

California Essential Habitat Connectivity Project

Natural Landscape Blocks to be Connected (Action Step 3.3)

Revised 1 June 2009

Trying to address issues raised by the TAG review, and considering some new data inputs, we developed a second iteration of Natural Landscape Blocks that we believe is a major improvement over previous attempts. There are a few final decisions to be made, but we think we are almost there.

First, we examined different combinations of input layers to try to generate a solid foundation that would not be so heavily determined by GAP status as the previous version. We also explored ways to apply model modifiers (e.g., biodiversity hotspots data) without overriding the core themes that pertain explicitly to relative ecological condition rather than biological value.

The new maps were built using the following general steps:

- Step 1: Create a gradient map of “naturalness” for the state based on human landscape alterations (agriculture, urban, roads) on a scale of 0 to 30.
- Step 2. Reduce the naturalness score (by 1 or 2 points) for areas having strongly altered fire regimes (a strong indicator of changes in ecosystem structure and function).
- Step 3. Increase the score (by 1 point) in areas of known high biological value, such as biological hotspots, Essential Habitat areas, or important wetlands (unless these areas already received the top score of 30).
- Step 4. Determine appropriate score thresholds (and block sizes) to delineate landscape blocks for each ecoregion.
- Step 5. Eliminate small blocks, cluster close together blocks, and dissolve “donut holes” within blocks.

These steps are detailed below.

STEP 1. The new models rely primarily on a “naturalness” score calculated by equally weighting three parameters – Percent Agriculture (rangelands not included as agriculture), Percent Road Density, and Housing Density. Substituting housing density for impervious surface (used in earlier maps) better delineated the wildland-urban interface. Each of these parameters was ranked from 1 (lowest naturalness) to 10 (highest naturalness) based on the detailed descriptions below:

Percent Agriculture

Source: NLCD, Land Cover, raster, 2001, 30m.

Agricultural lands – Cultivated Crops. Reclassed (class 82 to 1, all others to 0). Resampled from 30 to 100m, projected, and calculated focal mean to determine percent land cover in cultivated crops over 5-km² circular moving window.

Classified into 10 classes with natural breaks (10 = lowest % agriculture, 1 = highest % agriculture).

Road Density

Source: ESRI StreetMapNA Major roads data (9.3, 2008) for US, 1:100,000. Road density – Line density of ESRI Street Map major roads (primary limited access or interstate, primary US and state highway (FCC A1's – A2's); secondary state and county (FCC A3's) over 1300m radius (5 km²). Classified into 10 classes with natural breaks (10 = lowest road density, 1 = highest road density).

Housing Density

Source: California Department of Forestry and Fire Protection Development Footprint 05_1 (05_1, 2005.) 1:100,000. raster 30m.

Housing density – densclass10

- 1 NONE
- 2 LESS THAN 1 UNIT PER 160 ACRES (< 4 / Sq. mi.)
- 3 1 UNIT PER 160 ACRES TO 1 UNIT PER 40 ACRES (4 - 16 / Sq mi)
- 4 1 UNIT PER 40 ACRES TO 1 UNIT PER 20 ACRES (16 - 32 / Sq mi)
- 5 1 UNIT PER 20 ACRES TO 1 UNIT PER 10 ACRES (32 - 64 / Sq mi)
- 6 1 UNIT PER 10 ACRES TO 1 UNIT PER 5 ACRES (64 - 128 / Sq mi)
- 7 1 UNIT PER 5 ACRES TO 1 UNIT PER 1 ACRE (128 - 640 / Sq mi)
- 8 1 UNIT PER 1 ACRE TO 2 UNITS PER ACRE (640 - 1280 / Sq mi)*
- 9 2 UNITS PER 1 ACRE TO 5 UNITS PER ACRE (1280 - 3200 / Sq mi)
- 10 GREATER THAN OR EQUAL TO 5 UNITS PER ACRE (\geq 3200 / Sq mi).

Resampled from 30 to 100m, projected, and calculated focal mean density class over 5-km² circle moving window. Classified into 10 classes with natural breaks (10 = lowest mean density class, 1 = highest mean density class).

Adding these three scores gave scores across the state from 13 to 30, with 30 being the most natural areas (i.e., the areas least affected by development, roads, and agriculture).

