Southwest China - Forest Cover and Clearance

The Mountains of Southwest China Hotspot

stretches over 262,400 km² of temperate to alpine mountains between the easternmost edge of the Tibetan Plateau and the Central Chinese Plain. It lies to the north of the Indo-Burma Hotspot, and to the immediate east of the Himalaya Hotspot, and is bounded in the northwest by the dry Tibetan Plateau, in the north by the Tao River of southern Gansu, and in the east by the Sichuan Basin and the plateau of eastern Yunnan.

The Mountains of Southwest China are characterized by extremely complex topography, ranging from less than 2,000 meters in some valley floors to 7,558 meters at the summit of Gongga Shan (Mountain). The mountain ridges are oriented in a generally north-south direction, perpendicular to the main Himalayan chain. The region includes the Hengduan, and Gaoligong; the Nyainqentanglha, Ningling, Taniantaweng Shan, and others at the southeastern edge of the Tibetan Plateau; the Daxue (including Gongga Shan) and Qionglai Shan systems of Sichuan; and the Min Shan on the Sichuan-Gansu border. The Ailao Shan and Wuliang Shan of central Yunnan are not part of this hotspot (both are included in the Indo-Burma Hotspot).

The Mountains of Southwest China feed the most species-rich temperate and tropical river systems in Asia. Major river systems that traverse or originate in the hotspot include the Jingshajiang, Yalongjiang, Daduhe, and Minjiang, all branches of the Yangtze River, which empties in the East China Sea. The Lancangjiang (Mekong River), passes through Yunnan Province, Laos, Cambodia, and Vietnam on its way to the South China Sea. The Nujiang reaches the Indian Ocean through Yunnan Province and Burma.

The complex topography results in a wide range of climatic conditions. Temperatures range from frost-free throughout the year in parts of Yunnan and short, frost-free periods at the northern boundary of the region, to permanent glaciers on the high mountain peaks of Sichuan, Yunnan, and Xizang. Annual average rainfall in the region exceeds 1,000 millimeters on southwestern slopes at higher altitudes in Yunnan, while areas of the northwestern part of the region, in the rainshadow of the Tibetan Plateau, rarely receive more than 400 millimeters annually.

Climatic and topographic conditions result in a wide variety of vegetation types across the hotspot, including broad-leaved and coniferous forests, bamboo groves, scrub communities, savanna, meadow, prairie, freshwater wetlands, and alpine scrub and scree communities.

Methods of analysis:

This map is based on digital analysis of Landsat images from NASA's global ortho-rectified data set for circa 1990, and circa 2000.[1] For 1990 we used Landsat TM data from the period 1988 to 1994, predominantly 1990; and for 2000 we used Landsat ETM+ data from the period 1999 to 2003, predominantly 2000. We calculated average annual deforestation rates based on a change interval of 10 years.

Our analyses were conducted at a 28.5-meter spatial resolution. All dates of satellite imagery were co-registered to sub-pixel precision to minimize false change caused by locational inconsistency between dates. We mapped forest, non-forest, deforestation, water, and cloud/cloud shadow

We define "forest" as areas of primary vegetation dominated by closed-canopy tree cover. We do not include open-canopy areas, secondary formations, or plantations in our estimates of forest areas. Areas that have been selectively logged rather than clear-cut, and are predominantly closed-canopy mature forest, are included as forest.

The circa 1990 and circa 2000 data were classified together in a single, multi-date image, to produce a direct estimate of forest change. Classification of multi-date images, rather than classifying dates individually and then combining them to derive change estimates, reduces errors caused by differences in vegetation phenology and illumination conditions between image dates and differences in image interpretation.

A supervised methodology was used to classify each two-date "image pair". Spectral signatures for numerous sub-classes were created with training sites from an image pair, the image pair was classified, and the classification reviewed. Multiple iterations were run for each image pair, editing class training sites or including additional sub-classes when errors were noted. The sub-classes of the final classifications were recoded into the general classes of the final product. These were then filtered using a three-by-three orthogonal neighborhood majority filter, followed by a two-hectare sieve filter. The filtered classifications were then joined to produce a seamless mosaic.

For validation, we collected GPS-linked digital photography taken from the roof of a jeep during field surveys. We also obtained additional field data from the Third National Survey of Giant Panda Population and Habitat. From these data sources over 8,000 GPS points with site descriptions were randomly selected. All points that were within 100 meters of a forest edge in our forest map were excluded. This is because of the estimated potential 100 meters locational error of the Landsat images processed. This yielded over 2,800 points used for validation. By overlay of these points on the forest map, we estimate an 88% accuracy for the circa 2000 classification.

