

# Trifolium subterraneum

## SUBTERRANEAN CLOVER

**ENGLISH NAMES** Subterranean Clover  
**SCIENTIFIC NAME** *Trifolium subterraneum*  
**FAMILY** Fabaceae



Photo Credit: © ADOLF CESKA

Subterranean Clover produces hard-coated seeds below the soil.

### RANGE/KNOWN DISTRIBUTION

The species Subterranean Clover (*Trifolium subterraneum*) includes three subspecies native to the Mediterranean region. Subterranean Clover has been naturalized in many temperate areas, including regions of North America, Australia, and New Zealand. Subterranean Clover is valued as a cover crop, as an agricultural weed control, and as living mulch. Subterranean Clover is also used to reduce erosion and to supplement the available nitrogen of soils. It is also grown as animal feed.

The invasive character of Subterranean Clover is not well-documented, although its effectiveness as a cover crop is. Once established, Subterranean Clover's spreading growth habit allows it to compete well with other plant species, including other weedy species. Subterranean Clover is still used as a biocontrol for other weeds, including Yellow Starthistle (*Centaurea solstitialis*) in California. However, Subterranean Clover has been a concern in southwest British Columbia since the late 1990s. It is widespread in coastal bluff communities of southeastern Vancouver Island, and it occurs often where geese and deer are present. Elsewhere in North America, Subterranean Clover is considered invasive but too widespread to control. It can colonize areas quickly, choking out other ground-cover plants.

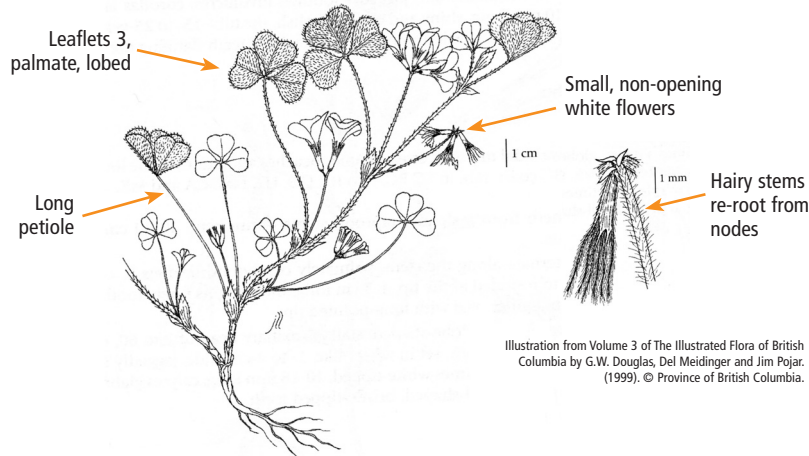
### IMPACTS ON GARRY OAK AND ASSOCIATED ECOSYSTEMS

As a member of the Pea (Fabacea) family, Subterranean Clover is a nitrogen-fixing species, capable of changing the availability of soil nitrogen. Many species of Garry Oak and associated ecosystems are adapted to nitrogen poor soils. In contrast, many invasive species introduced to this region prefer nitrogen-enriched soils. Therefore, by altering soil conditions, Subterranean Clover has the potential to alter the species composition of Garry Oak and associated ecosystems.

Vernal pool and vernal seep habitats of Garry Oak associated ecosystems are particularly susceptible to invasion by Subterranean Clover because it occurs in similar habitats as the BC Red-listed, federally Endangered Coast Microseris (*Microseris bigelovii*) and the Blue-listed, nationally Threatened Macoun's Meadowfoam (*Limnanthes macounii*). Where these species occur together, Subterranean Clover often out-competes the other species through uptake of available water. Subterranean Clover reduces the suitability of the limited remaining habitat for Coast Microseris.

INVASIVE SPECIES IN GARRY OAK AND ASSOCIATED ECOSYSTEMS IN BRITISH COLUMBIA

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### FIELD DESCRIPTION

Subterranean Clover is an annual herb in the pea family. Individuals grow prostrate (along the ground) from a taproot and runners can re-root from nodes along the plants' hairy stems. Despite the generally spreading growth-form, Subterranean Clover can sometimes grow to 30 cm tall. The leaves are distinctly "clover-like", having long petioles and being palmately branched (similar to the digits from a palm or hand) into three-lobed leaflets. The leaflets are 1–1.5 cm long. Individuals produce small, non-opening white flowers that self-pollinate, and produce inconspicuous blue fruits. The fruit of the fertile outer flowers produces a single, large seed that is pushed below the ground as the stalk grows.

