

Spatial Allocation of Wilderness Recreation Value

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Background

- The US Forest Service utilizes GIS-based fire modeling software that estimates the costs of fire prevention and firefighting efforts and the effects of those efforts on fire behavior.
- Current tools cannot estimate the economic benefits of such efforts.
- Investments in and trade-offs associated with fire management strategies therefore cannot be fully evaluated.

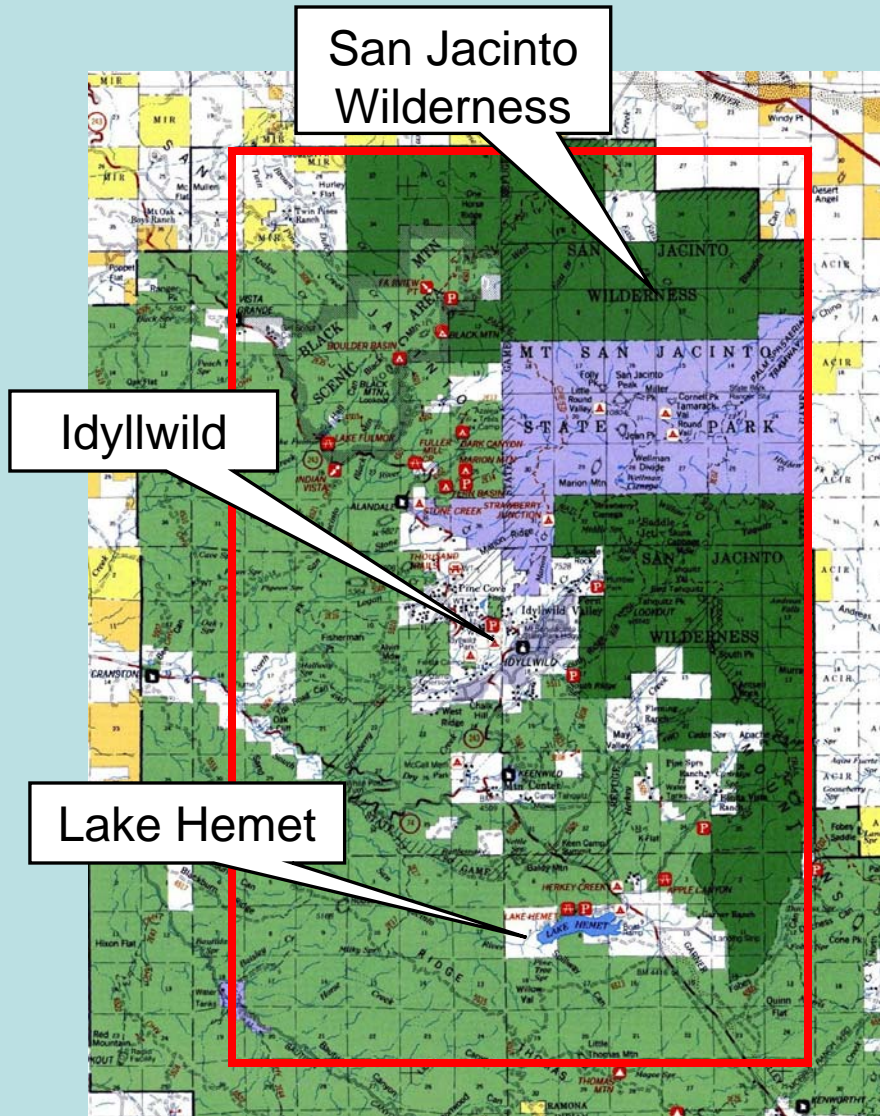
Objectives

- Expand the economic capabilities of the Stewardship and Fireshed Assessment process by developing a GIS-based framework for evaluating investments in fire management.
- Estimate and spatially allocate the value of assets at risk for a Southern California demonstration site.

