

SALICACEAE WILLOW FAMILY**Part One: Populus**

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Dioecious, deciduous trees and shrubs. LEAVES alternate, simple, stipulate, usually serrate, the teeth tipped by minute glands, the stipules sometimes suppressed. INFLORESCENCES bracteate catkins, the staminate falling after anthesis, the pistillate persisting until seed release. FLOWERS without a perianth; stamens 2-80; pistils 2-4-carpelled, unilocular, the placentae parietal, the ovary superior. FRUITS valvately dehiscent capsules. SEEDS with long, cottony hairs. --2-3 genera, over 500 spp., chiefly boreal and temperate, as pioneers in moist habitats of the N Hemisphere.

1. Leaf blades usually less than twice as long as wide (except *P. angustifolia*); catkins pendulous, leafless; floral bracts usually erose, caducous; floral disk continuous, cup- or saucer-shaped, nectarless; winter buds with several scales, often resinous; stipules minute, caducous; stamens 6-80; stigmas 2 mm or more long **Populus**
- 1' Leaf blades usually more than twice as long as wide; catkins usually erect, often terminating leafy branches; floral bracts usually entire, usually persistent; floral disk of 1-4 nectaries; winter buds with 1 scale, dry; stipules often leafy, persistent when present; stamens 2-8; stigmas 1 mm or less long **Salix**

Populus L. Poplar

Trees, sometimes forming groves by clonal root sprouts. WINTER BUDS of several scales, often resinous. LEAVES usually ovate to triangular-ovate or circular, but lanceolate in *P. angustifolia*; margins variously crenate-serrate; stipules minute, caducous. CATKINS borne before leaf emergence on twigs of previous year, pendulous; bracts erose, caducous. FLOWERS with a cup- or saucer-shaped, non-nectariferous disk; stamens 6-80; stigmas more than 2 mm long, usually flat, but often rolled or convoluted. $x = 19$. --20-30 spp., from the Arctic Circle s to Chis., Mex., e Africa, n India, s China; often grown for ornament, shelterbelts, timber, pulp, and specialty wood products. (Classical Roman name for *P. nigra*). Eckenwalder, J. E. 1977. *J. Arnold Arbor.* 58:193-208; Eckenwalder, J. E. 1984. *Canad. J. Bot.* 63:325-335.

1. Leaves finely crenate-serrate with more than 20 teeth on each side, the sinuses less than 1.5 mm deep; stamens fewer than 20; capsules 2-valved.
 2. Leaf blade usually more than twice as long as wide; bracts glabrous; winter buds evidently resinous; stamens 10-20; capsules ovoid to broadly ovoid ***P. angustifolia***
 - 2' Leaf blades usually about as long as wide; bracts ciliate; winter buds thinly resinous; stamens 6-12; capsules lanceoloid ***P. tremuloides***
- 1' Leaves coarsely crenate-serrate with fewer than 20 teeth on each side, the sinuses more than 2 mm deep; stamens more than 30; capsules 3-4-valved.
 3. Floral disks 1-4 mm wide in fruit, saucer-shaped; pedicels 5-15 mm long; young shoots and petioles glabrous; leaf blades often noticeably broader than long ***P. deltoides***
 - 3' Floral disks 5-9 mm wide in fruit, deeply cup-shaped; pedicels 3-4 mm long; young shoots and petioles often pubescent; leaf blades about as broad as long ***P. fremontii***

Populus angustifolia James (narrow leaf). Narrowleaf Cottonwood. --Tree to 20 m tall, not clonal; bark tan, furrowed. TWIGS orange-brown, turning ivory-white by the third year, glabrous; winter buds resinous, reddish-brown, glabrous. LEAVES 2-7(-10) cm long, predominantly lanceolate, but the first to emerge from

the buds broader; margins minutely to finely crenate-serrate with 35-50 uniform teeth on each side, these with sinuses up to 1.5 mm deep. CATKINS 3-8 cm long; bracts glabrous; pedicels (1-)2-3 mm long. FLOWERS with shallow disks, these 1-3 mm wide in fruit; stamens 10-20. CAPSULES 3-5 mm long, ovoid to broadly ovoid, 2-valved; $2n = 38$. --Mt. streamsides: Apache, Cochise, Coconino, Gila, Greenlee, Navajo, Pima, Yavapai cos.; 1500-2300 m (5000-7500 ft); Apr-May (fr. Jun-Jul); Rocky Mt. region, s Alberta, Can. to c Chih. and nw Coah. Mex.

