

ELEMENT STEWARDSHIP ABSTRACT
for

Conium maculatum

Poison Hemlock

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The Nature Conservancy
Element Stewardship Abstract
For *Conium maculatum*

I. IDENTIFIERS

Common Name: POISON-HEMLOCK

Global Rank: G5

General Description:

Tall biennial (sometimes perennial in favorable locations) that reproduces from seeds.

II. STEWARDSHIP SUMMARY

Conium maculatum is a highly toxic weed found in waste places throughout much of the world. A biennial, it reproduces only from seed. Some poison hemlock seeds germinate in the fall, producing flowers until the second spring. Poison hemlock can be easily controlled with the herbicide 2,4-D. No effective biological control techniques are known, but mechanical removal (hand pulling, grubbing, or mowing) is effective if done prior to flowering.

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III. NATURAL HISTORY

Range:

Conium maculatum is a native of Europe, western Asia and North Africa. It was brought to the United States from Europe as a garden plant. "Poison hemlock is common and spreading in parts of the United States and Canada, particularly on the West Coast; it is common and of some importance in New Zealand, and it also occurs in South America and the British Isles. In Australia, it occurs generally throughout the southern states but has occurred as far north as Queensland" (Parsons 1973).

Habitat:

Conium maculatum "commonly occurs in sizable stands of dense, rank growth along roadsides, field margins, ditchbanks and in low-lying waste areas. It also invades native plant communities in riparian woodlands and open flood plains of rivers and streams in

southern California" (Goeden and Ricker 1982) and other regions in the state. It is common on shady or moist ground below 5000 feet, especially in cismontane California.

Reproduction:

Life Cycle: In California, "poison hemlock reproduces only from seed, both as a biennial and winter annual, and occasionally as a short-lived perennial" (Goeden and Ricker 1982).

"Seeds germinate in autumn and plants develop rapidly throughout the winter and spring. Some produce flowering stems in the first spring and die in the summer. Others remain in the vegetative stage without producing flowering stems until the second spring, thus becoming a biennial. Plants are more likely to be biennial in very moist situations. After producing seeds, the plants die in the summer ... The spread of hemlock is by seeds which can adhere to farm machinery, vehicles, agricultural produce, mud and clothing as well as being carried by water and to a limited extent wind" (Parsons 1973).

"Hemlock is capable of rapid establishment after autumn rains, particularly on disturbed sites or where little vegetation exists at the start of the autumn growing season. Once it is firmly established under such conditions, hemlock can preclude most other vegetation and established pastures" (Parsons 1973).

Impacts:

Conium maculatum can be a tenacious weed particularly in moist habitats and along streams. Poison hemlock may act as a pioneer species quickly colonizing disturbed sites and displacing natives during early successional seres. The presence of *C. maculatum* degrades habitat quality and could indicate a management problem on an ecological preserve.

Conium maculatum is poisonous to both humans and livestock. It was probably used to poison Socrates. "Poisoning of humans has occurred after the ingestion of seeds, leaves and roots and even as a result of blowing through the hollow stems when used as whistles or pea-shooters. The seeds, however, are the most toxic part of the plant. Extracts of hemlock have been used as arrow poisons by North American Indians, and it was used medicinally for many years in treating tumors, ulcers and gout" (Parsons 1973).

Toxic Constituents: *Conium maculatum* "contains at least five distinct yet closely related alkaloids: coniine, N-methyl coniine, conhydrine, lambda-coniceine, and pseudoconhydrine. Of these, lambda-coniceine predominates in the plant during its vegetative growth, while coniine and N-methyl coniine increase and become predominant in the fruits with maturity. Coniine, synthesized by Ladenburg in 1886, was the first alkaloid to be synthesized. Its structure is based on a pyridine nucleus. Coniine is a colorless, volatile, strongly alkaline oil" (Kingsbury 1964).

Toxicity: "It has been shown that the predominant alkaloid in the plant changes with stage of development, and even from hour to hour, that the total amount of alkaloid varies with the stage of growth and part of plant and with geographic area, the plants from southern

latitudes being held more poisonous on the average than northern-grown ones. Variability in toxicity of this kind may explain the fact that in experimental feedings of a cow in Texas, Conium was found to produce symptoms but not death at about 2 percent of the animal's weight and did not produce death even at almost 4 percent. Coniine is volatile and is lost slowly from Conium while drying. The hemlock alkaloids are present in least amount in the root. As the plant grows, they accumulate in the stem, leaves, and fruits, being greater in amount in these organs in the order listed and in each reaching a maximum just prior to maturation of the seeds. Concentrations of total alkaloids as high as 1.6 percent have been measured in the green seed" (Kingsbury 1964).

"Cases have been described in cattle with depraved appetite--an indication of a latent metabolic disorder. While animals such as goats and sheep are not very sensitive, pigs react to quite small doses with clear symptoms of poisoning. If pregnant sows survive ingestion of the plant, besides the acute symptoms, limb deformations are observed in the piglets. That coniine has such teratogenic effects has been demonstrated in cattle" (Frohne and Pfander 1983).

Symptoms: Conium alkaloids are structurally related to nicotine and function similarly. "In addition to nicotinic activity, coniine also exhibits curare-like actions, and it paralyzes the striated musculature starting at the legs and rising until finally, while still fully conscious, death takes place as a result of respiratory paralysis" (Frohne and Pfander 1983).

Treatment: Frohne and Pfander (1983) recommend "measures to prevent absorption of the poison (elicit vomiting, gastric lavage, activated charcoal), strychnine in small doses (2 mg/h), and in the case of respiratory arrest, artificial respiration."