STEP 2. The naturalness score from Step 1 was reduced for areas suspected to be strongly altered in ecological structure and function, using FRAP Condition Class (departure from natural fire regime) modified for GAP 1 lands.

Condition Class

Source: California Department of Forestry and Fire Protection Fire Regime and Condition Class. (03_2, 2003). Condition class – CON_CLASS

- 1= Fire regime within or near historical range. Risk of key ecosystem component loss low.
- 2 = Fire regime moderately altered from historical range. Risk of key ecosystem component loss moderate.
- 3 = Fire regime significantly altered from historical range. Risk of key ecosystem component loss high.
- 9 = None Assigned (non-wildlands)

Any cell with GAP = 1, was re-assigned a condition class 1. Results were reclassified (1 and 9 to 0, 2 to 1, and 3 to 2). Data were resampled from 30 to 100m, reprojected, and calculated using focal mean condition class over 5-km² circular moving window.

Scores from Step 2 were then modified by subtracting 0, 1, or 2 points based on condition class:

- 0 = lowest mean condition class (less altered)
- 1 = middle condition class
- 2 = highest condition class (most altered).

Therefore, it was possible for locations scoring a 30 for naturalness in Step 1 to be demoted by a poor condition class (due to deviation from the natural fire regime).

STEP 3. Increase score (for areas not already receiving the top score of 30) by 1 point for known areas of high biological value (HBV), such as biodiversity hotspots, important wetlands, or Essential Habitat areas for listed species.

Data Layers

Essential or critical habitat; wetland/vernal pool; hotspot for amphibians, reptiles, mammals, or plants (as defined by CDFG maps of Rarity-Weighted Richness Indices for these taxa).

- Vernal Pools and Wetlands:
 - Central Valley Vernal Pool Complexes, DFG, 1998
 - California Central Valley Wetlands and Riparian GIS, DFG, 1997
 - Placer County Vernal Pool Resource Inventory, DFG, 2000
 - South Coast Ranges Vernal Pools, DFG, 2003
 - California Wetlands, USFWS, 2006
 - Wetland Reserve Program Lands, if available
- Rarity-Weighted Richness Index, CDFG, 2003
- Essential Habitat identified by USFWS for Federally listed species. (Essential Habitat includes geographic areas essential to a species' conservation, including those areas that may be excluded from designated Critical Habitat for economic or other reasons, such as coverage in long-term conservation agreements.)

These features were overlaid and converted to a 100-m grid. If any one of these HBV features exists within a grid cell > 1 km from a major road (primary limited access or interstate, primary US and state highway), the cell's score was increased by 1 point. Areas <1 km from major roads were excluded from this score upgrade because they are likely to be ecologically degraded and less likely to support HBV resources than areas farther from roads, and because this increased landscape discrimination within otherwise large areas with HBV resources.

STEP 4. We generated maps using different score thresholds and evaluated which scores appeared to best delineate landscape blocks in each ecoregion. In general, very high scores (28-30) appear to create the most defensible landscape blocks (see discussion and

maps below). More developed ecoregions appear to require slightly lower thresholds to discriminate blocks than more intact ecoregions. In two ecoregions where a single threshold did not seem appropriate (Central Coast and Northern Sierra Nevada), we also tried subdividing them to apply slightly different thresholds in different subregions.

The Mojave and Sonoran Desert Ecoregions have huge areas that score 30 and therefore tend to coalesce into one or a few huge blocks with little discrimination. We therefore also investigated including only those desert areas that scored 30 and are in GAP1 protection status, or in an HBV area, to discriminate landscape blocks there.

STEP 5. Eliminate small blocks, coalesce blocks, and remove “donut holes” within blocks. We eliminated blocks < 2,000 acres as being too small to be useful for this statewide map. Remaining blocks within 1 km of one another were aggregated. Holes within blocks were dissolved to form cohesive units.

Maps for Review

We provide three maps below for your review. These illustrate what we currently think is approaching the most defensible block delineation yet, but this is open to discussion.

Map 1 shows how ecoregions or portions of ecoregions were grouped for application of different score thresholds. The two desert ecoregions use the highest (least inclusive) threshold of 30, the North Coast and more intact counties of the Central Coast and Northern Sierra Nevada use an intermediate threshold of 29, and the remaining areas use the lowest (most inclusive) threshold of 28.

