                                            | 27             |
| 31-40                                            | 32             |
| 41-50                                            | 22             |
| 51-60                                            | 10             |
| 61-70                                            | 2              |
| 70+                                              | 1              |
| No response                                      | 1              |
| <b>Education</b>                                 |                |
| High School or less                              | 54             |
| Some college or degree                           | 46             |
| <b>Racial/Ethnic Group</b>                       |                |
| Hispanic/Latino/Chicano/Central American/Mexican | 57             |
| White                                            | 28             |
| Other                                            | 5              |
| No response                                      | 2              |
| <b>Forest Use Variables</b>                      |                |
| <b>Site Visitation History</b>                   |                |
| Repeat Visitor                                   | 64             |
| First-time Visitor                               | 36             |
| <b>Number of Activities</b>                      |                |
| 1                                                | 23             |
| 2                                                | 29             |
| 3                                                | 24             |
| 4                                                | 11             |
| 5                                                | 5              |
| 6                                                | 5              |
| 7                                                | 2              |
| 8                                                | 1              |
| 9                                                | 1              |

*Visitation Patterns*

The majority of day-use respondents were recreating with family members (52%), with friends (14%), or both (26%). Less than 10 percent were recreating alone or with a church or other organized group. Over half of the day-use respondents were repeat visitors (64%); that is, they had already been to the site where they were contacted. However, Latino

respondents returned to these sites more frequently than non-Latinos, and repeat visitors had visited a median 20 times in the past 12 months. A large majority of the day-use respondents (79%) had visited *other* National Forest day-use areas in the past, with non-Latino respondents reporting more visits to other day-use sites than the Latino respondents (see Table 4).

**Table 4**  
**Group Differences in Visitation Patterns**

| Variable                     | Percent | $\chi^2$ |
|------------------------------|---------|----------|
| <b>Been to site before</b>   |         |          |
| Latino                       | 70      | 6.26*    |
| Non-Latino                   | 54      |          |
| <b>Visited Day Use Sites</b> |         |          |
| Latino                       | 95      | 20.11**  |
| Non-Latino                   | 72      |          |

\* $p < .05$ ; \*\* $p < .01$ .

#### *Respondent Activities*

Respondents in the sample frequently engaged in picnicking (67%). Other common activities included relaxing (57%), hiking (42%), and camping (39%). Less frequently mentioned activities included sightseeing (17%), fishing (16%), driving for pleasure (11%), and off-road vehicle riding (11%).

College-educated respondents engaged in a significantly higher number of activities during a single visit when compared to those having a high school education or less (see Table 5). Additionally, non-Latino respondents reported participation in more activities than the Latinos in our sample. For Latino respondents, relaxing and picnicking were the most typical activities, while non-Latino respondents favored hiking and camping.

**Table 5**  
**Group Differences in Number of Activities During a Single Visit**

| Variable                    | Mean | T-Test |
|-----------------------------|------|--------|
| <b>Education</b>            |      |        |
| High School Diploma or Less | 2.39 | 3.91** |
| Some College or Degree      | 3.19 |        |
| <b>Ethnicity</b>            |      |        |
| Latino                      | 2.48 | 3.59** |
| Non-Latino                  | 3.32 |        |

\* $p < .05$ ; \*\* $p < .01$ .

*Respondent Characteristics and Understanding International Symbols*

On average, respondents identified 11.5 of the 20 symbols correctly (range: 3 - 18; SD = 2.72). Correct responses included those that were placed into the first three ISO categories: correct understanding of the symbol is certain, likely, or marginally likely. Incorrect responses included the remaining ISO categories: the meaning that is conveyed is opposite to the intended, the response is wrong, response given is "I don't know", and no response is given.

Some differences were found when visitor characteristics were considered (see Table 6). Latino and non-Latino respondents differed in the number of correct answers, with non-Latino respondents naming more symbols correctly than Latino respondents. The type of site where data were collected and the number of activities engaged in by respondents made a difference as well. Respondents who were recreating at a picnic area were able to correctly identify more symbols than those visiting other day-use areas, and individuals who typically engaged in three or more activities while on National Forest lands correctly identified more symbols than those who participated in two or fewer activities.

