

Using hyperspectral and digital camera images to quantify yellow star-thistle invasion of a California grassland eddy covariance site

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Abstract

The Jasper Ridge Biological Preserve (JRBP), located near Stanford University in San Mateo County, California, is situated on roughly 500 ha of mixed vegetation types including riparian, grassland, chaparral, deciduous, and evergreen woodland. Previously, the species composition of the eddy covariance site at the JRBP was dominated by European grasses, including wild oats (*Avena fatua* and *Avena barbata*) and soft and ripgut brome (*Bromus hordeaceus* and *Bromus diandrus*). A recent invasion by yellow star-thistle (*Centaurea solstitialis*) can be quantified using hyperspectral images from the Carnegie Airborne Observatory. We propose to investigate the effect of the invasive species on ecosystem function using eddy covariance measurements along with digital camera and hyperspectral images.

Yellow star thistle

Yellow star-thistle (YST) is thought to have originated in the Middle East and has been present in California since at least 1824. The ease with which it colonizes and spreads on disturbed sites has enabled it to establish solid stands throughout the state, especially in the north. The land area infested with YST has greatly increased in the 20th century.

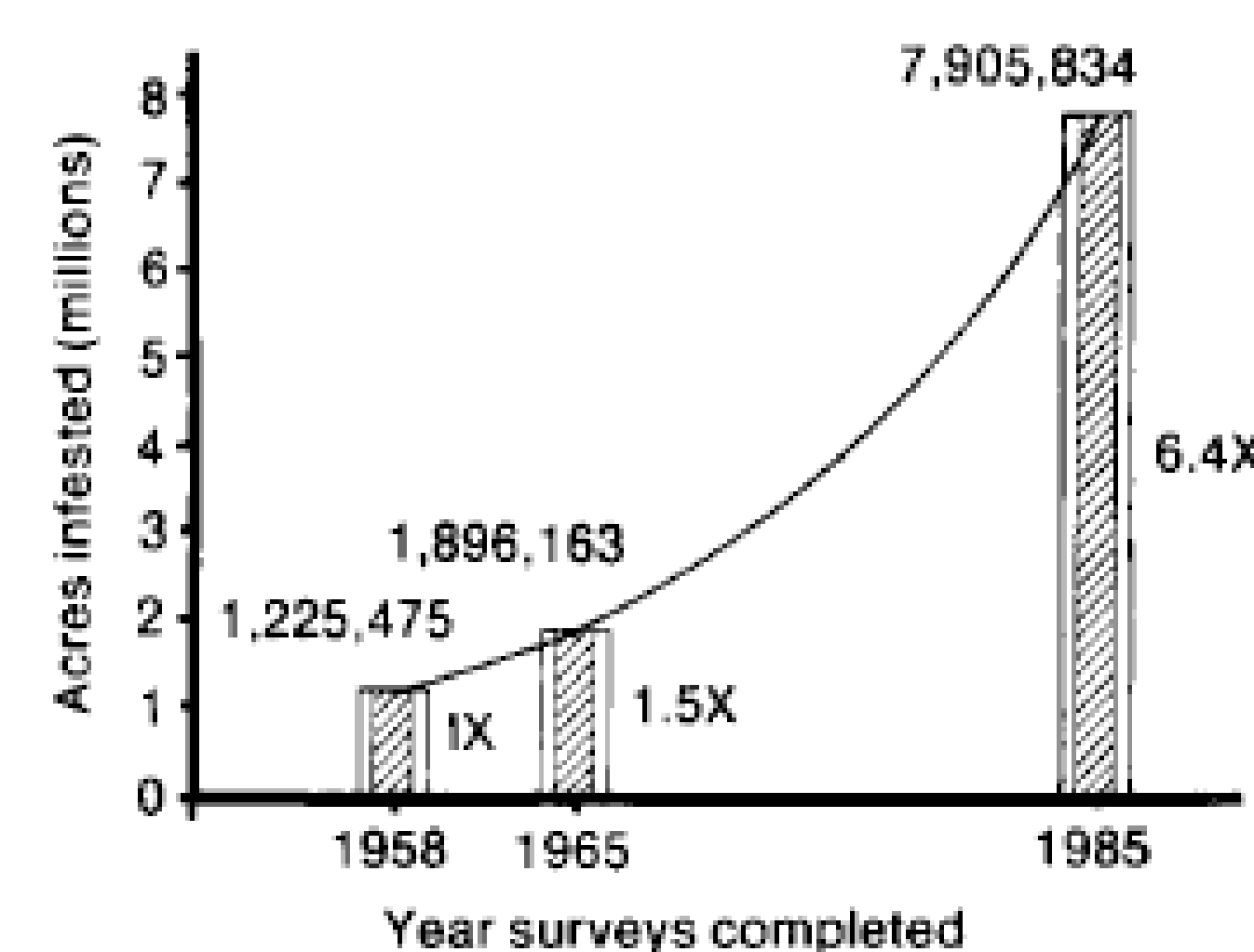
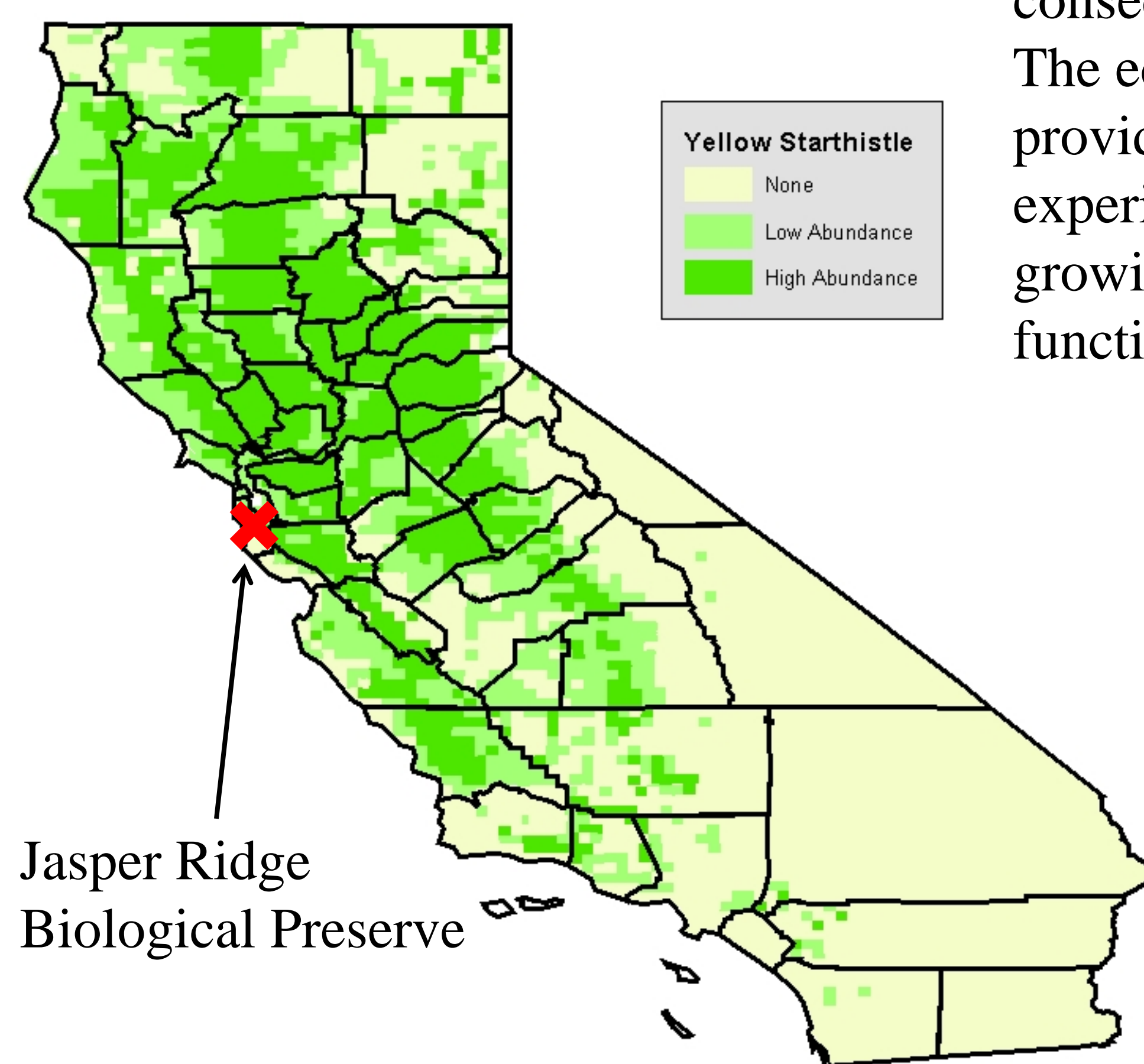


Fig. 1. Yellow starthistle increased 1.5 times in gross acreage from 1958 to 1965 and rose 4.2 times from 1965 to 1985.