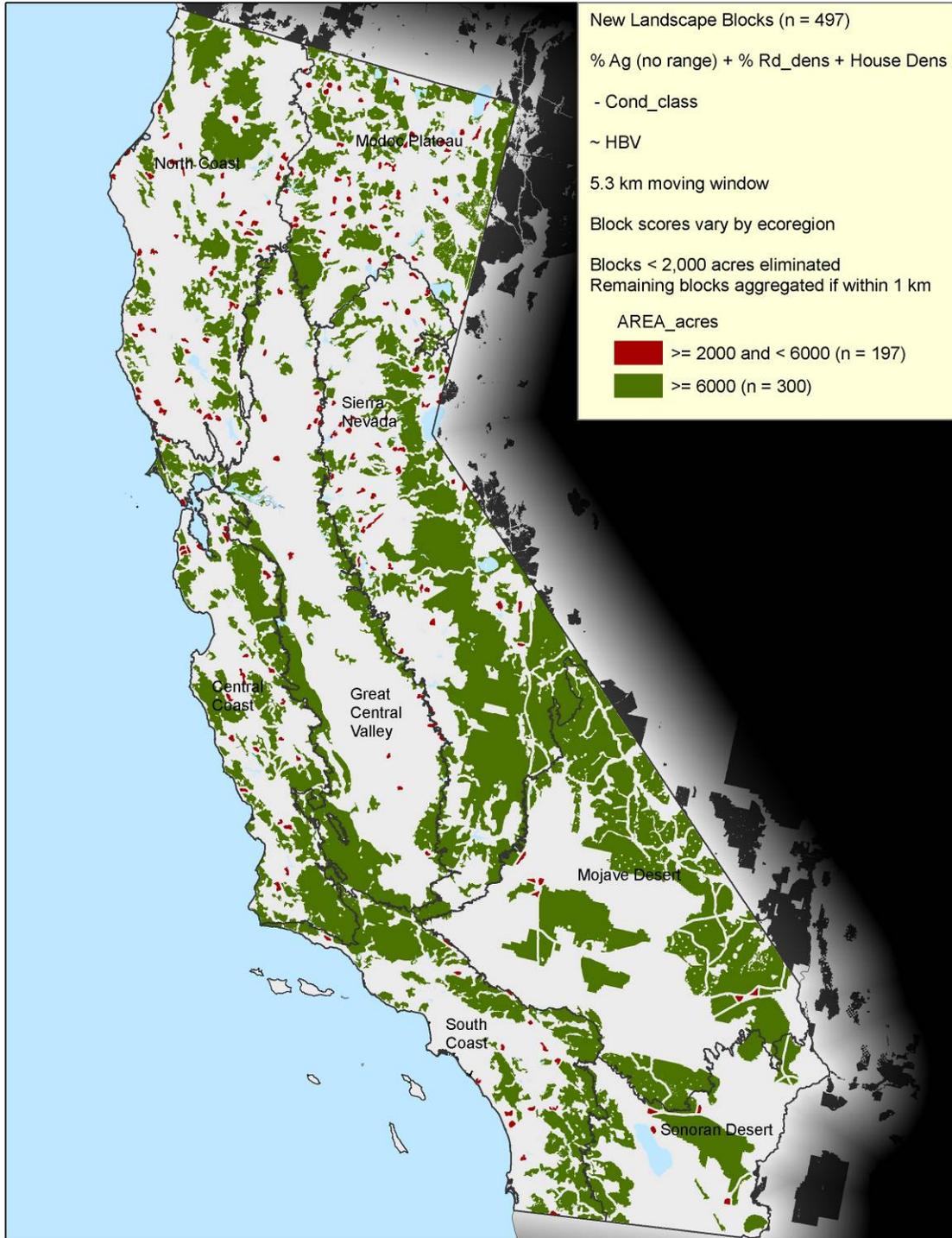
Map 2 shows the landscape blocks created using what we think is the most defensible criteria, prior to dissolving “donut holes” within the blocks.

Map 3 is the same as Map 2 after dissolving holes within the blocks.