Hybrids with *P. deltoides* (*P. x acuminata* Rydberg) occur where the parents grow near each other in ne AZ. They differ from *P. angustifolia* in larger, ovate leaves with coarser teeth. Hybrids with *P. fremontii* (*P. x hinckleyana* Correll [*P. acuminata* var. *rehderi* Sargent]) are scattered across the state in the region of sympatry of the parents. They differ from *P. x acuminata* in hairy young shoots and a broader floral disk. The black cottonwood, *P. trichocarpa* Torrey & A. Gray, a balsam poplar related to *P. angustifolia* and differing in broader leaves and hairy, 4-valved capsules, is found in nearby mts. of CA and NV, but is not known from AZ. Since it has left hybrid progeny with *P. fremontii* at the w edge of the state, it should be sought there in moist canyons of high mts. Many specimens of *P. angustifolia* suggest past hybridization with either this species or with *P. balsamifera* L., now growing no further s than c CO.

Populus deltoides Marshall (triangular, in reference to the leaf). Eastern Cottonwood. --Tree to 55 m tall, not clonal; bark light brown, deeply furrowed. TWIGS yellow brown, turning tan by the third year, glabrous; winter buds resinous, greenish yellow, sparsely hirsute. CATKINS 5-13 cm long; bracts glabrous. FLOWERS with shallow disks, these 1-4 mm wide in fruit; stamens 50-80. CAPSULES 8-15 mm long, narrowly ovoid, usually 4-valved. $2n = 38$. --3 subspp. of e N. Amer. w to Rocky Mt. region.

Subsp. *wislizeni* (S. Watson) Eckenwalder (for F. A. Wislizenus). Rio Grande Cottonwood, Alamo. --Rarely more than 20 m tall. LEAVES 3-8 cm long, broadly triangular-ovate, often broader than long; margins coarsely crenate-serrate with 5-10 graded teeth on each side (up to 25 on leaves of long shoots), the largest near the base of the blade, usually with sinuses more than 3.5 mm deep. CATKINS with pedicels 5-15 mm long. [*P. fremontii* var. *wislizeni* S. Watson, *P. wislizeni* (S. Watson) Sargent]. --Floodplains of permanent rivers: Apache, Coconino, Navajo cos.; 1200-2000 m (4000-6500 ft); Apr-May (fr. May-Aug); Rio Grande and Colorado Plateau regions from ne UT and nw CO and sw TX to n Chih., Mex.

Many specimens appear intermediate with *P. fremontii*, especially along the Little Colorado River drainage. Two related trees are frequently planted in AZ and often persist after cultivation but never become naturalized because they are staminate clones. The Lombardy poplar, *P. nigra* L. cv. 'Italica', is unmistakable with its columnar habit and rhombic leaves. The Carolina poplar *P. x canadensis* Moench cv. 'Eugenei' (*P. deltoides* x *P. nigra*), is often confused with *P. deltoides* but has narrower leaves, often slightly longer than wide with more numerous, smaller teeth and obtuse or rounded, rather than truncate or subcordate bases.

Populus fremontii S. Watson (for J. C. Frémont). Frémont Cottonwood, Alamo. --Tree to 30 m tall, usually not clonal; bark pale tan and deeply furrowed on the trunk. TWIGS tannish white, turning bone white to tan by the third year, glabrous or densely short-pilose; winter buds yellow-brown, resinous, usually hirsute. LEAVES 4-14 cm long; margins coarsely crenate-serrate with 3-10 graded teeth on each side (up to 25 on leaves of long shoots), the largest, near the base of the blade, usually with sinuses more than 2 mm deep. CATKINS 4-13 cm long; bracts glabrous; pedicels 3-4 mm long. FLOWERS with broadly cup-shaped disk, this 5-9 mm wide in fruit; stamens 30-70. CAPSULES 6-10 mm long, globose, usually 4-valved. $2n = 38$. --2 subspp. in sw N Amer., from n CA and n UT to Baja C. Sur and Pue., Mex.

