

Supporting Notes

Connecticut: river, swamp, and upland

All three sites are within 1 km of the Connecticut River near Haddam Neck, Connecticut (Fig. SN1). The river site is on a low levee directly adjacent to the Connecticut River; the site experiences periodic flooding. The swamp site is ~300 m northeast of CT-River. This site is in standing water for much of the year. Both the river and swamp are in George Dudley Seymour State Park. The upland site is near the summit of White Mountain (~100 m elevation) ~1.5 km north of the other two sites; the site is in Hurd State Park. Compared to the other two sites, the upland site is edaphically drier. Leaves from the outermost part of the canopy were sampled; when possible, three individuals of each species were sampled. For trees, an 8 m pole pruner was used. Each site is ~1 ha. Sampling was conducted by Dana Royer, Grisha Enikolopov, and Margo Fernandez-Burgos in 2005. Additional details can be found in Peppe *et al.* (2010).



Fig. SN1 Map of the river, upland, and swamp sites.

Wiliwili Nui Ridge Trail, Hawaii

The collection at this site was carried out between the top and 100-150 m below the top of Koolau Ridge on both sides of the Wiliwili Nui Ridge Trail. Most native species were sampled. The site includes an evergreen cloud forest at the ridge top and a low-stature tropical rainforest on the slopes. The area sampled was ~2 ha. Leaves were randomly sampled from fully-expanded sun leaves. Sampling was conducted in May 2007 by Ülo Niinemets. Additional details can be found in Llusá *et al.* (*in press*).

Alcornocales Natural Park, Spain

Specimens from Alcornocales National Park were collected from two separate sites. Both sites are composed of Mediterranean evergreen forest vegetation and remnants of Atlantic vegetation in V-shaped valleys (canutos). At both sites, sun leaves were collected from randomly chosen individuals. Site one specimens were collected close to the park entrance at El Aljibe in Alcalá de los Gazules at the park's western border and then collected along a transect towards the park center and eastern border. The area sampled was ~20 ha. At this site, *Ilex aquifolium*, *Rhododendron ponticum* and *Myrtus communis*, *Quercus suber* and *Q. canariensis* were collected. Site two specimens were collected near the outskirts of Malaga a few kilometers from site 1. The sample area was 2 ha. Sampling for both sites was conducted in July 2002 and 2003 by David Tena, Angelika Portsmouth, Fernando Valladares, and Ülo Niinemets. Additional details can be found in Niinemets *et al.* (2007) and Niinemets *et al.* (2003).

Gorgona, Colombia

Gorgona specimens were collected from leaf litter by Edwin Correa and Carlos Jaramillo. Collections were made every 10 – 11 days between December and March 2007. Specimens were collected from forty 50 cm² leaf traps located 1 m above the forest floor at random locations within a 1 ha plot. Although there is not a defined dry season at Gorgona, December-March correspond to the driest period during the year when rain intensity is at its lowest. Leaves were separated from the rest of the litter (reproductive and other vegetative parts), and 5 leaves were chosen using random numbers to be processed. Leaves were scanned using a flat bed scanner.

Yasuni, Ecuador: Yasuni-valley bottom and Yasuni-ridgetop and slope

The Yasuni Forest Dynamics plot (Valencia *et al.* 2004) is a permanent forest census plot in the Center for Tropical Forest Science network located in a mature, Western Amazonian terra firme rainforest in Ecuador (0° 41'S, 76° 24'W) characterized by an aseasonal climate. We targeted outer canopy leaves of trees in the 1-5 cm dbh size class growing under closed canopy that were readily accessed from the ground, rejecting individuals that showed heavy impact of herbivores, epiphylls, or that lacked sufficient recently produced, fully expanded and hardened leaves. Sampling was conducted in the summers of 2005, 2006 and 2007 by Nathan Kraft. Additional details can be found in Kraft *et al.* (2008) and Kraft and Ackerly (*in press*).

Danum Valley Field Center, Malaysia

The site is a tropical evergreen lowland rain forest dominated by dipterocarps reaching >70 m tall. Sampling was conducted along trails in the immediate vicinity of the Field Center and along the Tembaling Waterfall trail. Altogether, the area sampled was ~200 ha. Tree species for sampling were chosen randomly in large gaps. Fully-expanded, sun leaves were sampled. Sampling by Ülo Niinemets and Josep Peñuelas took place in 2008.

Robinson Falls, Pasoh, Tanjung Tuan, Kepong, Malaysia

Samples from Robinson Falls, Pasoh, Tanjung Tuan, and Kepong were each collected along a 300 m forest transect. Specimens were collected every ten meters along the edge of a small forest trail. All specimens were collected from about 4 m in the outer canopy using a pole pruner. These specimens were collected by Jonathan Adams in 2006 and 2007.

Murrua Track, Round Hill mallee, Round Hill woodland, West Head, Australia

Specimens from Murrua Track, Round Hill mallee, Round Hill woodland and West Head were collected by Ian Wright in 1998 and 1999. Specimens from Murrua Track and West Head were collected from a ~1 ha area (~50m x 200m). Due to a paucity of species, specimens from Round Hill mallee and Round Hill woodland were each collected from two sub sites located several kilometers apart, with a total collection area of ~1 km². Additional details about collection protocols and species chosen from each site can be found in Wright *et al.* (2001).

Noah Creek, Australia

Specimens from Noah Creek were collected by Kirk Johnson. Leaves were collected from trees with a dbh larger than 5 cm within a 10 ha forest plot.