**Table 6**  
**Group Differences in the Correct Identification of Symbol Signs**

| <b>Demographic Variable</b> | <b>Mean</b> | <b>T-Test</b> |
|-----------------------------|-------------|---------------|
| <b>Ethnicity</b>            |             |               |
| Latino                      | 10.7        |               |
| Non-Latino                  | 13.5        | 8.03**        |
| <b>Type of Site</b>         |             |               |
| Picnic                      | 11.95       |               |
| Other day-use               | 11.19       | 2.26*         |
| <b>Number of Activities</b> |             |               |
| 0 - 2                       | 11.01       |               |
| 3 or more                   | 12.06       | 3.22**        |

\* $p < .05$ ; \*\* $p < .01$ .

Differences were also found when the symbols were grouped according to source (professionally or forest-produced; see Table 7). For the "professionally produced" symbols, respondents who reported engaging in three or more activities correctly identified more symbols than those with fewer activities. The same pattern was observed with several other of the socio-demographic and Forest use category variables, with non-Latinos identifying more than Latinos, picnic area visitors naming more correctly than other day-use site visitors, those with some college identifying more than those with a high school degree or less, and visitors who were visiting the site for the first time naming more symbols correctly than repeat visitors.

For the “Forest-produced” symbols group, visitors that had attended some college identified more symbols in this group correctly when compared to those with a high school education or less, and non-Latino respondents named more correctly than the Latino visitors.

**Table 7**  
**Group Differences in the Core Identification of**  
**Symbol Signs by Symbol Source**

| <b>Professionally Produced Symbols</b> |             |               |
|----------------------------------------|-------------|---------------|
| <b>Variable</b>                        | <b>Mean</b> | <b>T-Test</b> |
| <b>Ethnicity</b>                       |             |               |
| Latino                                 | 7.74        |               |
| Non-Latino                             | 9.67        | -8.34***      |
| <b>Type of Site</b>                    |             |               |
| Picnic                                 | 8.81        |               |
| Other day-use                          | 8.13        | 2.62**        |
| <b>Number of Activities</b>            |             |               |
| 2 or fewer                             | 7.98        |               |
| 3 or more                              | 8.89        | -3.57***      |
| <b>Education</b>                       |             |               |
| High School Diploma or Less            | 7.79        |               |
| Some College or Degree                 | 9.15        | -5.56***      |
| <b>Site Visitation History</b>         |             |               |
| Repeat Visitor                         | 8.22        |               |
| First-time Visitor                     | 8.78        | 2.06*         |
| <b>Forest-produced Symbols</b>         |             |               |
| <b>Ethnicity</b>                       |             |               |
| Latino                                 | 2.94        |               |
| Non-Latino                             | 3.38        | -3.25**       |
| <b>Education</b>                       |             |               |
| High School Diploma or Less            | 2.96        |               |
| Some College or Degree                 | 3.26        | -2.20*        |

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

#### *Comprehension of International Symbols*

*The well-understood symbols.* When percentages of correct, likely correct, and marginally correct responses were combined, 11 of the 20 symbols evaluated conveyed the intended message (Table 8). In other words, they met the 66 percent recognition threshold determined by ISO (ISO, 2001). These symbols were for: *Fishing, Swimming, Restrooms, Horse Trail, No Fireworks, Hiking Trail, Picnic Area, No Trucks, Camping (Tent), Drown Campfires, and Hikers.*

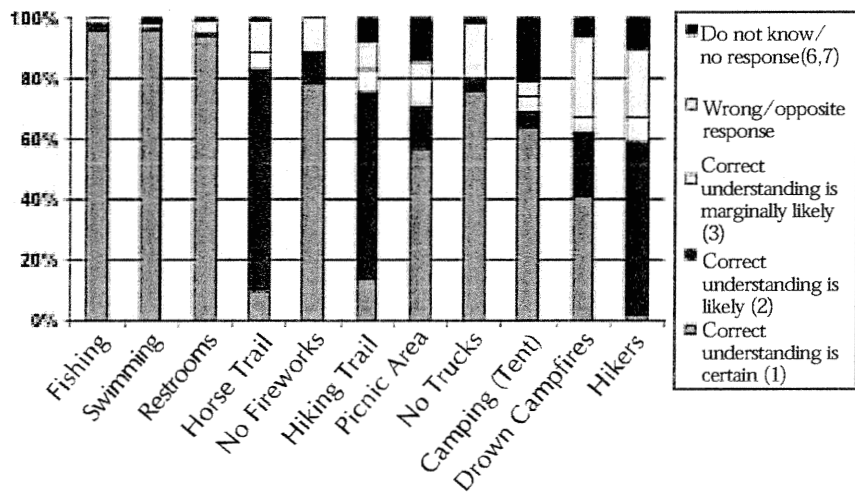
Table 8  
Percent Understanding Symbols (n=262)

