



Cryptic invasion and hybridization of *Phragmites australis* (common reed) in the Southwest.

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Phragmites australis (Cav.) Trin. ex Steud.

- Family Poaceae
- Tribe Arundineae
- Genus *Phragmites*
 - 5-8 species recognized
- Most widely distributed angiosperm?
- Found in all wetland types.
- Important wildlife plant.





Reproduction and dispersal





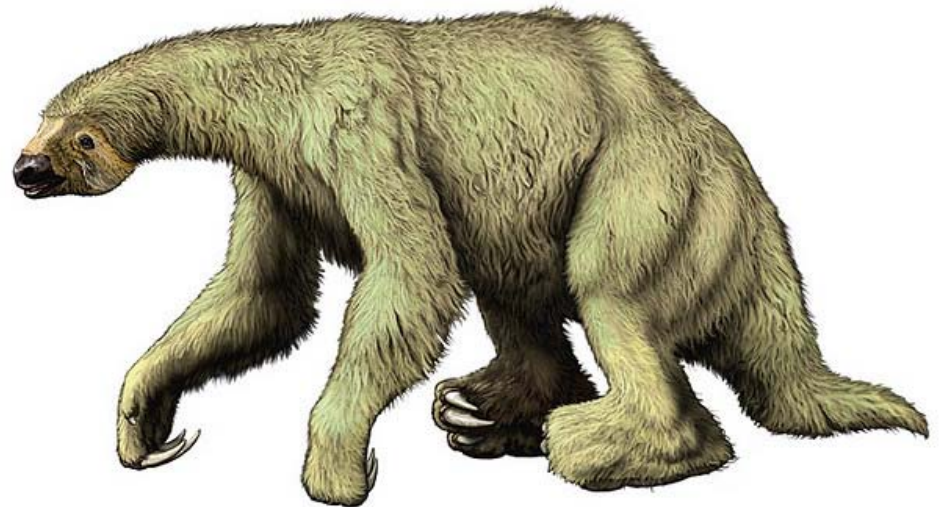
Historical/economic uses





Phragmites in North America

- Present for at least 40,000 years
 - Ground sloth dung
 - Pack rat middens
 - Archeological sites
 - Herbarium samples





Habitat associations are changing over time

Historical (Pre-1940)

- High marsh and aquatic environments.
- Occasional to rare in most habitat types.



Modern

- All salt marsh zones except *Spartina alterniflora* zone.
- Common in all aquatic habitats.
- Common in drier habitats.
- Common along road side (linear) wetlands.





Facilitation of a Native Species or Cryptic Invasion in North America

- Anthropogenic modification facilitating native species?
- Nitrogen enrichment of wetlands?
- Shipping trade
- Novel genotypes?