### LIFE HISTORY

Subterranean Clover is a winter annual, germinating in autumn and flowering in late winter or early spring. Individuals die back in the summer to resist drought. Subterranean Clover grows in light- to medium-textured soils that receive sufficient rain from autumn to spring. A number of cultivars of Subterranean Clover have been produced as agricultural cover crops and the range of precipitation tolerated by Subterranean Clover depends on the cultivar. However, all cultivars require a minimum of 350–450 mm of precipitation annually. Subterranean Clover prefers a Mediterranean climate and requires sufficiently dry summers for successful seed germination.

By producing seeds embedded in the soil, Subterranean Clover ensures its regeneration even where intense grazing pressure exists. The single seed produced per pod is large and hard. Seed longevity is considered intermediate and the seed bank large.

### HABITAT

Subterranean Clover grows (and is grown as an agricultural cover crop and animal feed) in habitats similar to those found in its native region of the

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Mediterranean. Subterranean Clover is successful in mesic to dry pastures, along roadsides, in vernal pool habitats, and on seaside bluffs. Subterranean Clover grows in British Columbia at lowland, steppe, and montane elevations. In British Columbia, Subterranean Clover is most often found on southwest to west facing aspects and it is becoming increasingly prevalent in Garry Oak and associated ecosystems.

### MANAGEMENT

**Develop a long-term, realistic program for invasive species removal before undertaking any work. Before taking action, obtain expert advice. Please refer to the introductory section of this manual.**

The invasive character of Subterranean Clover is not widely identified as a significant threat to many of the ecosystems in which it has established. Its invasiveness may be highly localized, but may increase over time, with changing environmental characteristics. Subterranean Clover is known to have a persistent seed bank and long-term management is likely necessary to deplete seed reserves.

On southeastern Vancouver Island, Subterranean Clover is invasive. More awareness about this species in Garry Oak and associated ecosystems is needed. Early detection, rapid response should occur where Subterranean Clover is observed invading new sites. Where Subterranean Clover is already established, long-term management should be practiced to control this invasive species.

**PHYSICAL CONTROL:** Subterranean Clover can be hand-pulled in small numbers before individuals have set seed. Although Subterranean Clover flowers, sets seed, and dies back at similar times to many of the native plants in Garry Oak and associated ecosystems, it germinates in autumn. Hand-pulling is therefore best conducted in the winter or very early spring to minimize damage to native plants. Disturbing areas with Subterranean Clover seedlings approximately two months after germination may significantly reduce seedling survival, but care must be taken to protect native species with similar seasonal growth patterns.

If hand-pulling takes place following the maturation of Subterranean Clover seeds but prior to seed set, the plant material should not be composted or solarized as the seed is hard and heat tolerant, and will remain viable.

**BIOLOGICAL CONTROL:** No biological controls for Subterranean Clover have been developed. However, it is affected by a number of plant diseases, viruses, and pests, which have been well-characterized because of Subterranean Clover's value as a cover crop and suppressant of other weeds. This knowledge may be useful for the development of biological controls for Subterranean Clover where it acts as an invasive species. Biological controls must be developed and applied with caution, however, as broad-spectrum ecosystem effects are difficult to predict and detect.

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**CHEMICAL CONTROL:** Subterranean Clover, like other *Trifolium* species, may be controlled by chemical treatments, potentially including high nitrogen, low phosphorus fertilizers. However, *chemical control should only be used under expert advice and with extreme caution in Garry Oak ecosystems*. Chemical controls may cause substantial damage to native flora and fauna, and run-off may affect wider ecological communities.

Check local bylaws and pesticide listings and seek expert advice before using chemical means to control infestations of Subterranean Clover.

**OTHER TECHNIQUES:** The application of corn gluten meal is an alternative, non-chemical weed suppressant that is used to control lawn weeds, including clovers. Corn gluten meal inhibits root growth of germinating weed seeds. Corn gluten meal also acts as a feed for mature plants. This technique is not appropriate for natural areas but may be effective in city gardens and yards to suppress the spread of Subterranean Clover into natural areas.

**PREVENTATIVE MEASURES:** Early detection, rapid response should be practiced for new colonies of Subterranean Clover in natural areas on southern Vancouver Island and the Gulf Islands.

**PERSISTENCE:** Subterranean Clover produces hard, hardy, heat-tolerant seeds. The seed bank can persist for several years.

### SELECT REFERENCES

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A comprehensive bibliography of literature specific to Subterranean Clover is available at [www.goert.ca/invasive](http://www.goert.ca/invasive).

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