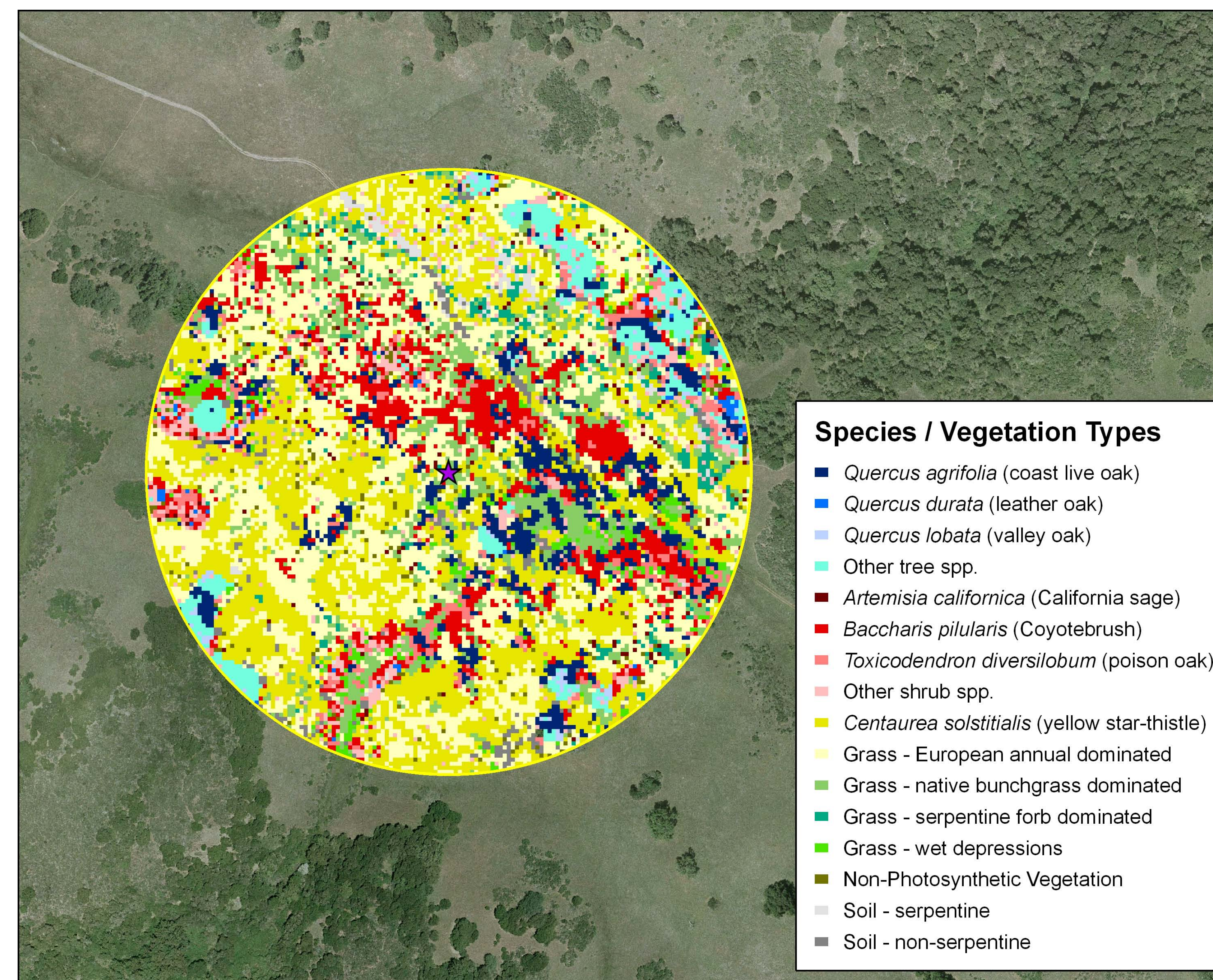