Determination of origin

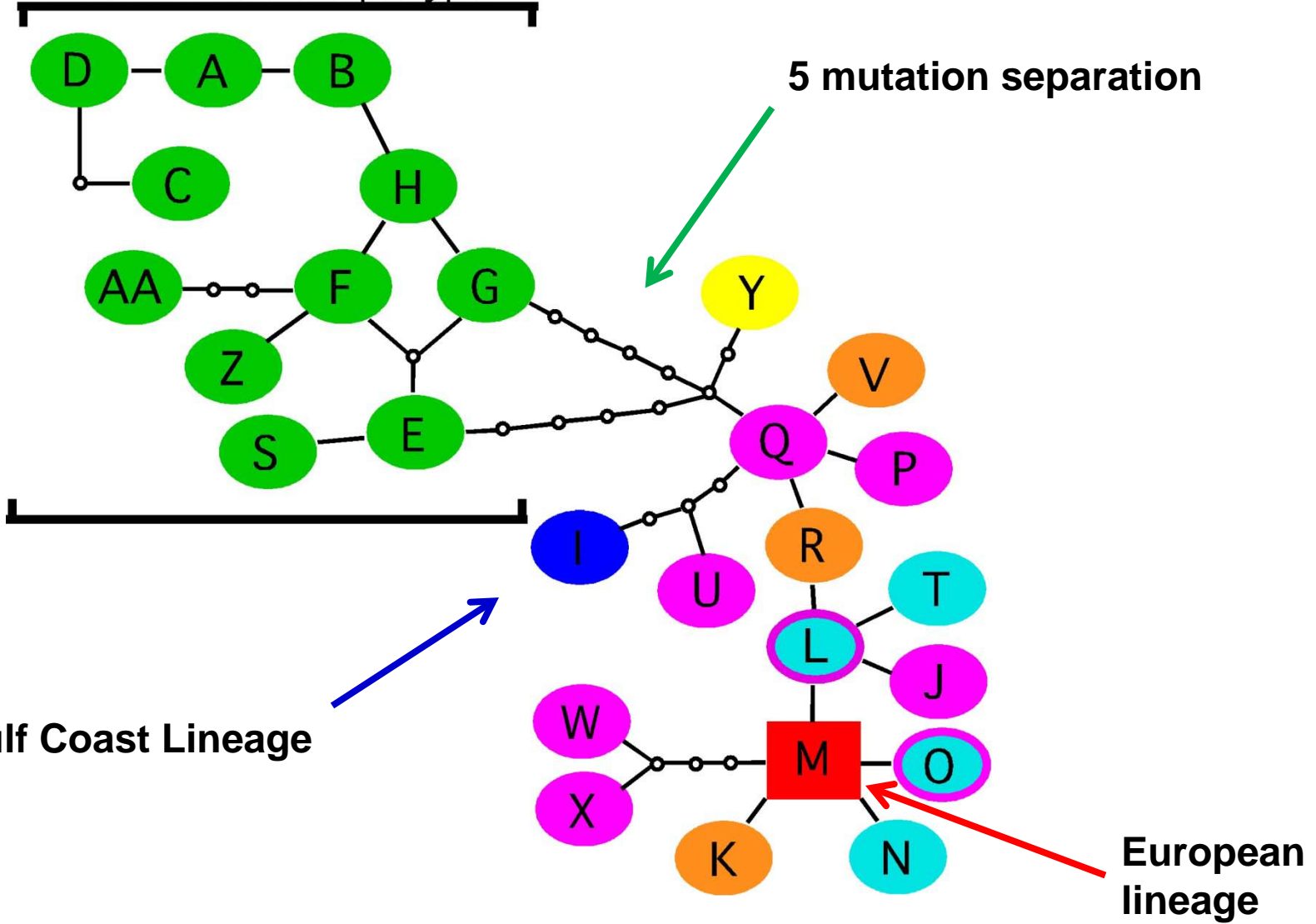
- Genetic
 - RFLP
 - Sequencing of cpDNA (maternal)
 - Nuclear microsatellite loci
- Morphological characters
 - Native haplotypes: longer ligules, glumes, and lemmas.
 - Various stem characteristics.