| Symbol Meaning                       | Correct | Incorrect |
|--------------------------------------|---------|-----------|
| <b>Well Understood Symbols</b>       |         |           |
| Fishing                              | 98      | 2         |
| Swimming                             | 97      | 3         |
| Restrooms                            | 95      | 5         |
| Horse Trail                          | 89      | 11        |
| No Fireworks                         | 89      | 11        |
| Hiking Trail                         | 84      | 16        |
| Picnic Area                          | 80      | 20        |
| No Trucks                            | 80      | 20        |
| Camping (Tent)                       | 74      | 26        |
| Drown Campfires                      | 67      | 33        |
| Hikers                               | 67      | 33        |
| <b>Moderately Understood Symbols</b> |         |           |
| Off-road Vehicle Trail               | 50      | 50        |
| Information                          | 45      | 55        |
| Automobiles Permitted                | 43      | 57        |
| <b>Misunderstood Symbols</b>         |         |           |
| No Alcohol                           | 34      | 66        |
| No Charcoal Grills                   | 31      | 69        |
| Amphitheater                         | 13      | 87        |
| Carry Water Back to Site             | 8       | 92        |
| Fish Hatchery                        | 7       | 93        |
| Conserve Water                       | 2       | 98        |

Some of these well-understood symbols were recognized with a higher level of certainty than others (Fig. 2). A high percentage of respondents recognized with certainty (coding category 1) the *Fishing*, *Swimming*, and *Restrooms* symbols. The symbols for *Fishing* and *Swimming* were recognized at the highest level of certainty by nearly all the respondents, with 96 percent of respondents able to supply the intended meanings with certainty, and 94 percent of respondents able to supply the intended meaning of the *Restrooms* symbol with certainty. These high rates of certain recognition are in contrast to the *Hikers*, *Horse Trail*, and *Hiking Trail* symbols.

The majority of respondents (57%, 62%, 73%, respectively) provided responses coded as “correct understanding is likely” (coding category 2). Two of the Forest-produced symbols in the study were found to be well-understood. The *No Fireworks* symbol was understood with certainty by most of the respondents (78%), and the *Drown Campfires* symbol was identified with certainty by 40 percent of respondents.

Figure 2  
Well-Understood Symbols



Within this group of well-understood symbols, some subgroup differences emerged (Table 9). Education and activity levels of respondents seemed to matter most in whether a symbol was identified correctly. Significant differences were found for both of these variables on four of the eleven symbols. More respondents with some college or a degree correctly identified the *Horse Trail*, *No Fireworks*, *Camping (Tent)*, and *Hiking Trail* symbols as compared to those having a high school education or less. Those who usually participated in three or more activities had more correct responses to *Horse Trail*, *No Fireworks*, *Camping (Tent)*, and *Picnic Area* symbols as compared to respondents who engaged in two or fewer activities. The ethnicity of the respondents was important as well, with non-Latino respondents providing more correct responses for the *Picnic Area*, *Drown Campfires*, *Hikers*, and *Hiking Trail* symbols than the Latino respondents. Finally, there were age differences in the correct identification of *Picnic Area*, with respondents older than 35 providing a larger number of correct answers, and site type differences in understanding *Hiking Trail*, with those visiting day-use sites other than picnic areas identifying more symbols correctly.

