Recommendation Suite	Impact total	Average Impact	Input total	Average Impact
Combination A: Immediate Impacts Volunteer corps + decreased parking turnouts + decreased parking on street + seasonal trash cans	16*	8*	7*	3.5*
Combination B: Public Education Volunteer training + Spanish-language educational materials + public campaign to reduce waste + visitor center displays	24	6	13	3.25
Combination C: Peer-to-peer outreach Volunteer corps + volunteer training + volunteer coordinator + Spanish-language educational material	31	7.75	9	2.25
Combination D: Multiple Angle Approach Volunteer corps + graffiti task force + decrease parking in turnouts + seasonal trash cans	25*	8.33*	9*	3*
Combination E: increase Proper Disposal Loudspeakers + trash bag dispensers + recycling bins + seasonal trash cans	26	6.5	10	2.5

The tool consists of two parts: Inputs, expected monetary and labor costs, and Impact Areas, methods to encourage public participation in proper waste disposal. Each proposed action can be evaluated on a simple scale for each input, typically high to low for costs. An input score is calculated, with a high score preferred over a low score. Similarly, the impact score is based on a binary yes/no system - each action either does or does not address a given impact area. Again, a higher score is preferred, as it indicates the action will have a broader impact.

The tool is designed to support decision making, and not as a determining factor in which actions to implement. No single action addresses all impact areas, and with no way to assess the effectiveness of an action, a suite of actions is likely the best way to address the waste problem at East Fork. We created five sets of four recommendations each. Each of these suites of action are designed with a different approach. The table above shows their Input and Impact scores from the tool, in order to compare potential costs and benefits of each recommendation suite. Those suites that are starred include parking or road actions, which fall under the jurisdiction of Los Angeles County, and require collaboration between the Forest Service and the County. These types of actions cannot be evaluated by the tool, and so within those suites were excluded in the scores.

Conclusions

Though the percent of litter that is easily recycled was low, when extrapolated out to the entire San Gabriel River Ranger District, we found an expected annual redemption value of $4400 (compared to $5165 in dump fees). Expert opinion tells us this is conservative, as more CRV recyclables are likely found in the trash bins than left as litter. The biggest contributing factor to visitor behavior that results in high levels of litter is a poor public perception of the forest. Changing this perception will likely create the longest-lasting, greatest impact in reducing waste at the East Fork and throughout the Forest.
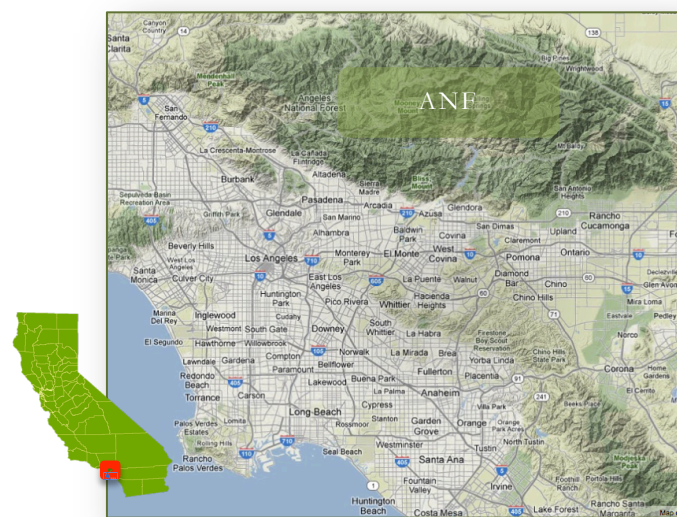
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Sustainable Visitorship at the Angeles National Forest: Strategies for Solid Waste Management

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Client: US Forest Service: Region 5 Pacific Southwest Region and the Angeles National Forest

The Problem
The Angeles National Forest has over 3 million visitors per year. These visitors are diverse and use the forest for a variety of recreation. Some areas of the forest are used more heavily than others. One of the most popular of these concentrated use areas, the East Fork of the San Gabriel River, experiences 10,000 visitors in a summer weekend. At the East Fork, visitors engage in day-use picnicking and water play, but frequently leave waste and remnants of their activities behind. The waste left behind has led to the East Fork's listing as an impaired waterway for trash by the California Environmental Protection Agency. Past efforts to reduce trash at the East Fork have proven insufficient, and the Forest faces limited resources in time and money. This project was designed to help the Forest understand the trash problem and develop potential management actions to address the trash problem in the East Fork.