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Smithsonian Institute



North American Haplotypes



a) Native Haplotypes Before 1910



b) Invasive Haplotype Before 1910



c) Native Haplotypes After 1960

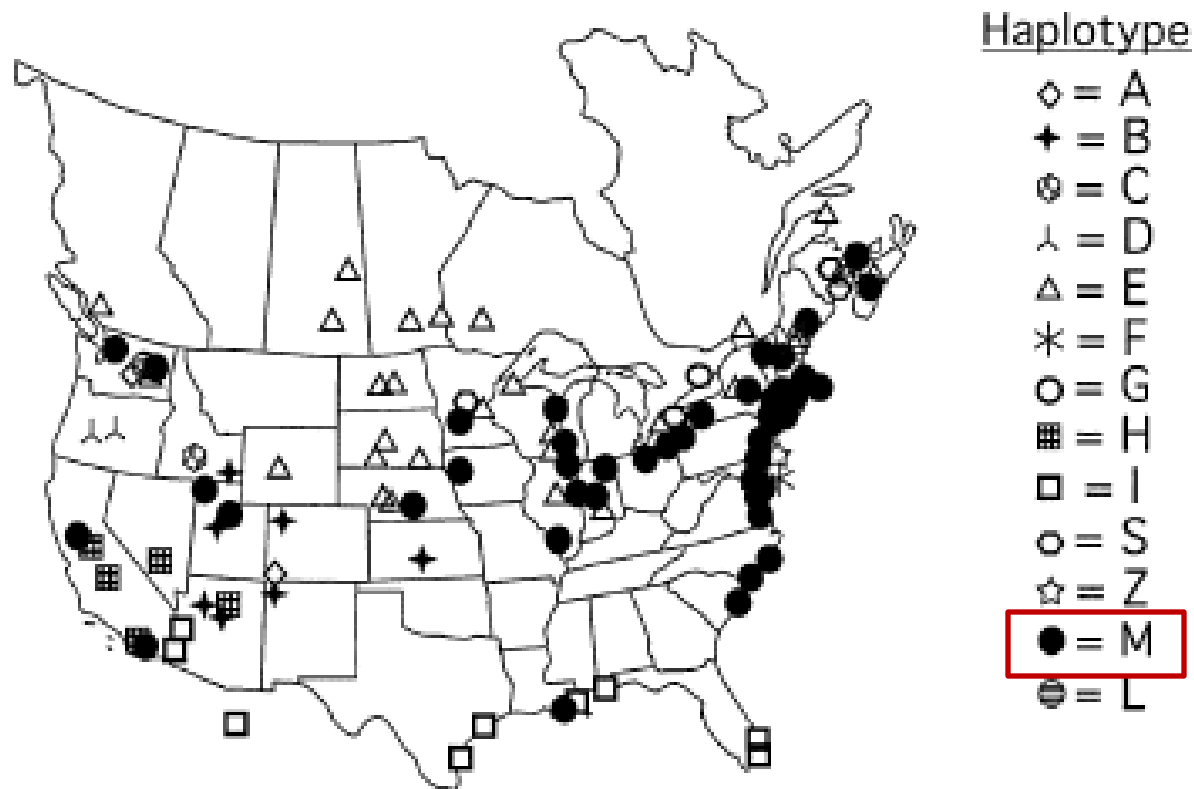


d) Invasive Haplotype After 1960

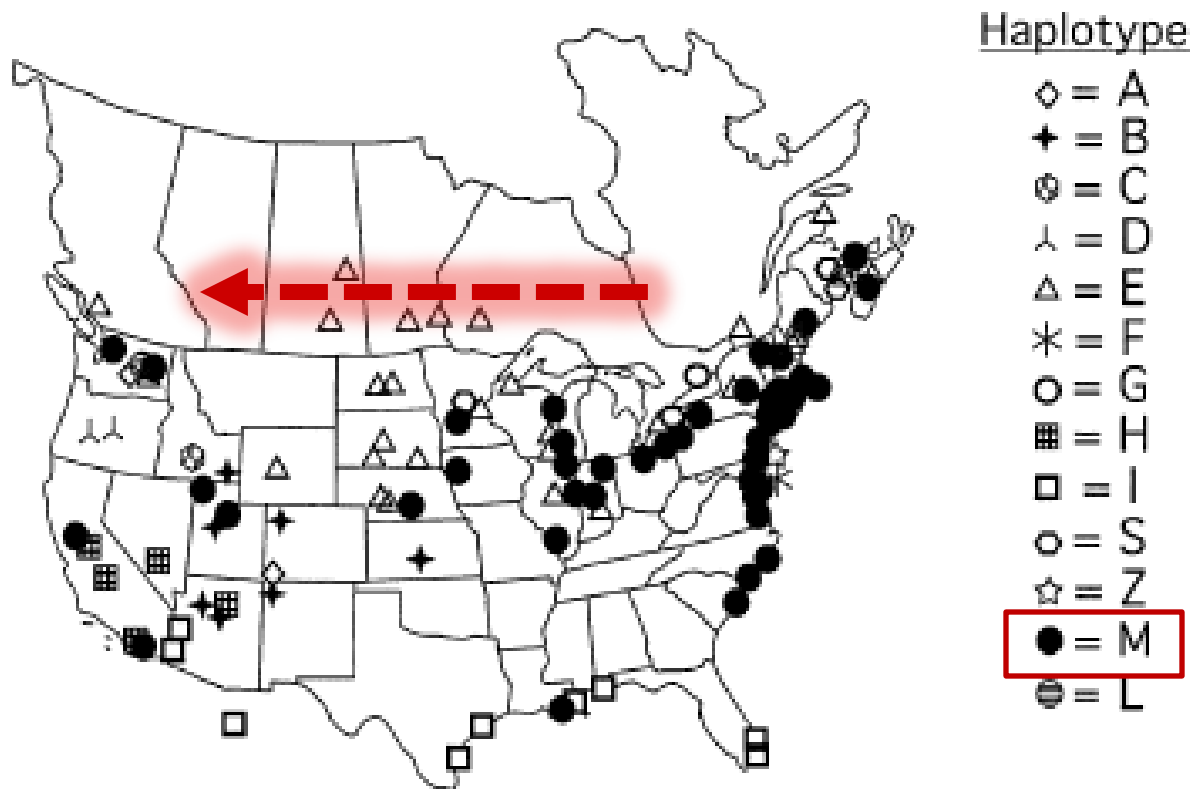


Haplotype - group of genes within an organism inherited together from a single parent.

