Green Infrastructure for Connecting People to the Natural Environment

Methodology

Analysis #1: Conserving the Green Infrastructure

Threat: Development

Threat of future development is based on recent GIS data developed for the Integrating Climate and Land Use Scenarios (ICLUS) program sponsored by the US EPA http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=153506. Development consists of two components;

Conversion: housing density of one housing unit per five acres or more
Parcelization: one housing unit per twenty acres up to one per five acres.

For ranking purposes, conversion is assigned a higher threat rank relative to parcelization, since it results in a loss of most or all Green Infrastructure value. Also, lands projected to be converted or parcelized in the near-term are ranked higher than those in the longer-term, since the time to apply protection tools is limited. The threat ranking scheme is provided below.

Threat Ranks: Development	
Conversion by	**Threat Rank**
2020	H
2030	M
2040	L
> 2040	-
Parcelized by	
2020	M
2030	L
≥ 2040	-

Finally, county general plan data from the Commission on Local Governance for the 21st Century (2000) (available from http://ceres.ca.gov/planning/genplan/) was used to identify areas restricted from development. We assumed these restrictions could apply until at least 2020, thus we reduced ranks for these areas by one, for example for High

to Medium. This rank reduction basically assumes development impacts would be delayed 10 years.

Asset: Green Infrastructure (Unprotected)

For this analysis, FRAP defines Green Infrastructure (GI) as all forest and rangeland vegetation, i.e., everything except urban, agriculture, and water. Also, to meet the criterion of connecting people to the "natural" landscape from the Redesign language, and based on limitations of our vegetation data, we eliminated Green Infrastructure "islands" (mainly isolated GI patches within urban areas) that are less than 50 acres.

Mapping the Green Infrastructure Asset

As part of the Fire Hazard Severity Zone mapping project, FRAP enhanced our existing vegetation data to exclude urban areas of one housing unit per acre of more using county parcel data. This data provided the best starting point for identifying areas of Green Infrastructure. Urban areas, agricultural lands, and water were removed, and the resulting lands provided our Green Infrastructure dataset.

Ranking the Green Infrastructure Asset

The ranking method for Green Infrastructure assigns higher ranks to GI that is close to large communities. Communities were mapped based on incorporated city boundaries maintained by FRAP, and Census Designated Places for unincorporated communities.

Per capita community Green Infrastructure (PCCGI) was calculated for each community as:

Total community population (from 2000 census block data) / Total Green Infrastructure acres within 10 miles of the community.

This provides a measure of value for each community's Green Infrastructure since it includes relative abundance/rarity in relation to the community population. The range of community values can be converted to community ranks as follows:

Asset Rank: Green Infrastructure (unprotected)	
PCCGI	**Asset Rank**
0	-
< 1	L
1-4.9	M
≥ 5	H

Community ranks were then assigned to individual GI cells:

1. Communities ranked low were buffered 10 miles, all GI cells within this buffer were assigned a low rank

2. Communities ranked medium were buffered 10 miles, all GI cells within this buffer were assigned a medium rank
3. Communities ranked high were buffered 10 miles, all GI cells within this buffer were assigned a high rank

The order of processing ensures that GI cells that are within the 10 mile buffer of multiple communities were assigned a rank based on the community with the highest PCCGI value.

As a final step, we made sure that protected areas are unranked, since they are not at risk. Since the development threat is ranked zero for all protected lands, we simply made sure that all areas with no development threat received a zero ranking in the priority landscape.

Priority Landscape

The overlay of the Green Infrastructure asset and development threat layer produces priority landscapes. Each priority landscape (PL) cell is assigned a rank based on adding the asset and threat rank scores (H=3 M=2 L=1). All protected areas are unranked, since they are not threatened.