**Table 9**  
**Correlations between Correctly Understood Symbols and Visitor/Forest Use Characteristics<sup>1</sup>**

| Symbol          | Demographic                    | % Correct | $\chi^2$ |
|-----------------|--------------------------------|-----------|----------|
| Horse Trail     | High school education or less  | 82        | 13.46*** |
|                 | Some college or degree         | 97        |          |
|                 | 2 or fewer typical activities  | 85        | 5.29*    |
|                 | 3 or more typical activities   | 94        |          |
| No Fireworks    | High school education or less  | 85        | 4.36*    |
|                 | Some college or degree         | 93        |          |
|                 | 2 or fewer typical activities  | 85        | 5.29*    |
|                 | 3 or more typical activities   | 94        |          |
| Camping (Tent)  | High school education or less  | 61        | 26.34*** |
|                 | Some college or degree         | 89        |          |
|                 | 2 or fewer typical activities  | 68        | 4.41*    |
|                 | 3 or more typical activities   | 80        |          |
| Hiking Trail    | High school education or less  | 79        | 5.02*    |
|                 | Some college or degree         | 89        |          |
|                 | Latino                         | 78        | 9.13**   |
|                 | Non-Latino                     | 93        |          |
|                 | Surveyed at picnic site        | 80        | 4.19*    |
|                 | Surveyed at other day-use site | 89        |          |
| Picnic Area     | 2 or fewer typical activities  | 68        | 4.46*    |
|                 | 3 or more typical activities   | 86        |          |
|                 | Latino                         | 74        | 12.10**  |
|                 | Non-Latino                     | 92        |          |
|                 | 35 years old or younger        | 75        | 3.94*    |
|                 | 36 years or older              | 85        |          |
| Drown Campfires | Latino                         | 61        | 9.11**   |
|                 | Non-Latino                     | 79        |          |
| Hikers          | Latino                         | 62        | 5.14*    |
|                 | Non-Latino                     | 78        |          |

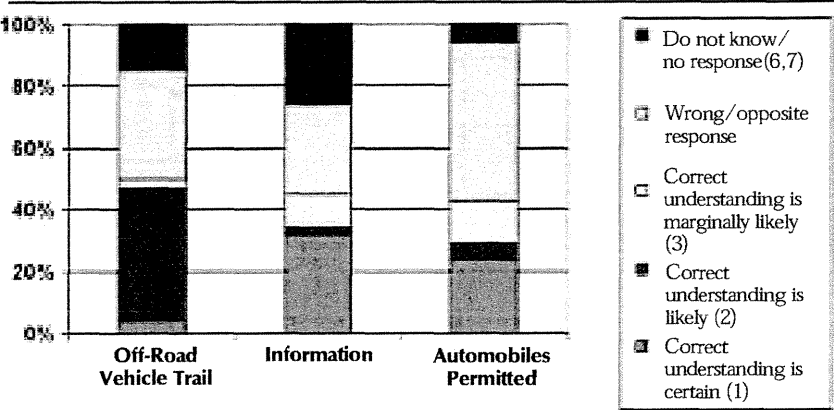
<sup>1</sup>Only characteristics where significant differences were found are presented

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

*The moderately understood symbols.* Three symbols were moderately understood: *Off-road Vehicle Trail*, *Information*, and *Automobiles Permitted*. For each of these symbols, most respondents did not reach a combined correct percentage of 66 percent or more but also did not reach a combined incorrect percentage of 66 percent or more (i.e., between 35% and 65% of responses were placed in the first three categories; Table 8).

For these three moderately understood symbols, respondents were about as likely to identify them correctly as they were to identify them incorrectly. Although half of the respondents identified the *Off-road Vehicle Trail* symbol correctly when coding categories 1, 2, and 3 were combined, it had the lowest percentage of responses that were certain to be correct among the symbols in this category (coding category 1, 4%; Fig. 3). The symbol for *Information* garnered the largest number of answers that were correct with certainty (32%), while *Automobiles Permitted* had the most incorrect or opposite responses in this group (51%).