Focus

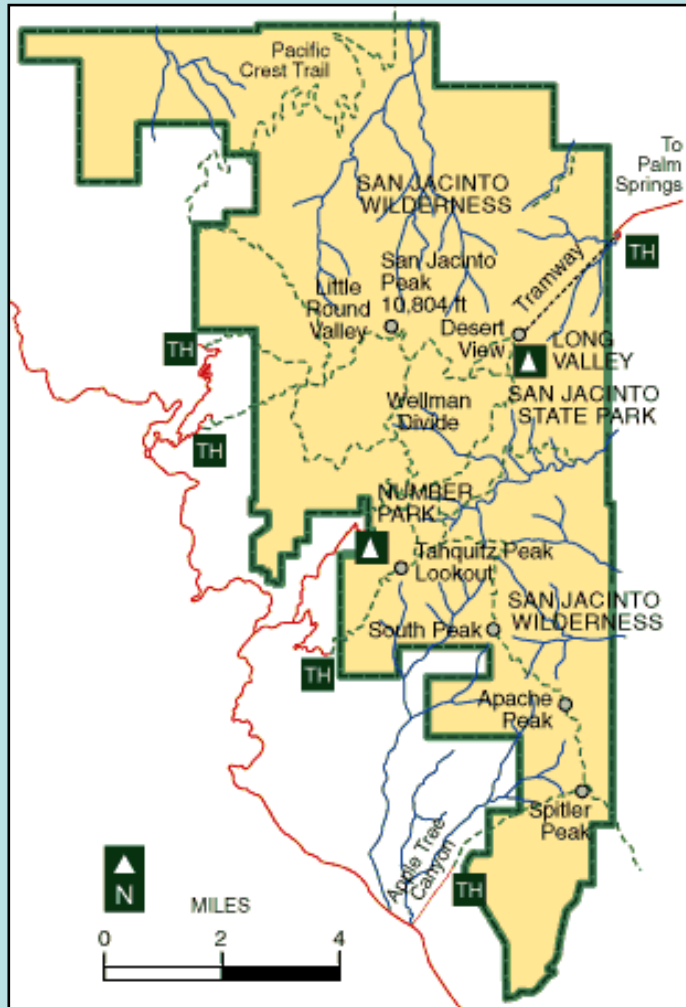
- Real estate – Idyllwild and surrounding areas
- Water resources – Lake Hemet
- **Recreation – San Jacinto Wilderness**

Study Site



- Study site lies within the San Bernardino National Forest in Southern California, west of Palm Springs.
- Extends nearly 51,000 hectares encompassing the San Jacinto Wilderness, the City of Idyllwild and the Lake Hemet Reservoir.

Recreation: Backcountry Hiking



- 13,350 hectares with 128 km of hiking trails.
- Attracts 60,000 backcountry visitors annually.
- Another 350,000 visitors ride the Palm Springs Aerial Tramway.
- Access is regulated through wilderness permits issued by two U.S. Forest Service Ranger Stations and one State Park office.

Recreation Value

Visitor permit data for 2005 is used to establish the number of backcountry daytrips taken from each ZIP code within a 2.5 hour drive.

Trailhead name	Sample number of users in 2005	Minimum number of users from any ZIP code	Median number of users across ZIP codes	Mean number of users across ZIP codes	Maximum number of users from any ZIP code	Starting elevation (m)	Distance to first trail junction (km)	Average slope (%)
Fuller Ridge	330	0	0	0.56	18	2,365	8.0	4.2
Seven Pines	196	0	0	0.33	15	1,928	6.1	11.3
Marion Mountain	1,391	0	0	2.37	40	1,964	4.0	16.3
Deer Springs	4,793	0	2	8.18	356	2,097	3.7	-9.8
Devil's Slide	8,428	0	4	14.38	855	1,956	4.0	12.7
Ernie Maxwell	269	0	0	0.46	21	1,956	3.7	-5.9
Spitler Peak	182	0	0	0.31	30	1,781	4.7	6.6
Fobes Trail	47	0	0	0.08	8	2,090	1.6	-5.0
South Ridge	2,143	0	0	3.65	534	2,303	6.4	3.9
Long Valley	16,439	0	13	28.05	1,024	2,576	0.5	0.6

Recreation Value

ZIP code data is combined with census data to create a zonal travel cost model, where the price of a trip from each ZIP code is estimated to be the sum of driving costs and time costs.