North American distribution

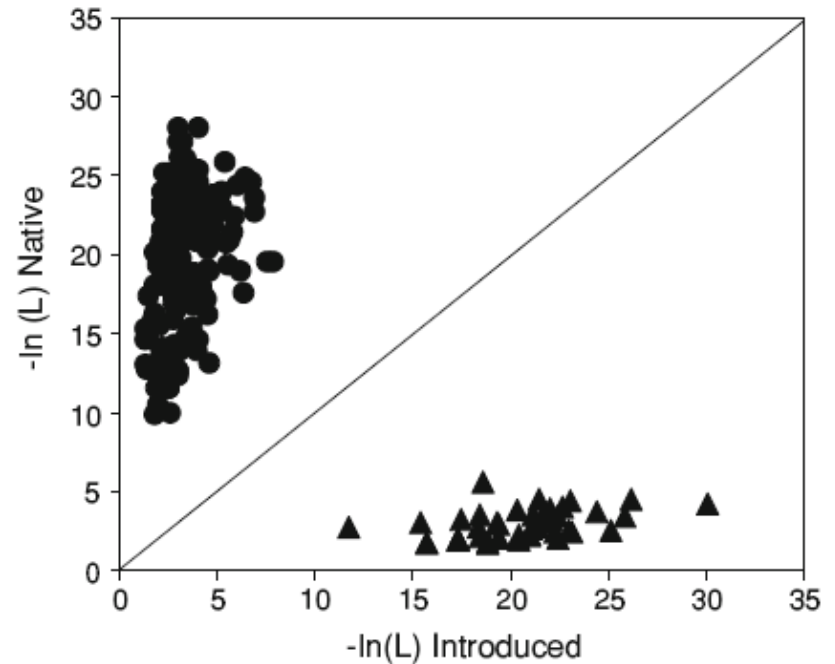


North American distribution



No evidence of hybridization in East

- Microsatellite analysis of east coast populations (Saltonstall 2011)
- Five native haplotypes tested only occur in Northeast.
- West coast haplotypes not tested.