Figure 3  
Moderately Understood Symbols



Some subgroup differences were found for the moderately understood symbols (Table 10). More respondents with some college or a degree were able to correctly identify the *Off-road Vehicle Trails* symbol than those who had a high school education or less, and more non-Latino respondents correctly identified the symbol's meaning than the Latino respondents in the study. For the *Off-road Vehicle Trail* symbol, activity level also had an influence, with more correct responses from those reporting they usually engage in three or more activities as compared to those who engage in two or fewer activities. For the *Information* symbol, more respondents having some college education or a degree demonstrated correct understanding than those with a high school education or less. Additionally, more non-Latino respondents correctly identified the symbol than the Latino respondents, while those who had never been to the site before did better than repeat visitors. Ethnicity was a factor in correctly identifying the *Automobiles Permitted* symbol as well, with fewer Latino respondents correctly identifying the symbol compared to non-Latino respondents.

**Table 10**  
**Correlations between Moderately Understood Symbols and Visitor/Forest Use Characteristics**

| Symbol                 | Demographic                   | % Correct | $\chi^2$ |
|------------------------|-------------------------------|-----------|----------|
| Off-road Vehicle Trail | High school education or less | 41        | 11.14**  |
|                        | Some college or degree        | 61        |          |
|                        | Latino                        | 36        | 31.68*** |
|                        | Non-Latino                    | 74        |          |
|                        | 2 or fewer typical activities | 42        | 6.09*    |
|                        | 3 or more typical activities  | 58        |          |
| Information            | High school education or less | 34        | 15.81*** |
|                        | Some college or degree        | 58        |          |
|                        | Latino                        | 40        | 5.35*    |
|                        | Non-Latino                    | 55        |          |
|                        | Repeat visitor to site        | 39        | 8.23**   |
|                        | First-time visitor to site    | 56        |          |
| Automobiles Permitted  | Latino                        | 38        | 5.03*    |
|                        | Non-Latino                    | 53        |          |

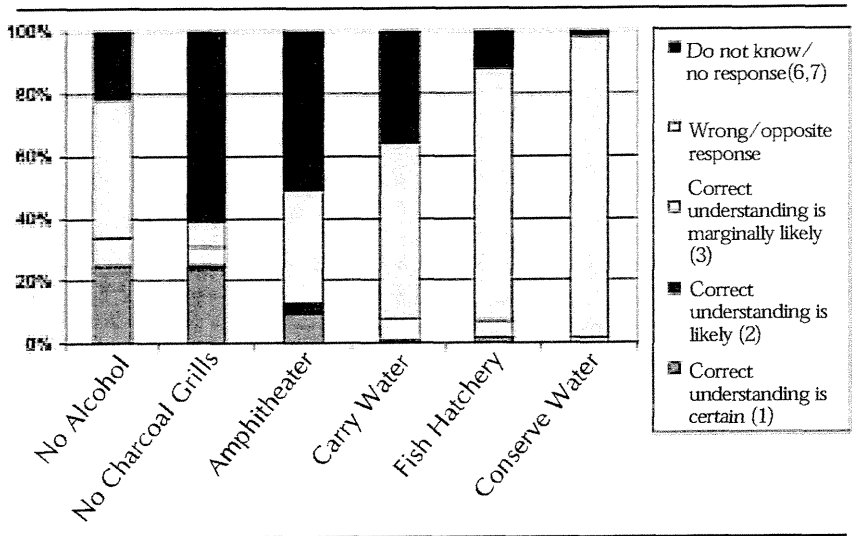
<sup>1</sup>Only characteristics where significant differences were found are presented

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

*The misunderstood symbols.* Finally, there were six symbols which proved difficult for respondents to identify correctly: *No Alcohol*, *No Charcoals Grills*, *Amphitheater*, *Carry Water Back to Site*, *Fish Hatchery*, and *Conserve Water* (Table 8). Symbols in this category had a high rate (66% or more) of incorrect or opposite answers and many "do not know" responses. Of these, four were Forest-produced symbols.