Margaret River, Australia, Frodsham's Pass, Mt. Read, and Hobart, Tasmania, Australia

At the Margaret River, Frodsham's Pass, Mt. Read and Hobart collection sites, a minimum of five typical leaves were collected from a single tree of each species. These leaves were scanned while still fresh. At each site, all woody species within the collection area were sampled. The collection areas were chosen so that they each represented a single major vegetation type. The Margaret River site was in open eucalypt woodland, Frodsham's Pass was in wet heathland/scrub, Mt. Read was montane rainforest, Hobart was in wet sclerophyll forest. Approximate collection areas for the sites were 0.25 ha at Margaret River, 0.5 ha at Frodsham's Pass, 10 ha at Mt Read, 2 ha in Hobart. Collections were made by Greg Jordan.

Okataina Scenic Reserve, New Zealand

Eighteen tree and shrub species were sampled from the Okataina Scenic Reserve on the North Island of New Zealand (400m asl). Vegetation is warm-temperate podocarp-broadleaf rainforest, although only broadleaved species were sampled. Nearly all species present are evergreen, including all sampled species. Sampled species included relatively short-lived early-successional trees and shrubs, as well as longer-lived species that occur in old-growth stands. Leaves were collected from saplings or low branches of larger trees, growing in well-lit situations on the margin of large clearings. The youngest fully-expanded leaves with minimal herbivore damage were sampled in each case. Sampling was conducted by Christopher Lusk in 2007.

Goulard Downs, Kaimanawa Mountains, New Zealand

Specimens from Goulard Downs and Kaimanawa Mountains come from the Allan Herbarium in New Zealand. All specimens used are from historical collections. All woody dicot collected in an ~1 ha area around the Goulard Downs and Kaimanawa Mountains areas on the South Island of New Zealand currently housed in the Allan Herbarium were photographed.

Foxton Estuary New Zealand

As part of a field survey in Foxton Estuary, specimens were collected from every species found in the estuary, generally on the first occasion encountered, covering an area of about 3 km². Sampling was conducted by Jillian Rapson in 2008.

Los Ruiles, Los Queles, Nahuelbuta, Cordillera Pelada, Chile

Chilean sampling of modern foliar material was conducted in five regionally representative native forests of the Coastal Range of south-central Chile, between 33° and 40° S. In each forest site, fresh samples of leaves from dicotyledonous woody species were collected along an elevation gradient. The Los Ruiles and Los Queules localities are deciduous “Maulino” forests and the altitudinal gradient used in this study was from 200 -500 m asl. The Nahuelbuta locality is a mixed deciduous-evergreen forest, where the altitudinal gradient sampled was 400 - 800 m asl. Finally, the Cordillera Pelada locality is a broad-leaved evergreen forest and the collection gradient was from 0 - 400 m asl. Sampling was conducted by Luis Felipe Hinojosa in 2001. Additional details about the sites can be found in Hinojosa *et al.* (2006).

Chamela, Mexico; Parque el Ray, Argentina; Ducke, Brazil

All specimens from these sites were collected by Alwyn Gentry and are housed at the Missouri Botanical Gardens. Details about collection protocols can be found in Philips and Miller (2002).

Hubbard Brook, New Hampshire; Allegheney National Forest, Pennsylvania, Harvard Forest, Massachusetts; Huyck Preserve, New York; IES, New York; Cockaponset, Connecticut; Hawk Mountain, Pennsylvania; York County, Pennsylvania; SERC, Maryland; Duke Forest, North Carolina; Pee Dee, South Carolina; Big Hammock, Georgia; Dilcher’s Woods Lowland, Florida; Dilcher’s Woods Upland, Florida; Archbold, Florida; Panther Refuge, Florida; Barro Colorado Island, Republic of Panama

These 17 sites were used by Royer *et al.* (2005) for their initial exploration of digital leaf physiognomy. Details about each site and their collection protocols can be found in Wilf (1997); Kowalski and Dilcher (2003); Huff *et al.* (2003); and Royer *et al.* (2005).

Portal, Arizona; Childs, Arizona; Red Fleet, Utah; Wolf Creek, Colorado; Santa Cruz, California; Half Moon Bay, California; Placerville, California; Bandon, Oregon; Nestucca River, Oregon; Hood River, Oregon; Cape Blanco, Oregon; Government Camp, Oregon; North Bend, Oregon; Parkdale, Oregon; Powers, Oregon; Three Lynx, Oregon; Republic, Washington; Ketchikan, Alaska; Talkeetna, Alaska; Homer, Alaska; Alamos, Mexico, Empalme, Mexico; Cabo San Lucas, Mexico; San Bartolo, Mexico; Nuri, Mexico; Guanica, Puerto Rico; Borinquen, Puerto Rico; Monte Guilarte, Puerto Rico; Buena Vista, Puerto Rico; Cabo Rojo, Puerto Rico; Toro Negro, Puerto Rico; Guajataca, Puerto Rico; Chuzenji-Ko, Japan; Suganuma, Japan; Yakasugi, Japan (260 m); Yakasugi, Japan (800m); Yakasugi, Japan (1080 m); Yakasugi, Japan (1350); Nagakubo, Japan; Keka, Fiji; Seqaga, Fiji

These 42 sites represent a subset of the CLAMP database and were collected by Jack Wolfe and his collaborators. Detailed descriptions of all sites and collection protocols for each site can be found in Wolfe (1993) and Spicer (2009).

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