Variable	Description	Estimate	Standard Error
travcost	Roundtrip travel cost from ZIP code to trailhead (\$2005)	-0.0529	0.0003
prop12	% of ZIP code residents voting “yes” on Proposition 12	0.0051	0.0008
white	% of ZIP code residents who are white/Caucasian	0.0299	0.0005
M1839	% of ZIP code residents who are male, ages 18-39	0.0593	0.0018
M4059	% of ZIP code residents who are male, ages 40-59	0.0244	0.0033
M60	% of ZIP code residents who are male, ages 60 and over	0.0992	0.0043
F1839	% of ZIP code residents who are female, ages 18-39	-0.0157	0.0030
F4059	% of ZIP code residents who are female, ages 40-59	0.0002	0.0001
F60	% of ZIP code residents who are female, ages 60+	-0.0457	0.0040
urban	% of ZIP code residents living in urbanized areas	-0.0135	0.0003
college	% of ZIP code residents with a Bachelors degree	0.0661	0.0004
PCinc	Average per-capita income for the ZIP code (\$2005)	-1.611e-6	1.113e-6

Recreation Value

Net benefit per trip is added to travel cost and aggregated to determine trailhead access values.

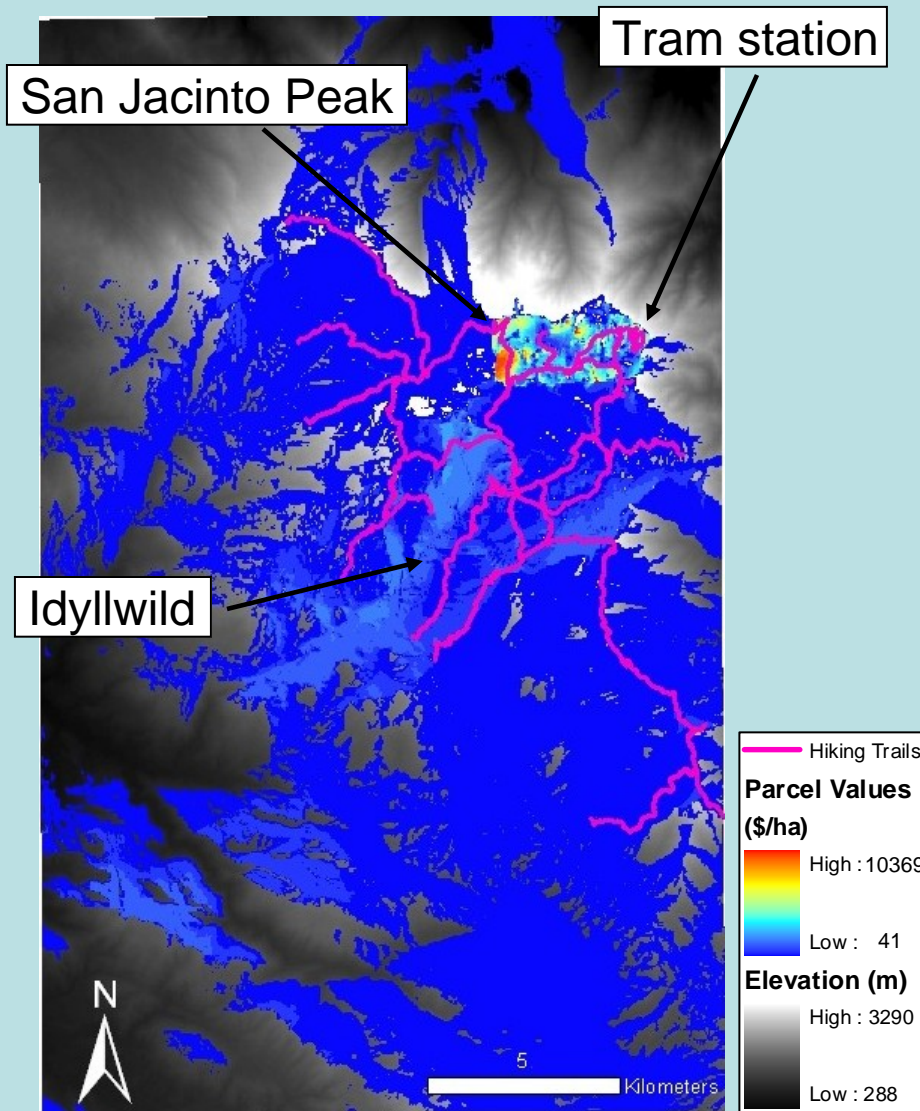
Trailhead name	Total number of users	Mean travel cost to trailhead (\$2005/trip)	Mean net benefit (\$2005/trip)	Mean total value (\$2005/trip)	Aggregate travel cost (\$2005/yr)	Aggregate equivalent variation (\$2005/yr)	Aggregate total value (\$2005/yr)
Fuller Ridge	586	64.67	18.89	83.56	37,897	11,070	48,966
Seven Pines	348	60.85	18.89	79.74	21,176	6,574	27,750
Marion Mountain	2,546	58.83	18.89	77.72	149,781	48,094	197,875
Deer Springs	8,656	54.72	18.89	73.61	473,656	163,512	637,168
Devil's Slide	15,138	56.45	18.89	75.34	854,540	285,957	1,140,497
Ernie Maxwell	478	55.40	18.89	74.29	26,481	9,029	35,511
Spitler Peak	316	61.21	18.89	80.10	19,342	5,969	25,312
Fobes Trail	82	65.22	18.89	84.11	5,348	1,549	6,897
South Ridge	3,827	56.67	18.89	75.56	216,876	72,292	289,168
Long Valley	28,678	73.25	18.89	92.14	2,100,664	541,727	2,642,391
Total Wilderness	60,655	--	--	--	3,905,761	1,145,773	5,051,534