There was much variation in identification among the misunderstood symbols (Fig. 4). While over two-thirds of respondents could not identify any of the symbols in this group, *No Alcohol* and *No Charcoal Grills* were recognized by over 30 percent of respondents when coding categories 1, 2, and 3 were combined, and approximately 25 percent of respondents identified these symbols with certainty (coding category 1). More than 60 percent of the respondents surveyed either did not know what the *No Charcoal Grills* symbol was referring to or could not even come up with a guess. The same was true of the *Amphitheater* symbol, with the majority of respondents indicating either they did not know what it meant (36%) or did not guess (51%). The Forest-produced symbol *Carry Water Back to Site* clearly did not convey the intended meaning to the respondents. Fifty-six percent of respondents did not provide correct answers and another 35 percent did not guess. Many of these responses indicated an understanding that water was available, but little understanding of what to do with it. Finally, *Fish Hatchery* and *Conserve Water* were misunderstood by 93 and 98 percent of respondents, respectively.

Figure 4  
Misunderstood Symbols



Subgroup analyses for the *Amphitheater* symbol indicated that more respondents with some college education or degree correctly identified it than those who had a high school education or less (Table 11). Site type played a role as well, with more picnic area respondents correctly identifying the symbol when compared to those surveyed at other day-use areas. Finally, there were differences between Latino and non-Latino respondents; non-Latinos had more correct responses than the Latino respondents.

Subgroup differences existed for the *Carry Water Back to Site* symbol, with more respondents who were 36 years of age or older able to correctly name this symbol than the younger respondents (Table 11). Age was also a factor for *Fish Hatchery*. More respondents 36 years of age or older correctly identified this symbol than those 35 years or younger.

Conclusions and Recommendations

The purpose of this study was to evaluate recreationists' levels of comprehension of International Symbols in use on the Angeles and San Bernardino National Forests in southern California. A secondary purpose was to ascertain whether demographic and forest visit characteristics/use patterns were related to the overall understanding of these symbols.

Results indicated that just over half of the symbols assessed were correctly identified by the respondents in the study. These symbols had a high rate of recognition, with at least two-thirds of respondents being able to name the activity/facility/rule to which the symbol was referring. Familiarity with these symbols and the resources with which they are

**Table 11**  
**Correlations between Misunderstood Symbols and**  
**Visitor/Forest Use Characteristics<sup>1</sup>**

| Symbol                   | Demographic                    | % Correct | $\chi^2$ |
|--------------------------|--------------------------------|-----------|----------|
| Amphitheater             | High school education or less  | 7         | 9.67**   |
|                          | Some college or degree         | 20        |          |
|                          | Surveyed at picnic area        | 18        | 4.55*    |
|                          | Surveyed at other day-use site | 9         |          |
|                          | Latino                         | 4         | 34.14*** |
|                          | Non-Latino                     | 30        |          |
| Carry Water Back to Site | 35 years old or younger        | 4%        | 3.82*    |
|                          | 36 years of age and older      | 11%       |          |
| Fish Hatchery            | 35 years old or younger        | 3%        | 5.55*    |
|                          | 36 years of age and older      | 10%       |          |

<sup>1</sup>Only characteristics where significant differences were found are presented

\*p < .05; \*\*p < .01; \*\*\*p < .001.

connected may play a role in their high rate of recognition. Most of these symbols depict common recreational activities and facilities found on forestlands, such as restrooms, fishing, camping, hiking, and picnicking. Only two Forest-produced symbols (*No Fireworks and Drown Campfires*) were well understood. It could be that because of high fire danger during the data collection phase there was heightened public awareness due to increased enforcement and signage present. The pictorial quality of the images on these well-understood symbols may play a role, allowing respondents to guess with more accuracy. This is an important feature of International Symbols because it allows individuals to comprehend the intended meaning with some certainty, even though they may have never seen it before.

Some of these same qualities (e.g., familiarity with the symbols and the resources with which they are connected) are useful in considering why nine of the symbols were only moderately understood or misunderstood. First, many of these symbols may be used infrequently on these Forests, which lowers the chance for visitors to be exposed to them and learn their meanings. Also, the images used on these symbols may not be conducive to accurate guessing. This may have been particularly true of several Forest-produced symbols (*No Alcohol*, *No Charcoal Grills*, *Carry Water Back to Site*, *Conserve Water*), with over six of 10 respondents misunderstanding the messages intended.