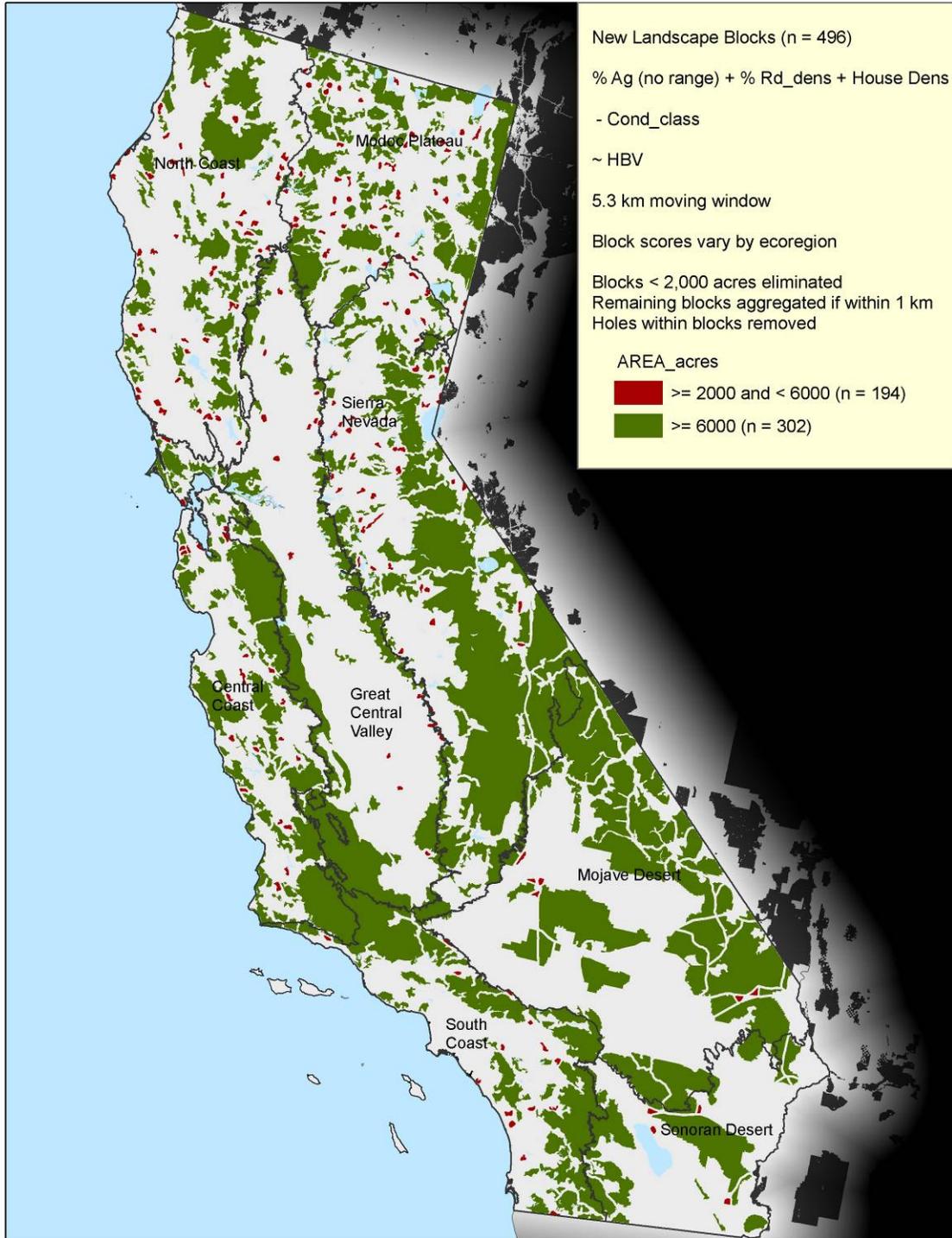
Both Map 2 and 3 also show the blocks in two size classes (2,000 – 6,000 ac and > 6,000 ac). Note that size thresholds can also vary by ecoregion. We think that blocks > 6,000 ac should be included, perhaps supplemented by blocks of 2,000-6000 in some ecoregions (e.g., North and Central South Coasts).



MAP 1



MAP 2



MAP 3