Priority landscape scores were translated to the priority landscape rank as follows;

Priority Landscape Rank: Conserving the Green Infrastructure	
Score	**PL Rank**
0	-
2,3	L
4	M
5,6	H

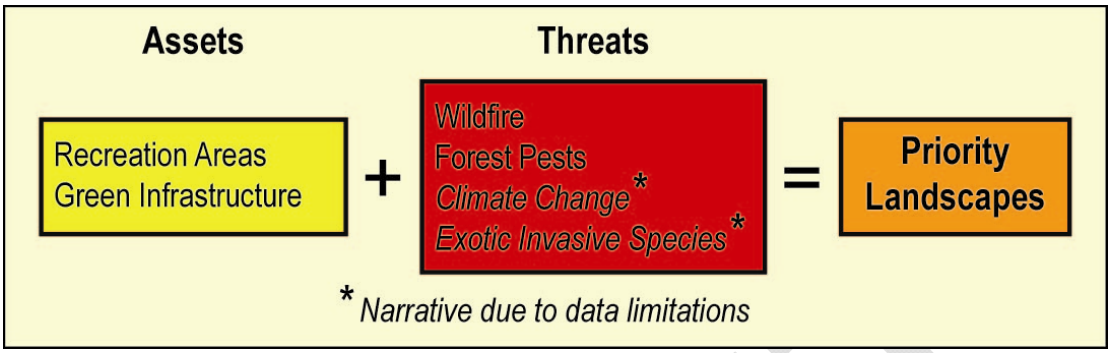
Data Used in the Analysis

The datasets used in this analysis are available at http://frap.fire.ca.gov/assessment2010/3.6_green_infrastructure.html. These are provided to document the analysis, and to provide the potential to replicate results. Updated versions of these datasets may be available from the various data providers.

ANALYSIS: Conserving Green Infrastructure			
Data theme		**Dataset name**	**Purpose**
THREATS			
THREAT1: Development		thr_developLOC09_11.gdb	Threat, derived from potential future development (EPA ICLUS) constrained by county general plans
Inputs	EPA ICLUS	input_bhcs_iclus_ca.gdb	Potential future development
	County general plans	input_genplans_rr.gdb	Constraints on future development
ASSETS			
ASSET1: Green infrastructure (unprotected)		ast_gi09_3.gdb[1]	Asset, derived from vegetation data, and ranking based on community population within 10 miles of each GI area
Inputs	Vegetation	input_fveg06_2.gdb	Vegetation communities used to define green infrastructure.
	Communities	community09_3.gdb	Used to rank green infrastructure asset based on community population within 10 miles
	Census 2000 block data	cen00blm03_1.gdb	Used to derive community population
PRIORITY LANDSCAPE			
PL: Conserving the green infrastructure		pl_t36_a109_3.gdb	Priority landscape for conserving the green infrastructure
OTHER DATA			
County boundaries		cty24k09_1.gdb	Reporting unit for summarizing results
Bioregions		INACCBioreg04_1.gdb	Reporting unit for summarizing results

1 A separate unprotected green infrastructure dataset was not actually created. This dataset includes all green infrastructure lands, protected and unprotected. However, since the development threat is ranked zero for all protected lands, areas with no development threat received a zero ranking in the priority landscape.

Analysis #2: Managing the Green Infrastructure



Threat: Wildfire

Wildifire threat is identical to the "Stand-level wildfire threat" from *Wildfire Threat to Ecosystem Health and Community Safety*.

Threat: Forest Pests

Forest Pest threat is identical to the "Stand-level forest pest threat" from *Forest Pests and Other Threats to Ecosystem Health and Community Safety*.

Composite Threat

The two threat layers were combined to create a composite threat layer. Since wildfire can heavily damage recreation areas and other Green Infrastructure, it was weighted three to one relative to forest pests. For converting the resulting scores to composite threat ranks;

- Any cell with high wildfire threat gets a high composite threat rank.
- Medium wildfire threat areas can get a high composite rank only if they also have a forest pest threat of high or medium. All other medium fire threat areas get a medium rank.
- A low wildfire rank area can only get a medium composite rank if it has a high forest pest rank.