Recreation Value

Trailhead access values obtained from the travel cost model are allocated to the landscape using ArcGIS.

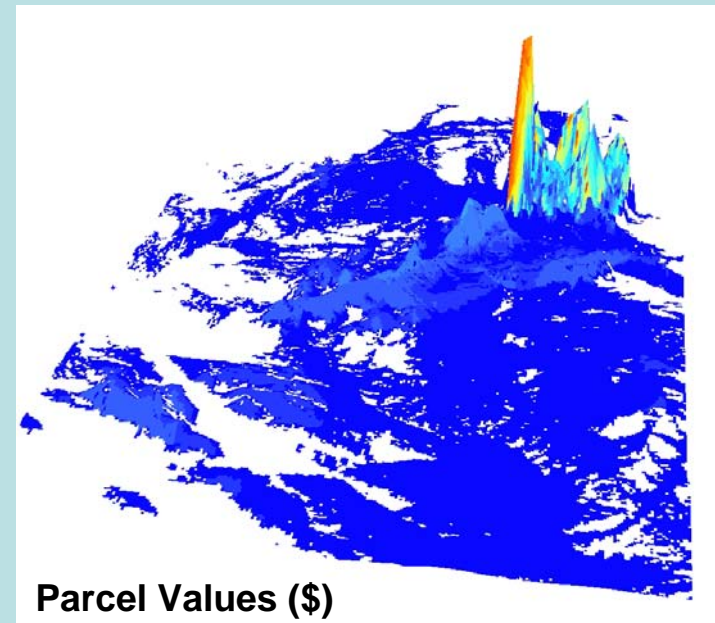
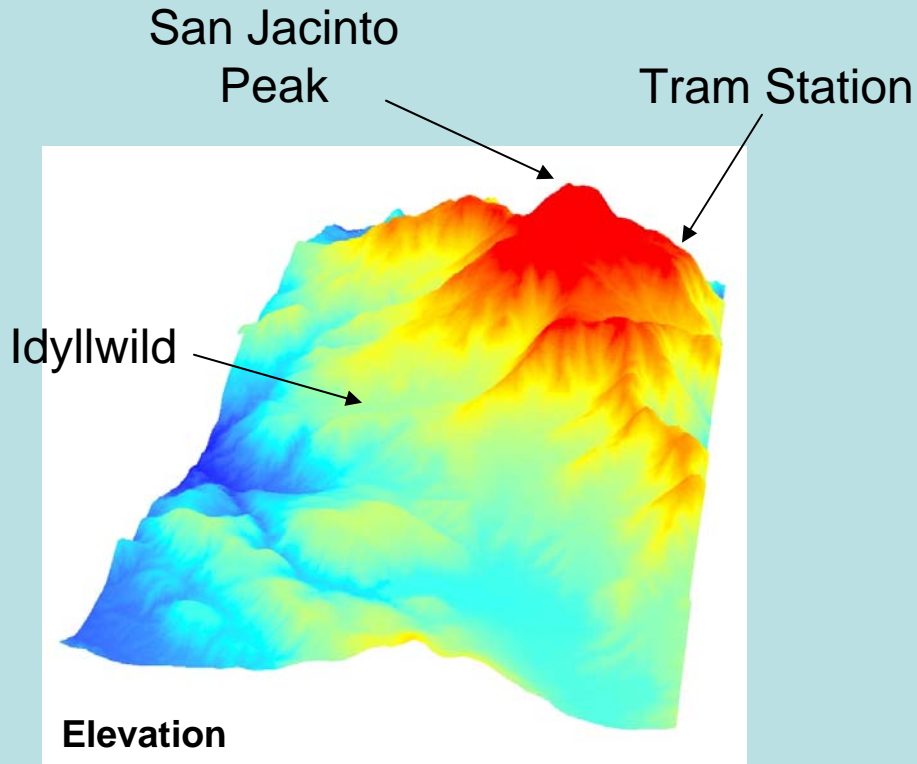
- Hiking paths are inferred from destination data and hiking speeds.
- Aggregate trailhead values are allocated to trail segments along these hiking paths.
- Trail segment values are allocated to the landscape using viewsheds:
 - For a given trail segment, each point in the landscape receives a weighted score based on how frequently and at what distance it is visible to a hiker traversing the trail segment.
 - The trail segment value is allocated to the visible points based on the relative magnitudes of these weighted scores.
 - The aggregate value of any point in the landscape is the sum of the values it receives from all trail segments.

Value Surface



- When allocated to the landscape, annual wilderness recreation values range from \$41 to \$10,369/ha, with a mean of \$378/ha.
- Distribution of values is skewed by few highly valued parcels: 90% of values are less than \$750/ha.
- Annual value of tram access (not shown) is at least \$7M.

Elevations and Values



San Jacinto Peak has the highest parcel values in the landscape due to its visibility and popularity with hikers.

Discussion

- The method works well but needs to be tested. Could accomplish this with a trail-intercept survey and “stated-preference” data.
- For comparison, average per-hectare recreation value is only 1% of average real estate value; but aggregate recreation value is 15% of real estate value due to significantly larger wilderness area.
- Analysis does not incorporate non-use or “existence” values.
- Appropriate benefit-cost analysis of fire prevention and suppression activities must consider the risk of fires spreading from low to high value areas; or from small to large areas.
- Also must consider transitory nature of fire: benefits will be disrupted temporarily but not completely lost.
- Extensions: trail network design, campground sighting, locating scenic byways and overlooks, building regulations & impact fees.