Subsp. *fremontii*. --LEAVES broadly triangular-ovate, usually about as wide as long. [*P. arizonica* Sargent, *P. macdougalii* Rose, *P. fremontii* var. *macdougalii* (Rose) Jepson, *P. fremontii* var. *pubescens* Sargent, *P. fremontii* var. *thornberi* Sargent, *P. fremontii* var. *toumeyii* Sargent]. --Floodplains, canyons, springs and other moist places: all cos. except Apache; 8-2200 m (25-7300 ft); Feb-Apr (fr. Mar-May); w of the continental divide, n CA and n UT to Baja C. Sur and c Son., Mex.

Morphological influence of *P. fremontii* extends into the area of *P. deltoides* in AZ. This influence shows in shorter pedicels, broader disks, and occasional sparse pubescence in the latter species. Rare hybrids with

P. trichocarpa (*P. x parryi* Sargent) occur in Mohave Co., e of the present known range of *P. trichocarpa*. They are distinguished by sparsely hairy, rather than glabrous, capsules, and leaves dark green above and pale beneath, rather than light green on both surfaces.

Populus tremuloides A. Michaux (like *tremula*, the Eurasian aspen, whose name in turn means trembling, referring to the leaves). Aspen, Quaking Aspen. --Tree to 30 m tall, but usually less than 15 m, forming groves by clonal growth; bark greenish or yellowish white and smooth or dark gray and furrowed at the base of large trees. TWIGS reddish brown turning yellowish tan by the third year, glabrous; winter buds reddish brown, usually not evidently resinous, glabrous. LEAVES 2-7 cm long, commonly circular, but ranging from broadly ovate to reniform; margins minutely to finely crenate-serrate with 15-35 slightly graded teeth on each side (up to 50 on leaves of suckers), these usually with sinuses less than 1 mm deep. CATKINS 2-10 cm long; bracts ciliate with long hairs; pedicels 1-2 mm long. FLOWERS with a deep cup-shaped disk, this 2-3 mm wide in fruit; stamens 6-12. CAPSULES 4-7 mm long, lanceoloid, 2-valved. $2n = 38, 57, 76$. [*P. aurea* Tidestrom, *P. tremuloides* var. *aurea* (Tidestrom) Daniels]. --Subalpine and montane forests, edges of meadows in mts., especially after fires: all cos. except La Paz, Maricopa, Pinal, and Yuma; 1950-3050 m (6400-10000 ft); Apr-May (fr. May-Jun); throughout cool-temperate N. Amer. from coast to coast and from within the Arctic Circle to the n rim of the Valley of Mex.

The related Eurasian white poplar, *P. alba* L., is commonly planted in AZ as a fastigate staminate clone (cv. 'Pyramidalis') or as a spreading pistilate clone which can persist after cultivation and even spread to a limited extent through root sprouts. It differs from *P. tremuloides* in having leaves tomentose beneath and those of long shoots palmately 5 lobed.