This ranking scheme is shown below.

Composite Threat Ranks: Managing the Green Infrastructure	
Composite score	**Rank**
8-12	H
6-7	M
1-5	L
0	-

Asset: Recreation Areas

The impact of wildfire and forest pests can be particularly severe in developed recreation areas, where facilities can be damaged, popular areas closed, and/or recreation experiences degraded. The following table shows the general approach used to assign the recreation asset ranks.

Recreation values	Asset Rank
Developed and/or high use and/or high educational value and/or unique opportunity	H
Limited facilities and/or moderate use and/or moderate education value	M
Accessible, low or unknown use	L
Not accessible or Non-GI	-

More specifically, GreenInfo Network's California Protected Areas Database (CPAD) http://www.calands.org/ was used to identify outdoor recreation and education areas, determine access, and assign ranks. Initially, we assigned a default low rank to all accessible lands administered by agencies with large acreages (see table).

Asset Rank: Recreation Areas		
Agency	**Access**	**Asset Rank**
BLM	Open	L
USDA Forest Service	Open	L
National Park Service	Open	L
CAL FIRE	Open	L

In the next step, we used the primary purpose field in CPAD to identify higher ranked recreation areas within these ownerships, as well as additional areas administered by other public or private entities.

Asset Rank: Recreation Areas					
Primary purpose	**Access**				**Notes/Examples**
	Open	**Restricted**	**Unknown**	**None**	
Flood control	L	-	-	-	Includes areas surrounding bike paths
Forestry	L	-	-	-	Mostly low use dispersed recreation (USFS, CDF, etc.)
Historical/cultural	H	-	-	-	Most will not be GI
Open space	L	-	-	-	
Parks and recreation	H	M	M	-	Restricted are often open certain hours
Plant & animal habitat	L	-	-	-	
Scientific research	H	H	-	H	High educational value, unique opportunities
Terrestrial habitat	L	-	-	-	
Water supply	L or M	-	-	-	Rank Medium if the name contains either: recreation, recreational, parkland

Finally, USDA Forest Service developed recreation areas that are existing/operational status and all California Department of Parks and Recreation lands were assigned a High rank.

Asset: Green Infrastructure

This asset is ranked the same as in the first analysis using Per Capita Community Green Infrastructure, but all Green Infrastructure is included, not just areas unprotected from development, since wildfire and forest pests can impact all Green Infrastructure. Even for Green Infrastructure that is not used for recreation, these threats can degrade visual quality and other public benefits.

Composite Asset

The recreation areas and Green Infrastructure assets were combined using equal weights to produce a composite asset, scores were translated into ranks as follows;

Composite Asset Ranks: Managing the Green Infrastructure	
Score	**Rank**
0	-
1,2	L
3,4	M
5,6	H

Priority Landscapes

The composite asset and composite threat layers were combined to produce priority landscapes using equal weights. The rankings were assigned as follows;

Priority Landscape Rank: Managing the Green Infrastructure	
Score	**PL Rank**
0-3	-
4	L
5	M
6	H

Data Used in the Analysis

The datasets used in this analysis are available at http://frap.fire.ca.gov/assessment2010/3.6_green_infrastructure.html. These are provided to document the analysis, and to provide the potential to replicate results. Updated versions of these datasets may be available from the various data providers.