Differences were found within the various subgroup analyses of the responses to the International Symbols. Ethnicity, education, and activities were the variables most likely to influence comprehension. Differences between Latinos and non-Latino respondents were found for nine of the 20 symbols, with a higher percentage of non-Latinos correctly understanding

them. These were: *Picnic Area*, *Hiking Trail*, *Camping (Tent)*, *Drown Campfires*, *Hikers*, *Off-road Vehicle Trail*, *Information*, *Automobiles Permitted*, and *Amphitheater*. Education level had a large influence as well, with subgroup differences in six of the symbols: *No Fireworks*, *Camping (Tent)*, *Hiking Trail*, *Off-road Vehicle Trail*, *Information*, and *Amphitheater*. Respondents with some college experience were more likely to correctly identify the symbols. The number of activities in which respondents usually engaged while on the Forest also influenced responses to the symbols, with those who usually engaged in three or more activities providing more correct responses to these symbols: *Camping (Tent)*, *No Fireworks*, *Off-road Vehicle Trail*, and *Horse Trail*.

### *Management Implications*

Findings from this study suggest potential management actions for the Angeles and San Bernardino National Forests. Eleven of the 20 International Symbols need no further management action since they were correctly understood by most respondents. These were symbols for *Fishing*, *Swimming*, *Restrooms*, *Horse Trail*, *No Fireworks*, *Picnic Area*, *No Trucks*, *Hiking Trail*, *Camping (Tent)*, *Drown Campfires*, and *Hikers*. The six misunderstood symbols (*No Alcohol*, *No Charcoal Grills*, *Amphitheater*, *Carry Water Back to Site*, *Fish Hatchery*, and *Conserve Water*) require major modification, or discontinued use. If the message is important, then managers may consider developing a different International Symbol to convey the message or use a different communication method. Over two-thirds of the respondents did not understand the intended messages of these symbols. The remaining three symbols are worth further consideration by Forest managers (these were symbols for *Off-road Vehicle Trail*, *Information* and *Automobiles Permitted*). These symbols probably need modification to clarify the intended message. Perhaps these symbols should be used only if there is accompanying text. The Federal Highway Administration recommends providing textual messages for three years when introducing all recreational and cultural interest area symbol signs (U.S. Department of Transportation, 2000). It may be necessary to use textual messages for more than three years (perhaps indefinitely) with these three symbols, particularly if there are many new site visitors or visitors from newly immigrated groups.

The findings suggest that managers need to consider ethnicity, education levels, and the number of activities visitors usually engage in while on these Forests when considering which symbols to use. For example, if Latinos are typical site visitors, then some of these symbols may not be the best medium for conveying a message, and another communication medium ought to be considered (such as a site host to convey important messages face-to-face with visitors).

Finally, when managers are preparing new International Symbols for use, they might consider incorporating representational, not abstract, designs. They might also consult the revised ISO Standard 9186 (ISO, 2001), as it specifies the procedure they could use to achieve standardiza-

tion of graphical symbols. For example, ISO recommends tests of symbols be conducted in at least two countries, preferably countries with different cultural backgrounds.

### *Study Limitations*

Though it was beyond the scope of this study, there are some additional considerations for these results. It is unknown how many of the symbols included in this study were already familiar to the respondents, prior to their visit to the Forests. Those who had more opportunities for exposure (outside these study areas) may have been more likely to comprehend them. Additionally, familiarity with resource conservation concepts outside the Forests may have contributed to understanding for some respondents for the symbols relating to resource conservation (e.g., *Conserve Water*). The number of Forest sites visited (for example, in a 12-month period), may also have contributed to comprehension with those visiting more types of sites (e.g., picnic areas, campgrounds, trailheads) possibly better able to correctly identify symbols.

### *Future Research*

Future studies assessing National Forest visitors' comprehension of International Symbols for communicating outdoor recreation messages can build upon the results of this study, as well as its limitations. Building upon these results, we suggest testing symbols that are in use on-site on the Forests at the time of the study (Davies et al., 1998; ISO, 2001). At a minimum this ensures visitors have had the opportunity to see the symbol in advance of the survey. We would also suggest counting the number of places where the International Symbol is found on the forest (e.g., it is used once or it is in 20 locations). Future research instruments may also measure if visitors are already familiar with the symbols being tested, visitor familiarity with resource conservation concepts outside the forests, and the number of forest sites visited.

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