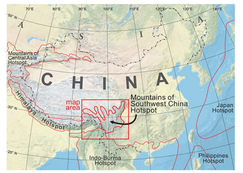
Data available: http://science.conservation.org/portal/server.pt?open=512&objID=828&mode=2&in_hi_userid=124188&cached=true

1. Tucker, C.J., Grant, D.M. & Dykstra, J.D. (2004) NASA's Global Orthorectified Landsat Data Set. Photogram Eng. Remote Sens. 70(3): 313-322

Mountains of Southwest CHINA Hotspot

Forest Cover and Clearance

1000 0 1000 2000 3000 Kilometers 1:125,000,000



500 0 500 1000 1500 Kilometers 1:42,000,000

Forest Area

square kilometers

Province Name	total land area	forest cover 1990	forest cover 2000 estimated	forest clearance observed
Sichuan Sheng	450,378	81,429	80,563	866
Guizhou Sheng	77,840	857	857	0
Yunnan Sheng	366,488	89,239	88,068	1,172
Xizang Zizhiqu	430,915	66,810	66,441	370
Shaanxi Sheng	9,919	1,686	1,686	-
Gansu Sheng	102,383	9,968	9,728	240
Qinghai Sheng	325,701	299	289	9
Ningxiahuizu Zizhiqu	926	-	-	-
total	1,764,549	250,289	247,632	2,657

Percent Cover

Province Name	forest cover 1990	forest cover 2000 estimated	forest clearance observed over 10 years
Sichuan Sheng	18.1	17.9	1.1
Guizhou Sheng	1.1	1.1	0.0
Yunnan Sheng	24.3	24.0	1.3
Xizang Zizhiqu	15.5	15.4	0.6
Shaanxi Sheng	17.0	17.0	-
Gansu Sheng	9.7	9.5	2.4
Qinghai Sheng	0.1	0.1	3.1
Ningxiahuizu Zizhiqu			
overall percentages	14.2	14.0	1.1

50 0 50 100 150 200 Kilometers 1:1,300,000

projection for all maps:
Lambert Azimuthal Equal-Area
centre point: 98° 30' east 29° north

NOTE:
The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of Conservation International concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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Forest change data are available at
http://science.conservation.org/portal/server.pt?open=512&objID=828&mode=2&in_hi_userid=124188&cached=true

cartography: M. Denil Conservation International - CABS Mapping

cover photos: ©Zerenpingcuo
above: Yangtze river, below: Kawagebo mountain

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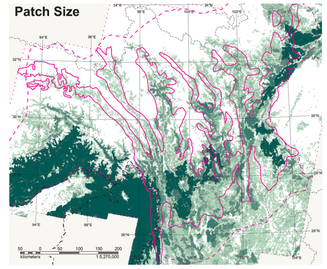
Forest Analysis
- forest circa 2000
- forest loss 1990 to 2000
- cloud covered both dates
- cloud obscured one date
- nonforest circa 1990
- outside analysis

conventional signs
- SW China Hotspot
- SW China area of interest
- settlements
- major road
- minor road
- river, dam, lake
- national boundary
- provincial boundary
- edge of image analysis
- geographic graticule

Mountains of Southwest CHINA Hotspot

Forest Cover and Clearance

Patch Size



Patch size (square kilometers): 10, 50, 100, 500, 1000

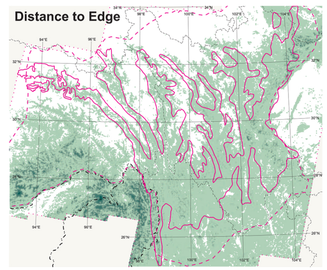
conventional signs
- SW China Hotspot
- SW China area of interest
- edge of analysis
- national, provincial boundaries
- nonforest
- outside analysis

Habitat Fragmentation

We define fragmentation of forest habitat as the proportion of area in isolated patches of less than 100 km² or within 100 meters of a non-forest edge. Both of types of fragmentation were mapped for each time period.
These maps display the fragmentation status as of circa 2000

50 0 50 100 150 200 Kilometers 1:5,070,000

Distance to Edge



Distance to edge of forest (kilometers): ½, 1, 2, 4, 8

conventional signs
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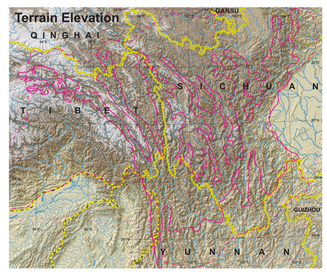
Terrain Elevation



Elevation (meters above sea level): 7360, 5000, 4000, 3000, 2000, 1000

conventional signs
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