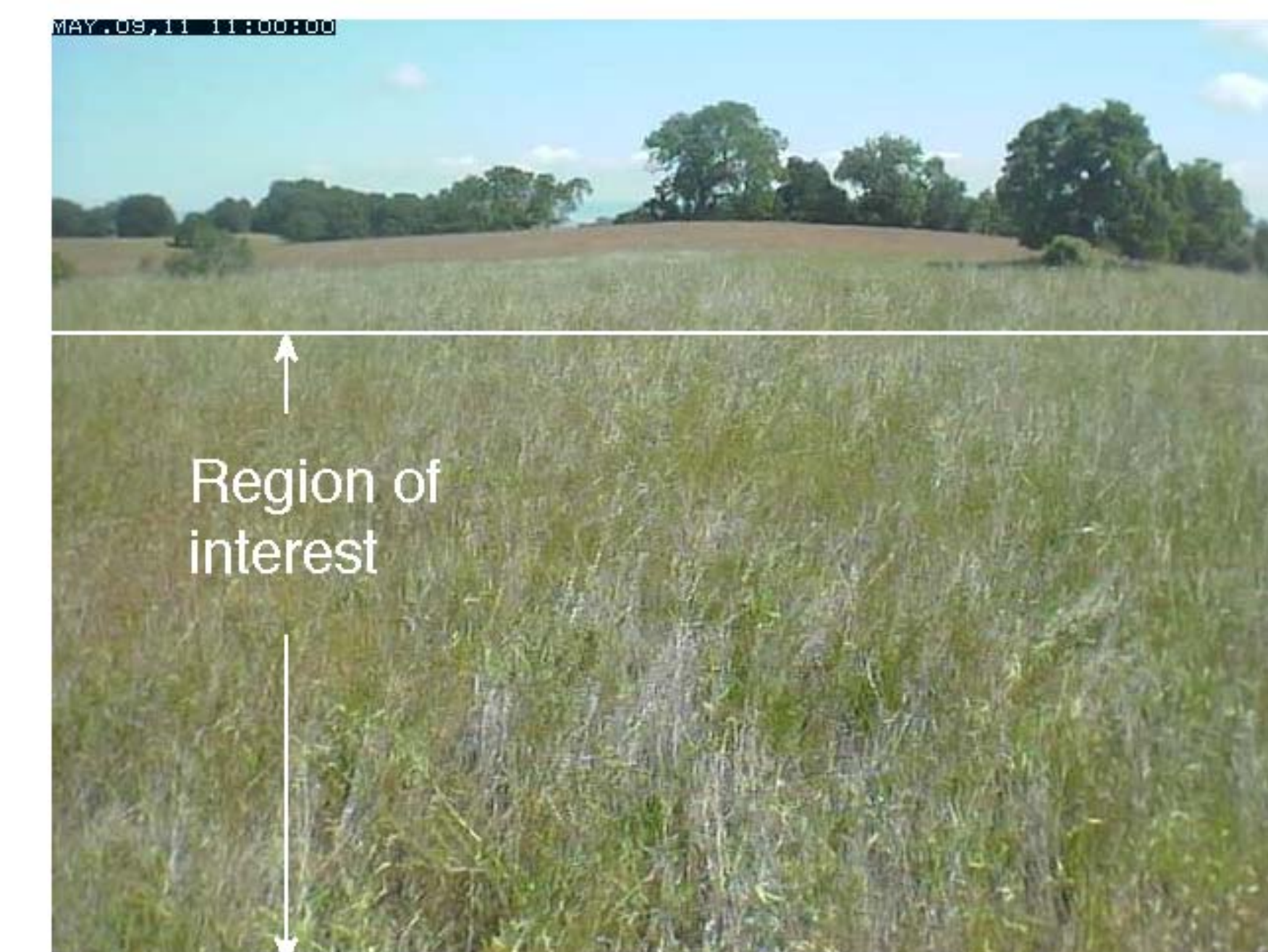