ANALYSIS: Managing Green Infrastructure			
Data theme		**Dataset name**	**Purpose**
THREATS			
THREAT1: Wildfire		thr_wfireSTrisk09_1.gdb	Ranks based on expected fire frequency and severity
Inputs	Fire threat	input_fthreat05_1.gdb	Based on fuel rank and fire rotation.
THREAT2: Forest Pests		thr_insctSTrisk09_1.gdb	Ranked areas based on expected loss of tree volume over the next 15 years.
Inputs	Forest Pest Risk, USFS FHP (2006 v1)	insctRisk09_1.gdb	Input dataset used to develop forest pest rank based on expected future tree mortality
ASSETS			
ASSET1: Recreation areas		ast_girecland09_1.gdb	Ranking of recreation areas within green infrastructure based on primary purpose and access
Inputs	California Protected Areas Database (CPAD), GreenInfo Network (2009)	CPAD_Fee_March09.gdb[1]	Provides parcel-based recreation area boundaries with primary purpose and access
	US Forest Service developed recreation areas (2006)	DevelopedRecreation06_2.mdb	Used to depict U.S. Forest Service lands used for recreation.
ASSET 2: Green Infrastructure		ast_gi09_3.gdb	Asset, derived from vegetation data, and ranking based on community population within 10 miles of each GI area
Inputs	Vegetation	input_fveg06_2.gdb	Input used to identify the green infrastructure asset
	Communities	community09_3.gdb	Used to rank green infrastructure asset based on community population within 10 miles
	Census 2000 block data	cen00blm03_1.gdb	Used to define community population
PRIORITY LANDSCAPE			
PL: Managing the green infrastructure		pl_t36_a209_3.gdb	Priority landscape for managing the green infrastructure

OTHER DATA		
County boundaries	cnty24k09_1.gdb	Reporting unit for summarizing results
Bioregions	INACCBioreg04_1.gdb	Reporting unit for summarizing results

1 The downloadable data differs from the dataset used in the analysis in that easements are not included. Requests for easement data should be made directly to GreenInfo Network.

Data and Analysis Limitations

Data Quality

Data Element[1]	Date	Source	Purpose	Currency[2]	Completeness	Detail	Consistency	Relevance	Limitations
California Protected Areas Database	2009	Greeninfo Network	Recreation areas	E	G	E	G	F	Was not designed to identify and rank recreation areas
USDA Forest Service recreation areas	2009	USFS	Forest Service camp grounds	E	E	E	E	E	
Vegetation	2003	CAL FIRE-FRAP	Green Infrastructure asset	F	G	G	P	E	Needs updating, created from multiple sources as old as 1997
Projected development	2009	US EPA ICLUS	Future development impacts	E	E	G	E	E	
County general plans	2008	Counties	Limits on future development	G	G	E	G	E	Lack of standards between counties
Fire threat	2003	CAL FIRE-FRAP	Wildfire threat	F	G	G	P	E	Based on outdated, inconsistent vegetation data
Forest pest threat	2009	USFS RSL	Forest pest threat	E	G	E	E	E	
Communities	2009	FRAP 2009 (incorporated cities)	Reporting unit	E	E	E	G	E	
Communities	2000	US Census (unincorporated communities)	Reporting unit	F	F	P	F	F	Examples of huge boundaries around small communities, and omitted some small population centers
Missing Data Element									
Exotic invasive species			Problem areas, future threats						
Other federal recreation areas			BLM, NPS recreation areas						

1. Other data required as inputs to create the above data layers: Fire perimeters
2. P = Poor F = Fair G = Good E = Excellent

Appropriate use and limitations

Priority landscapes were created to estimate the relative acreage of priority areas by county, not to identify specific areas for protection. Local data and expertise are necessary in order to identify actual project areas for protection.

Data gaps and data improvements

- Vegetation: the "best" vegetation data available is not consistent across the state, is outdated in many regions, and does not sufficiently map smaller Green Infrastructure inclusions within urban areas. This was a critical limitation for identifying Green Infrastructure areas in urbanized counties such as San Francisco, and for identifying remaining Green Infrastructure fragments in counties such as Kings and San Joaquin.
- Recreation areas: data sources were not readily available to identify important recreation areas within large federal landholdings such as national parks.
- We should consider an alternative way to designate and map unincorporated communities, and to maintain boundaries more frequently than once a decade.
- Data were not available to characterize the threat from exotic invasive species, or climate change.