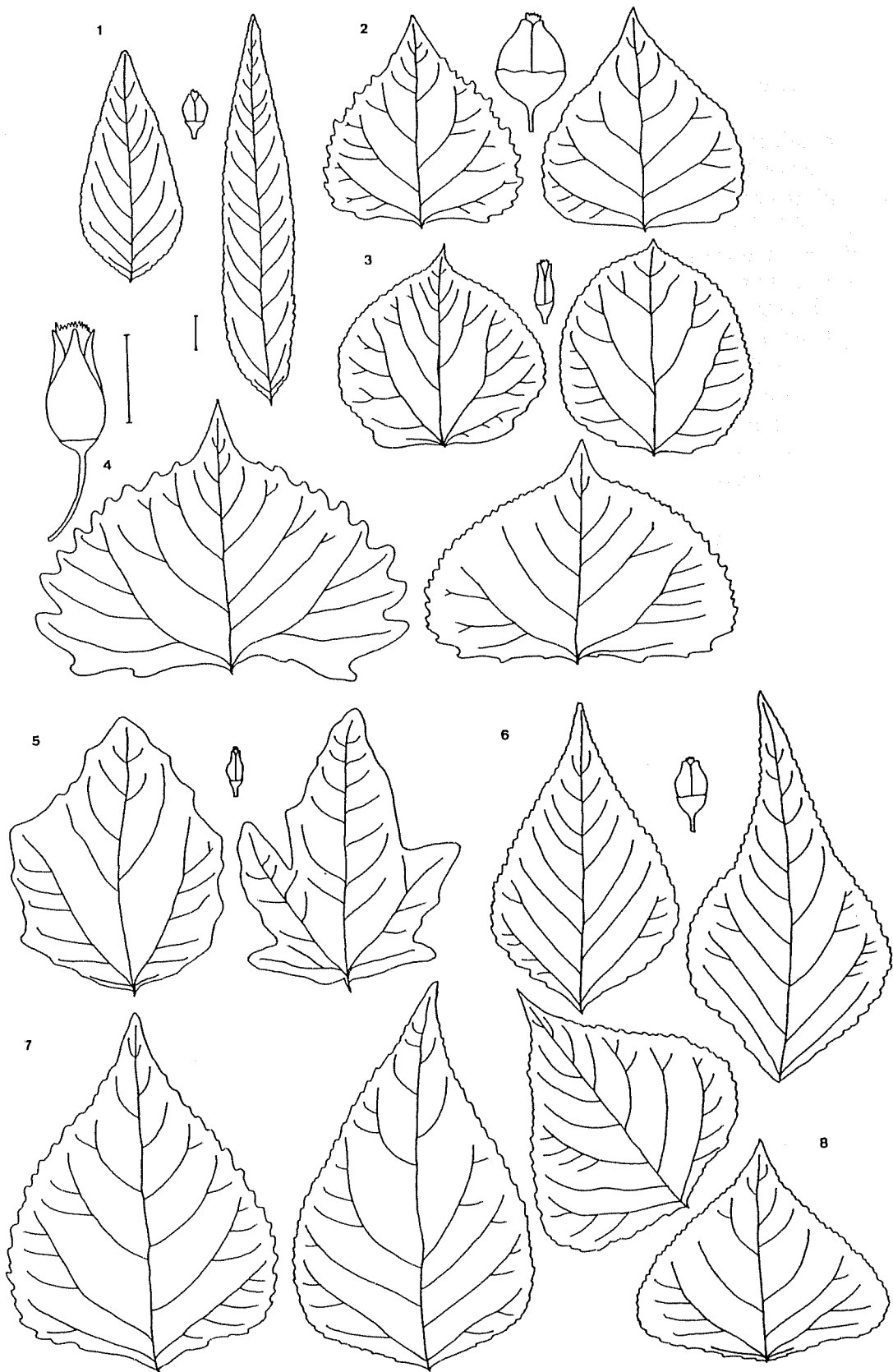
NOTES FOR COLLECTORS

In documenting a particular poplar population, it is best to sample on three separate occasions:

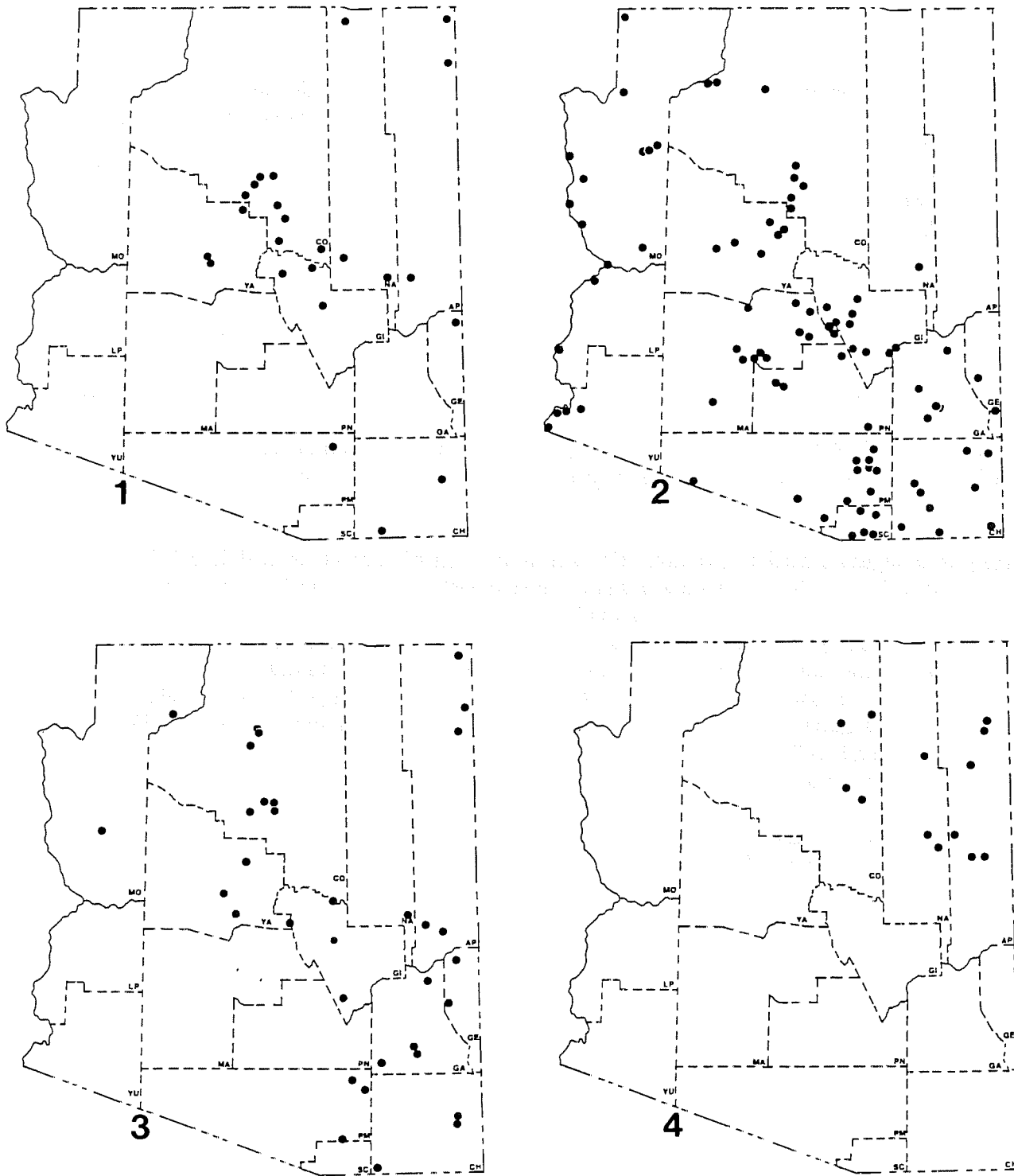
- 1) to obtain staminate and pistilate flowering specimens, preferably while pistilate flowers still retain their bracts;
- 2) to obtain specimens with mature fruits, preferably just before natural dehiscence;
- 3) to obtain specimens with mature winter buds (with both vegetative and flowering buds, the latter lateral and conspicuously larger than lateral vegetative buds), along with a full complement of leaves, including both spring leaves and long shoot leaves. The 2-8 spring leaves, also called early leaves, are those that overwinter in the buds and emerge in the spring flush. They are usually separated by internodes of no more than about 1 cm and occur on short shoots and at the base of long shoots. The long shoot leaves, also called late leaves, mature without overwintering. They are typically separated by internodes of at least 1.5 cm (except at the very tip of the shoot, or where growth has paused for a while) and occupy the upper portions of long shoots, above the spring leaves. These two leaf forms often differ in shape and especially in tothing.

Three problems in poplar variation in Arizona would benefit from such full collections:

1. To what extent is the variability found in *Populus angustifolia* due to past hybridization with *P. trichocarpa* and *P. balsamifera*? Are either of the latter two species present in the state in an unambiguous form?
2. What are the details of the transition from *Populus deltoides* to *P. fremontii* down the Little Colorado River into the Grand Canyon? Is it an abrupt replacement or a gradual intergradation?
3. Are there distinctive races of *Populus fremontii* associated with different habitats across floodplain and canyon ecosystems (cf. Asplund & Gooch. 1988. *Desert Plants* 9:17-27)?



Salicaceae: *Populus* Fig. 1. Spring leaves (left), long shoot leaves (right), and mature capsules of native species (1-4) and cultivated species (5-8); scale bars are 1 cm, the smaller for the leaves, the larger for the capsules; (1) *P. angustifolia*, (2) *P. fremontii*, (3) *P. tremuloides*, (4) *P. deltoides*, (5) *P. alba*, (6) *P. X hinckleyana*, (7) *P. X canadensis* (staminate only), (8) *P. nigra* (staminate only).



Salicaceae: *Populus* Fig. 2. Distribution of (1) *P. angustifolia*, (2) *P. fremontii*, (3) *P. tremuloides*, (4) *P. deltoides*.