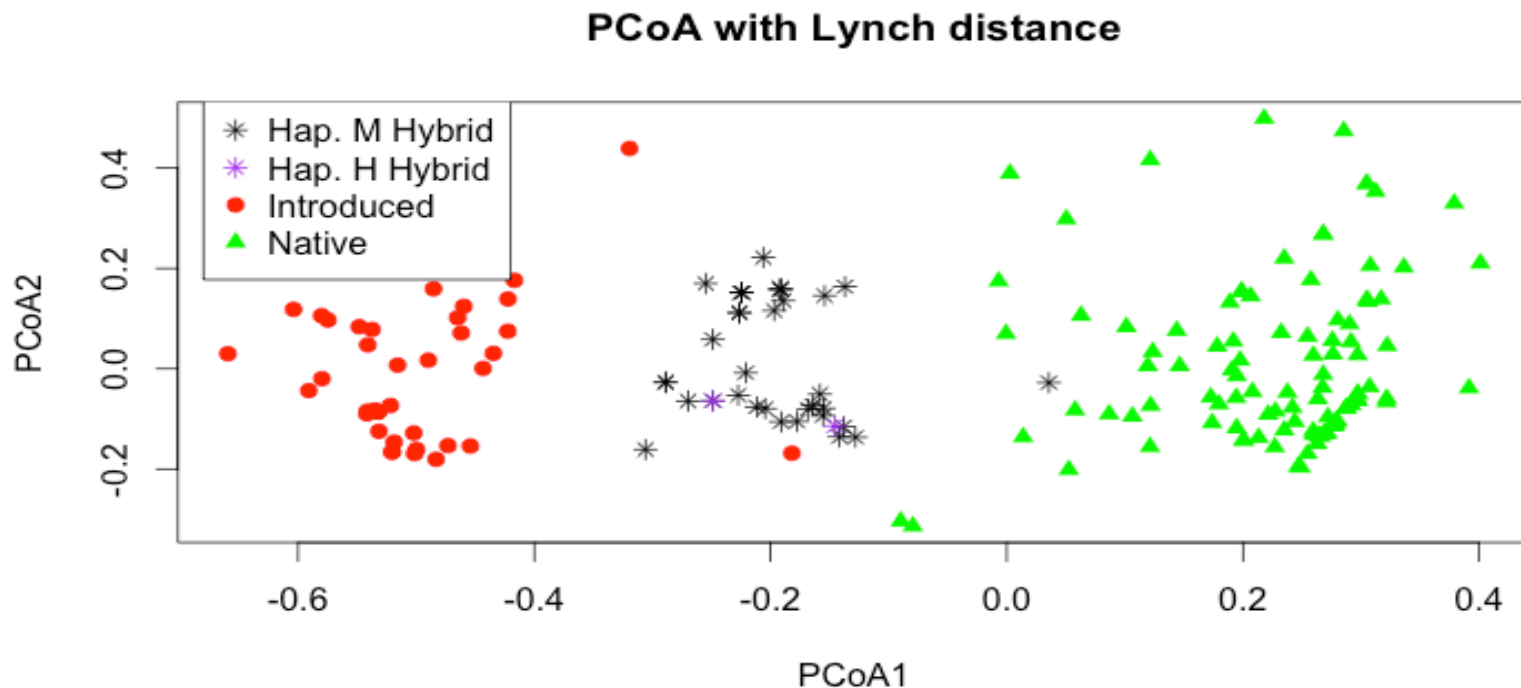


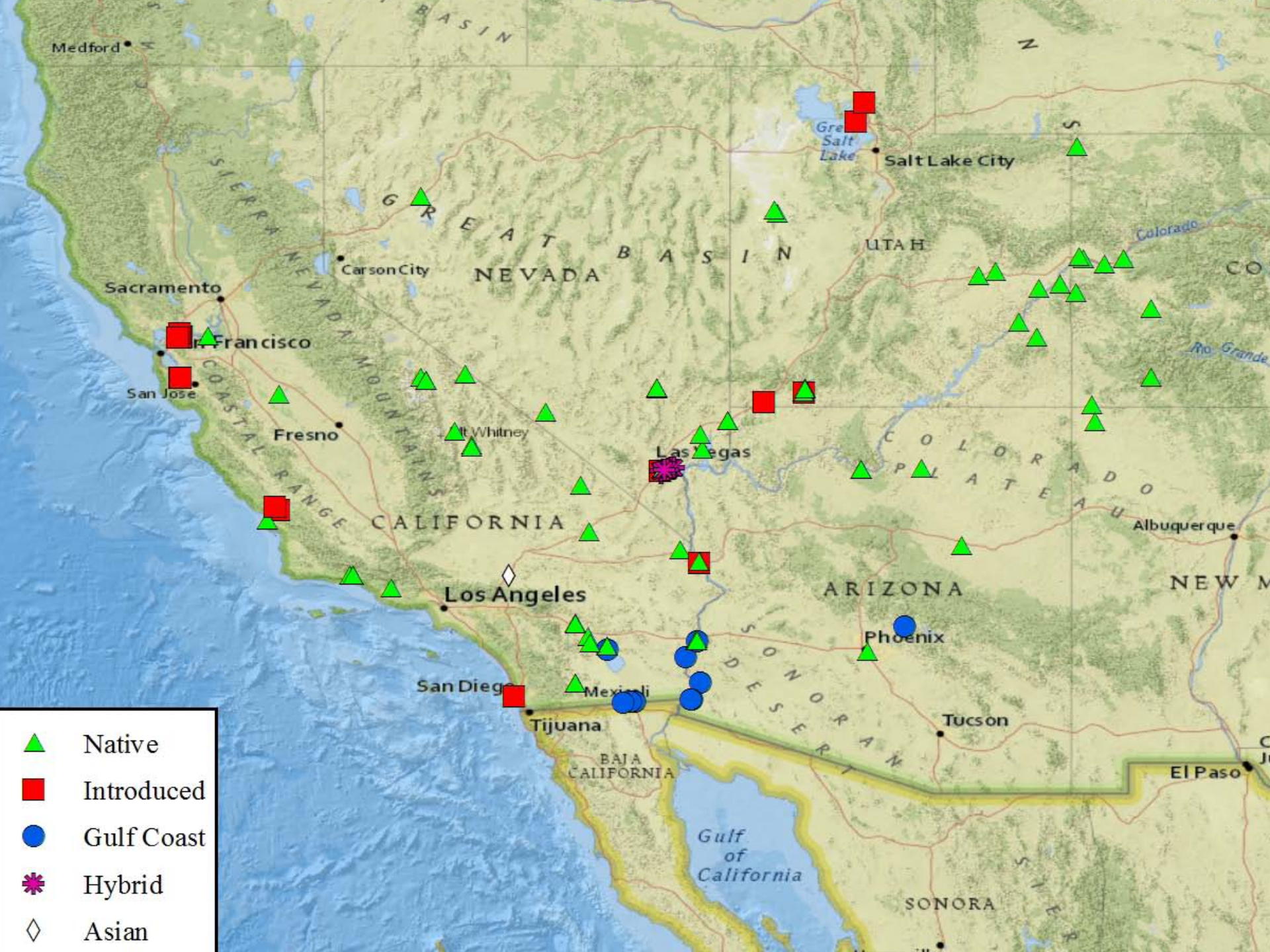
Methods

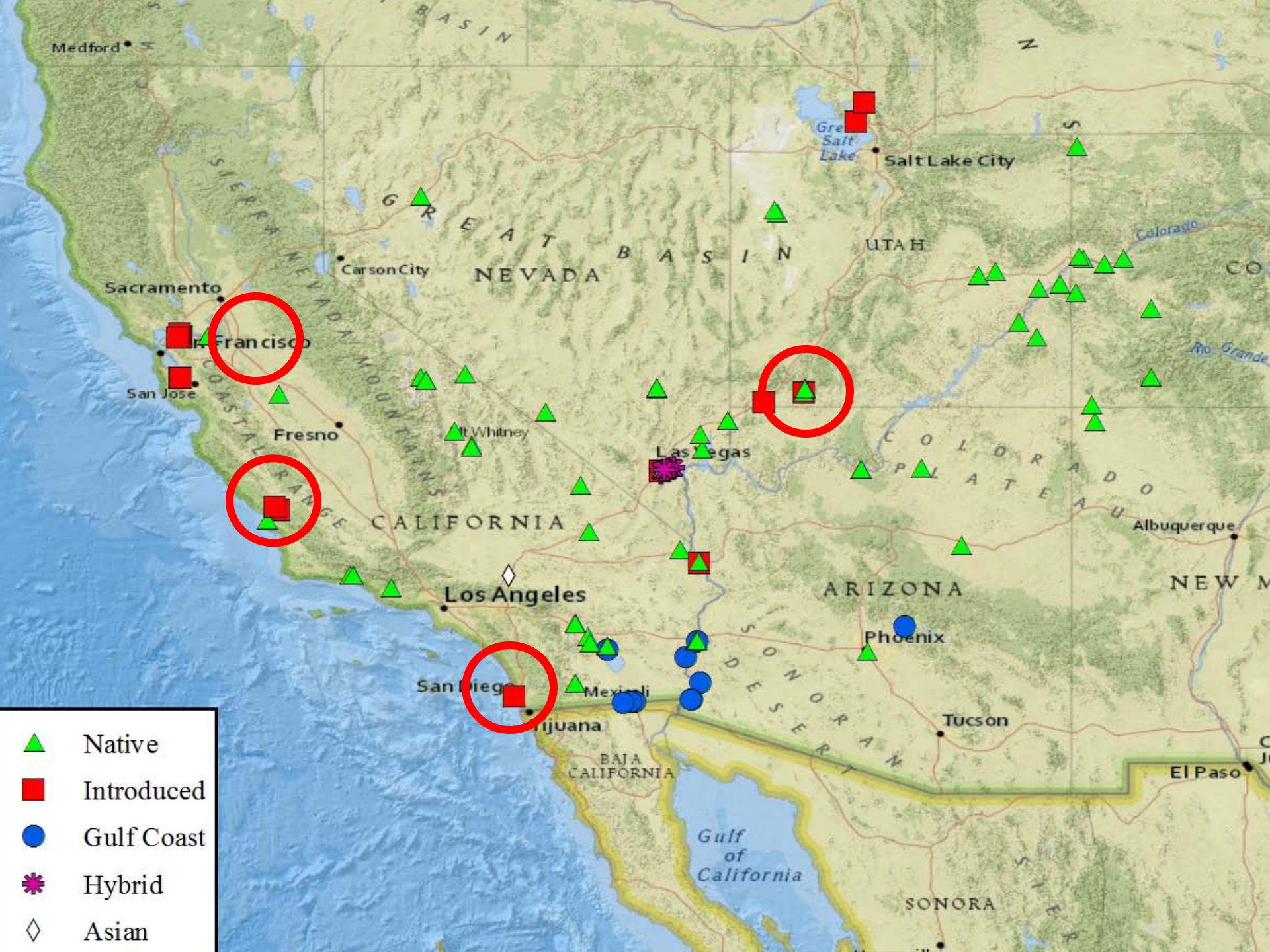
- Identify locations based on herbarium records, land managers, extensive surveys (2006-2015).
- Molecular analysis
 - Microsatellites (9 loci)
 - Sequencing of chloroplast DNA
 - Intron between *trnT*(UGU) “a” and *trnL*(UAA)5’ “b”
 - Intergenic spacer between *rbcL* and *psaI*
 - Principal Components Analysis to assess hybridization
 - Lynch Distance