Questions:

1. How do visitor demographics influence waste?
2. What is the composition and abundance of waste?
3. What actions can be done to reduce litter and overall waste?

Background
The US Forest Service is responsible for the stewardship of 193 million acres of public land. Of this area, 20 million acres are in Region 5: Pacific Southwest Region, including California and the Pacific islands. Within Region 5, the Angeles National Forest (ANF) receives the greatest number of visitors, existing within a 90-minute drive of 15 million people. Further, the ANF abuts a major, urban area, including the cities of Azusa, Arcadia, Santa Clarita, and Los Angeles.

The ANF is as diverse as its users. It provides recreation opportunities ranging from snowplay, backpacking, off-highway vehicle use, hiking, and day-use waterplay. In addition to the recreational activities supported by the forest, the ANF represents 70% of the open space in Los Angeles County and contains diverse habitat supporting numerous species. Additionally, the ANF provides ecosystem services, including 23% of the water supply for the 13 million people in the Los Angeles Basin.

The Forest Service mission to sustain the forests to meet the needs of present and future generations requires them to find a balance between maintaining the health of the natural system with providing access to the forest for visitors. This tension drives the problem found in the East Fork of the San Gabriel River.

Source: Wikipedia Commons

**Project website:** www.bren.ucsb.edu/~angeles

1. How do visitor demographics influence waste?

This question includes determining the number of visitors, the type of visitors, and how they use the Forest. Data were gathered from the National Visitor Use Monitoring (NVUM) Program, CalTrans car counts, and informational interviews with ANF employees whose duties ranged from on the ground trash pick up to visitor center staffing to managers.

The NVUM survey showed that the majority of visitors at the East Fork were there for recreation purposes. A sizeable percentage of the users who took the survey were Hispanic, confirming what we learned in informational interviews.
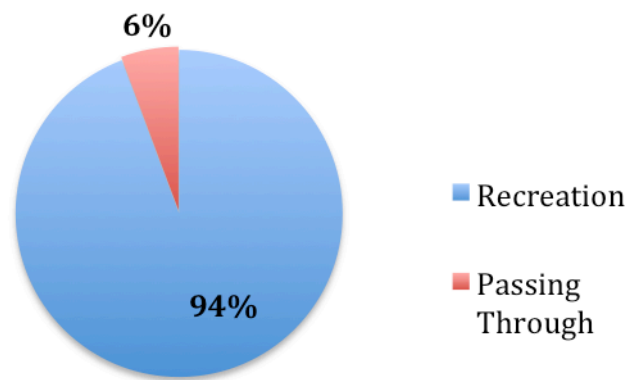

CalTrans car count data was also consistent with what we learned from the informational interviews. Visitation peaked on weekends in the summer, with an average of 2400 cars per weekend. Assuming four people per car, this translates to 9500 people per average summer weekend.

Average number of cars per day in summer 2010
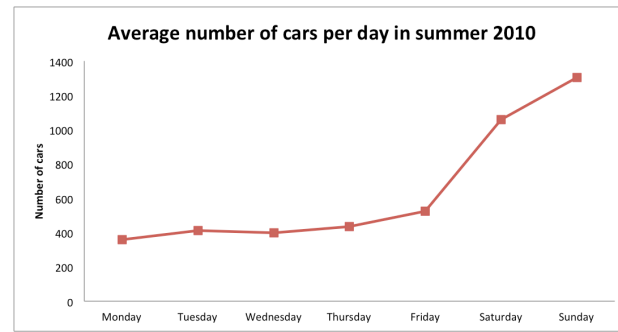
## 2. What is the composition and abundance of waste?