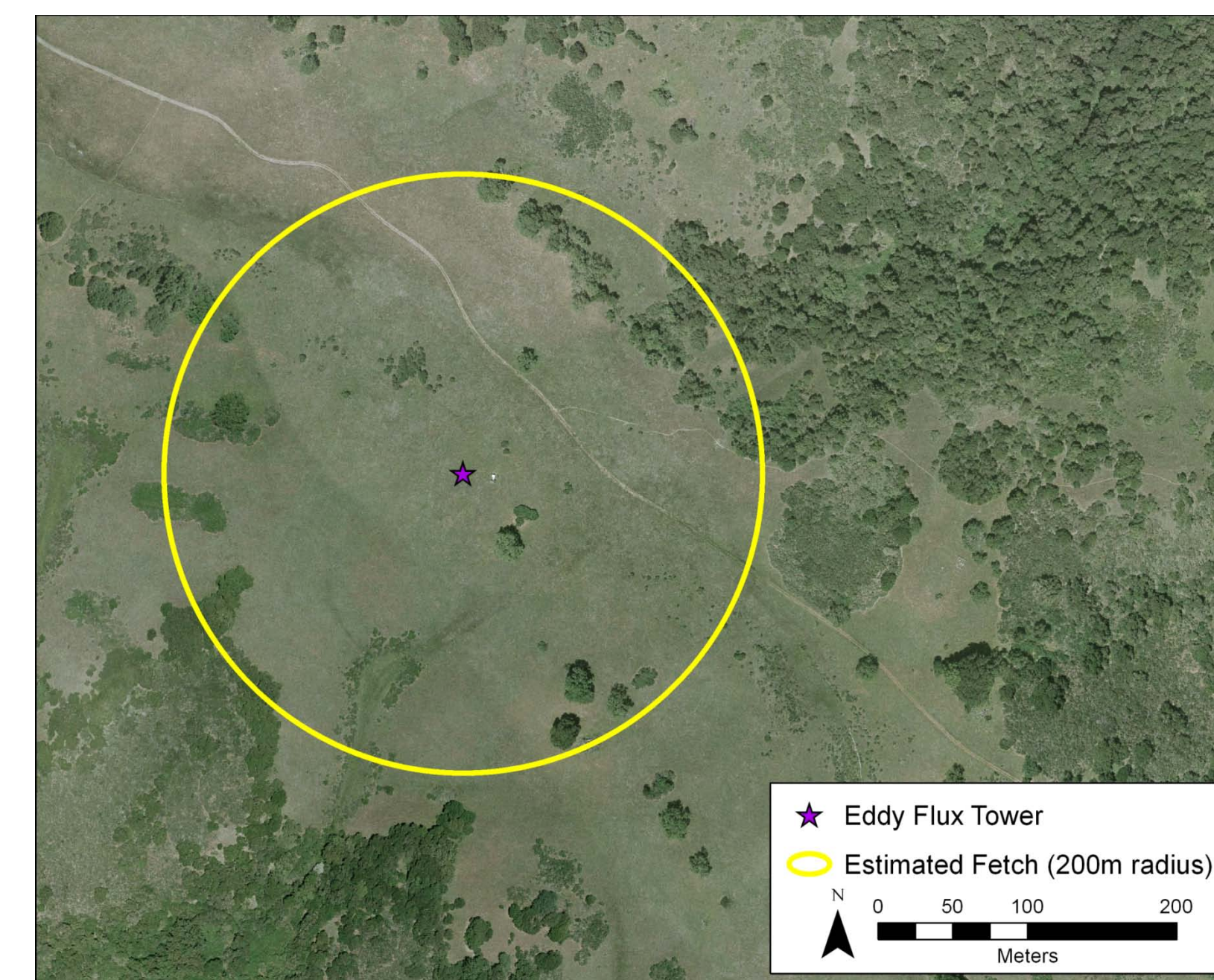
(Maddox and Mayfield, 1985)