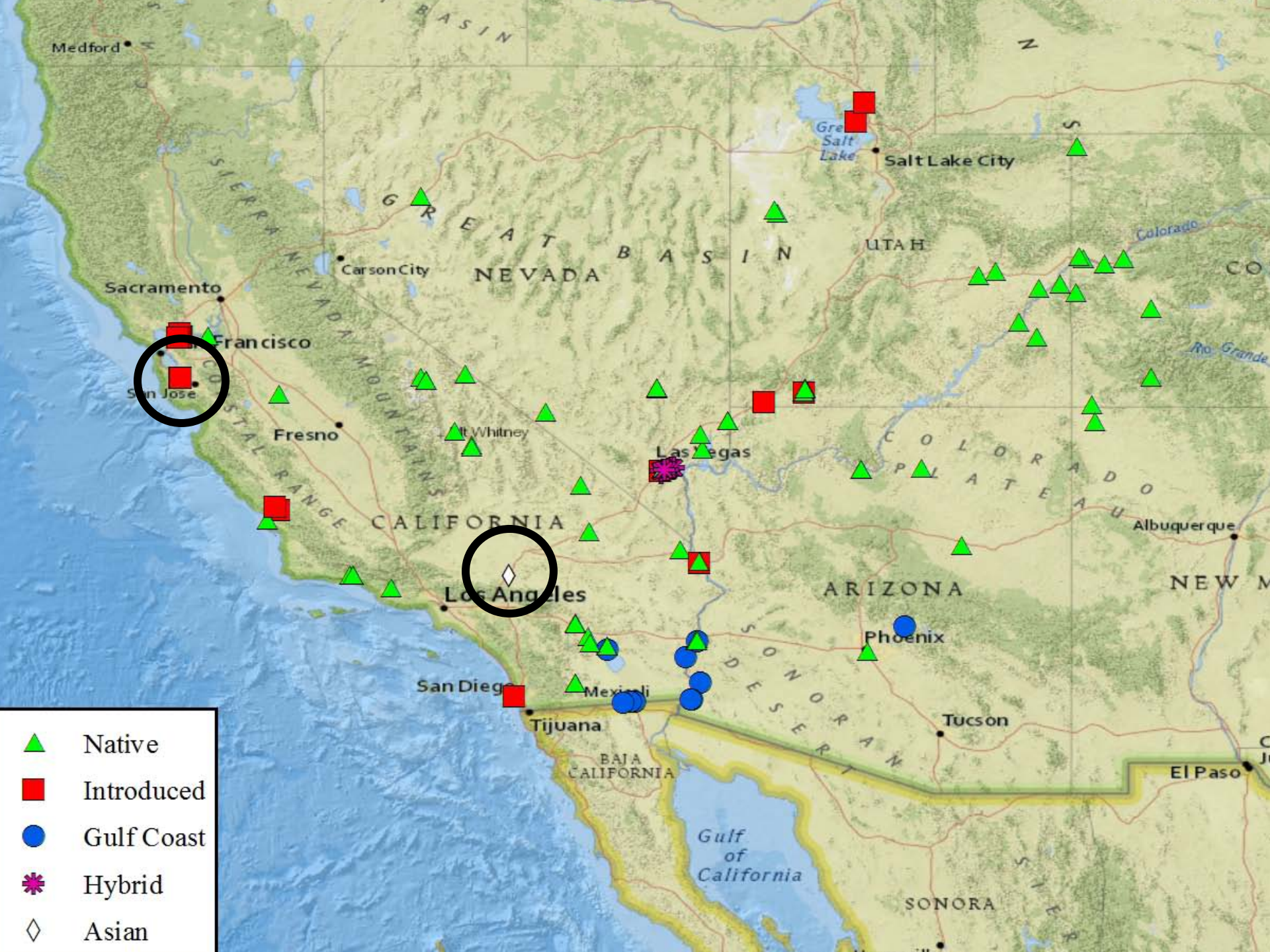
- Found 105 Native, 24 Introduced, 39 hybrids
 - Native haplotypes A, B, H, AR
 - Haplotypes Q and P
- Hybrids are clear intermediates between the two parental strains