Here, we looked at the types of items that were left behind as waste, as well as how much of a given item there was. We used the landfill receipts from 2010 for the entire San Gabriel Ranger District - of which the East Fork is a part - to get estimates of the entire amount of trash disposed of in the district. Looking at it by season, we found a significant increase in trash in the district over the summer.
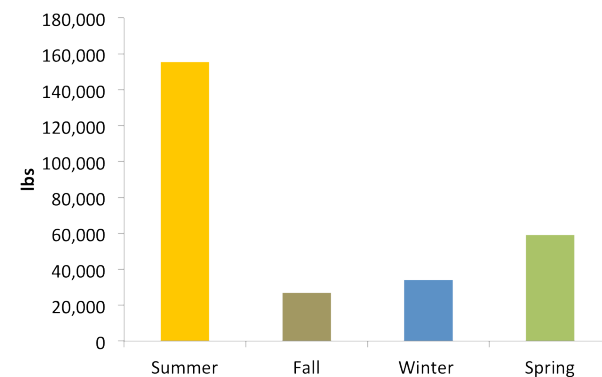
To learn more about the composition of waste at the ANF, we used the Total Maximum Daily Load (TMDL) data that was collected in the East Fork as part of its impaired waterway status. The TMDL data provided counts of individual items of litter - uncontained trash - along 4 to 6 of the most popular recreation spots along the East Fork. TMDL data were collected approximately once per month from 2004 to 2008, for a total of 44 days of data.

Within the TMDL data, there were 42 "standard" categories of trash - those items found on most days data were collected - and an additional 145 categories for unusual or rare items, for a total of 187 types of trash. All counts were translated into weights in order to compare different types of waste. To do this, we assigned weights to each standard category assuming standard materials and styles used by typical day-use picnickers. Non-standard categories were grouped into weight ranges (0 to <2 lbs, 2 to <5 pounds, 5 to <10 lbs, and >10 lbs).

We were interested in the recycling potential of the trash from the San Gabriel River Ranger District, so we pulled out the recyclable items from the TMDL data to determine what percent of the waste stream was recyclable. Common California Redemption Value (CRV) items - glass bottles, aluminum cans, and plastic bottles - were found to make up approximately 1.7% of the litter at East Fork, while approximately 6% of the litter at East Fork was recyclable (including common CRV items).
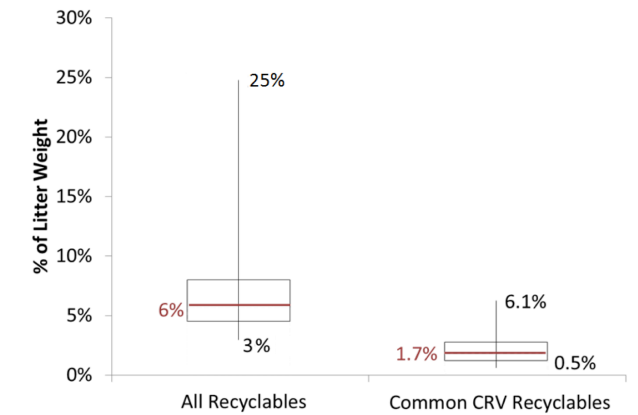
3. What actions can be done to reduce litter and overall waste?

Through literature review, visitor demographics, and informational interviews, we identified problems with visitor participation in proper waste disposal, as well as a number of possible management actions that could be implemented to reduce litter and total volume of waste.
Our list of 25 actions included recommendations to install trash cans seasonally along the river terrace, develop a volunteer corps that would pick up trash as well as provide peer-to-peer outreach, re-install recycling bins, and reduce available parking at East Fork, among others. The list, however, would not be useful to Forest Service managers on its own. So we developed a tool to help managers set priorities and compare the potential costs and methods of impact an action would have with other actions they choose to consider (see below).

Recommendation Action	Forest Service Inputs						Input Subtotal	Areas of Beneficial Impact						Impact Subtotal	Total
	Expected Implementation cost	Expected maintenance cost	Expected maintenance frequency	FS labor for implementation/initial effort	FS Labor for maintenance/continued efforts	NEPA required		Visibility of Authority	Reduced Volume of Trash	Education/ Outreach	On-site trigger for desired behavior	Increases Diversion Potential	Improves Visitor Perception of Forest		
Outreach and trash volunteer corps	Low	Low	Infrequent	Low	None	No	9	Yes	No	Yes	Yes	No	Yes	4	13
Visitor center displays/ exhibits (large, eye-catching)	Medium	Low	Infrequent	Medium	Low	No	7	No	No	Yes	Yes	Yes	Yes	4	11
Seasonal trash can installation along river terrace	Low	Low	Regular	Low	High	No	7	Yes	No	No	Yes	Yes	No	3	10
Angeles public photo contest for public information campaign	Low	Low	None	Medium	Low	No	10	No	No	Yes	No	No	Yes	2	12

Most unusual item found at East Fork: Come-A-Long power puller

Most common item found at East Fork: Styrofoam cups, plates and bowls