YST may therefore have important consequences for California ecosystems. The eddy covariance site at JRBP provides the opportunity for a natural experiment on the effect of YST on growing season length and ecosystem function of invaded California grassland.



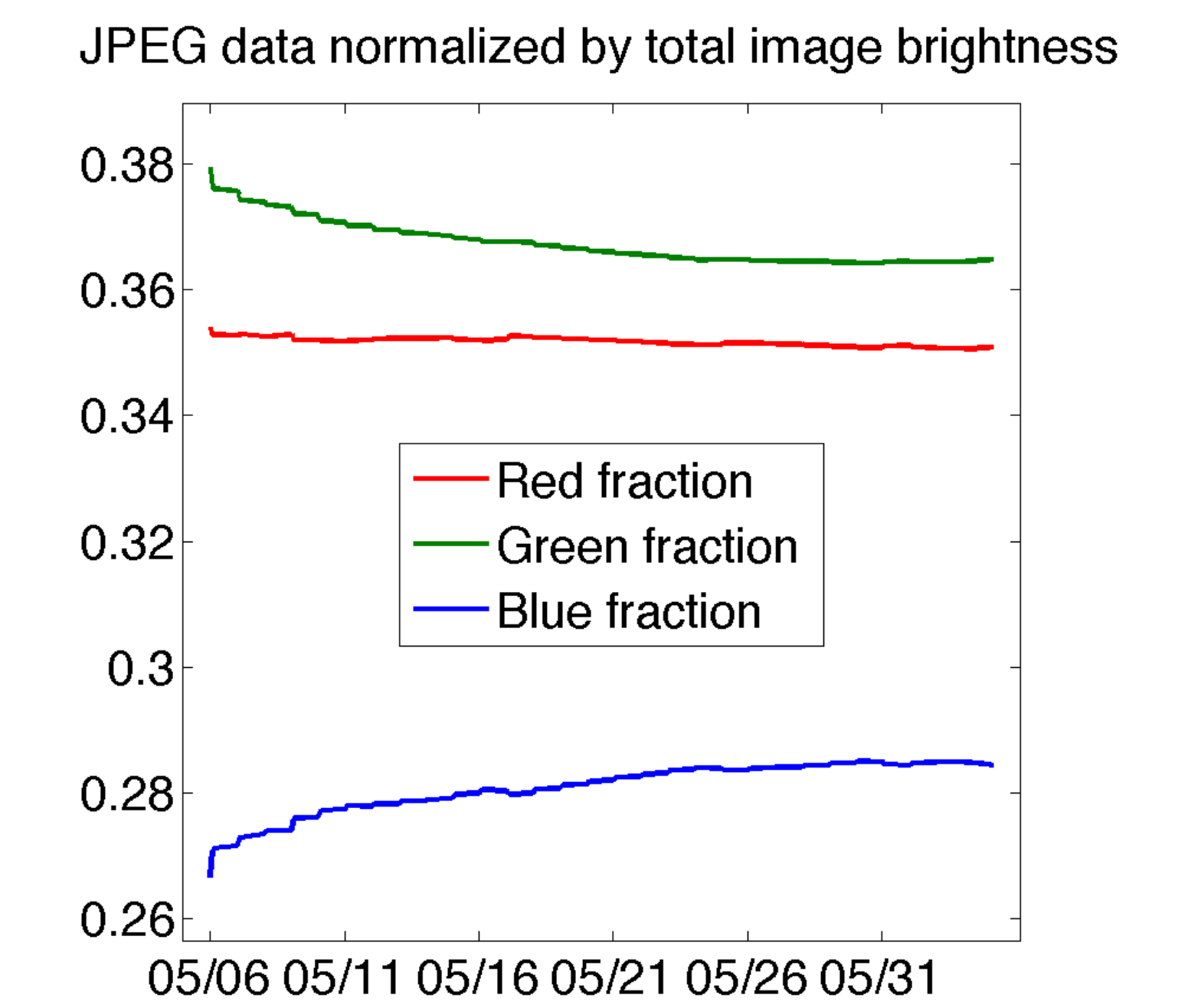
(CDFA © 2003) Yellow star-thistle (Maddox and Mayfield, 1985)

Hyperspectral species mapping



The species distribution of the eddy flux site was estimated from hyperspectral observations taken by the Carnegie Airborne Observatory (CAO) in 2007 (Dahlin and Asner, in preparation). The CAO may take a similar flight over JRBP in the near future with higher resolution instrumentation. These observations can provide a high degree of spatial detail, while digital camera and flux observations can provide greater temporal resolution.

Digital camera images



(Klosterman, unpublished)

A digital camera at the flux site captures images at 11:00, 12:00, 13:00, and 14:00 daily. The images can aid in finer scale species identification and observations of the effect of YST on ecosystem phenology. The camera was installed on 5/6, in time to capture a green down signal as the dry season begins. YST may be causing a change in the timing or intensity of this signal.

Vegetation cover of flux footprint