- ▲ Native
- Introduced
- Gulf Coast
- ✱ Hybrid
- ◇ Asian



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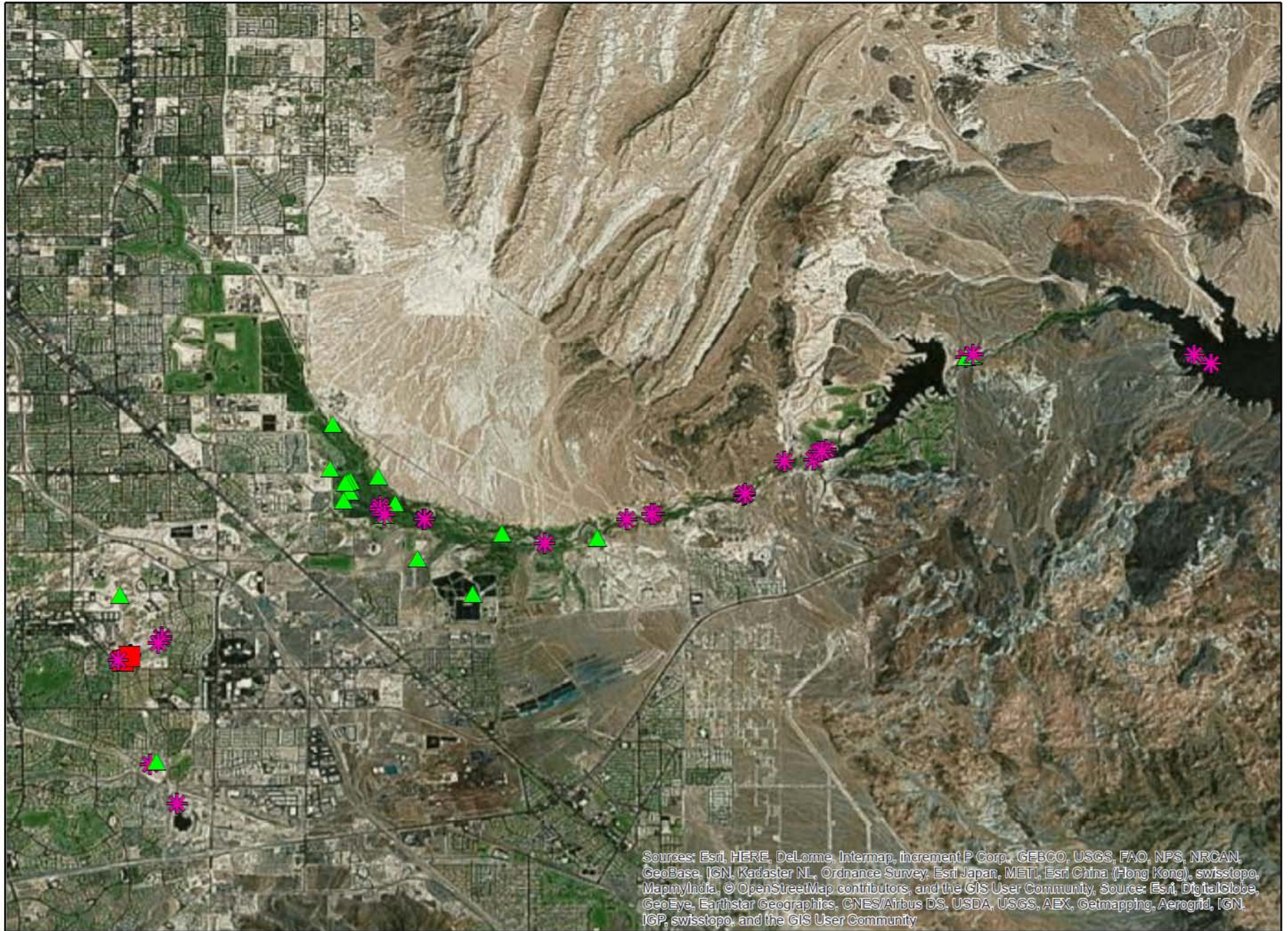












Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geimapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Las Vegas Wash and Tributaries



Native



Hybrid













What are the effects of hybridization?

- Will we lose our native haplotypes?
- Will control/management affect native haplotypes or hybrids?
- Are hybrids more invasive?



Summary - Western needs

- Introduced *Phragmites* continues to expand.
- Better understand genetic diversity and distribution.
- Potential for spread and susceptible habitats.
- Human facilitation?
- Identify potential impacts.



Native

Low stem density

Red stems

Sparse inflorescence

Slow expansion

Yellowish-green leaves

Sparse rhizomes

Bent stems



Exotic

High stem density

Tan stems

Dense inflorescence

Fast expansion

Dark green leaves

Dense rhizomes

Straight stems