IV. CONDITION

V. MANAGEMENT/MONITORING

Management Requirements:

Mechanical or chemical removal of Conium maculatum is relatively easy (see Management section below), but complete eradication may be difficult due to reintroductions and the presence of viable seeds in the soil.

Conium maculatum requires active control measures or it can become dominant on a site, particularly disturbed areas such as roadsides.

Most of the following management information was obtained through personal communication with Jim McHenry, U.C. Davis Agricultural Extension (1985).

Biological Control: There are no known methods of effective biological control of Conium maculatum. The methods of using viral infection and/or phytophagous insects to control this weed need more research and experimentation.

Conium maculatum is often found infected by one or more strains of virus such as ringspot virus, carrot thin leaf virus (CTLV), alfalfa mosaic virus (AMV), and celery mosaic virus (CeMV) (Freitag and Severin 1945, Howell and Mink 1981). However, the stands of poison hemlock seem to survive in spite of viral attack. It is generally common for virus-affected plants to be more often stunted than killed. An apparent example of this phenomenon is the presence of extremely high populations of the ringspot vector, the honeysuckle aphid *Rhopalosiphum conii* (Dvd.), occurring on *Conium*.

Conium "is the only plant known to be infected by ringspot in nature. The two symptoms most useful in identifying this ringspot have been the chlorotic areas and the line patterns. They can easily be detected by the mottling of the leaves and by line and ringspot patterns. Under natural conditions the infected plants are not stunted, but often show a downward curling of the leaflets along the midrib" (Freitag and Severin 1945).

Similarly, populations of CTLV, AMV, and CeMV were isolated from *Conium maculatum* during a survey in southeastern Washington in 1975 and 1979. "CTLV and CeMV were the most prevalent viruses in wild carrot and poison hemlock of southeastern Washington. CTLV and CEMV were each recovered from 9% of the wild carrots and from slightly more than 20% of the poison hemlock, with 7% and 11% infected by both CTLV and CeMV, respectively ... AMV was found only at one location, infecting four poison hemlock plants" (Howell and Mink 1981).

"The incidence of CTLV and CeMV ranged from 0 to more than 80 percent. This variation appeared related to moisture availability. Where water was short through the summer, many of the second-year biennials matured and died before new plants emerged, thus decreasing the probability of virus transmission from the older to the younger weeds ... Poison hemlock, which is abundant in southeastern Washington, is considered a natural reservoir for CeMV in England (Pemberton and Frost 1974) and California (Sutabutra and Campbell 1971)" (Howell and Mink 1981).

However, as in the ringspot virus example cited above, use of these viruses as *Conium maculatum* controlling agents would depend upon (1) how they affect the viability of poison hemlock and (2) the feasibility of using an agent in the wild that could also adversely affect agricultural crops.

The useability of phytophagous insects to control *Conium maculatum* needs more experimentation. The phytophagous insect fauna of poison hemlock in southern California is largely comprised of relatively unspecialized, polyphagous, ectophagous, sap- and foliage-feeding species. Thereof, poison hemlock hosted amazingly few insect species or individuals. A clear majority, 16 of the 20 phytophagous insect species found on this weed, were rare.

"Substantial, but unquantified seed destruction by *Hyadaphis foeniculi* was noted at several locations, but otherwise poison hemlock suffered little insect injury. Most parts of this weed remain essentially free of deleterious insect attack. Apparently, the century since

this weed was accidentally introduced into California (Robbins 1940) has provided sufficient opportunity for only very few native phytophagous insects to overcome its toxic defenses and transfer to this colonizing plant species" (Goeden and Ricker 1982).

"The larval 'anise swallowtail' usually feeds on Umbelliferae. This butterfly may be in the process of adopting poison hemlock as an additional food plant in California ... Foreign exploration for natural enemies of poison hemlock in Europe, especially in areas of Mediterranean climate for use in California, is indicated as the next step in ascertaining whether the relative trophic vacuum that this weed represents might be usefully filled by a complex of intentionally introduced, specialized natural enemies" (Goeden and Ricker 1982).

Mechanical control: Hand Pulling or Grubbing: Hand pulling works easiest with wet soils and with small infestations. When grubbing, it is not necessary to remove the entire root system since the plant is not perennial. It is best to pull or grub out the plant prior to flowering (Parsons 1973). "Follow-up cultivation is necessary to deal with any seedlings and if possible a vigorous pasture should be established to compete with any further seedling growth" (Parsons 1973). Poison hemlock remains toxic for several years after being pulled, and it is wise not to leave the dead plants where they might be eaten by wildlife or children.

Mowing: Multiple mowings close to the ground may eventually kill *Conium maculatum*. "Mowing or slashing of the plants just before flowering is often effective, but sometimes new growth which requires re-treatment is produced from the base" (Parsons 1973).

Chemical control: If extensive areas are covered with *Conium maculatum*, chemical controls are simpler and less labor intensive.

2,4-D in moderate doses does not kill grasses (except the more susceptible bentgrass). It is most effective against poison hemlock when the ester form is mixed with diesel oil to allow penetration of the leaves and stems. It can be used to hand spot (the most effective technique), or to spray larger areas. The suggested mixture is 1.5 lbs acid equivalent per acre. Mix 2 quarts of diesel oil with 1.5 lbs of 2,4-D ester and add to 100 gallons of water in a spray tank. A 100-gallon tank should cover approximately one acre.

Banvel (active ingredient Dicamba) also works on broad-leaved plants but not as effectively as 2,4-D. The suggested mixture is 1/2 to 3/4 per 100 gallons of water and a surfactant is required.

VI. RESEARCH

Management Research Needs:

Most *Conium maculatum* control projects have emphasized chemical methods, and research has been primarily concerned with controlling it on rangelands. No research has been done on removing poison hemlock to restore natural ecosystems. More work needs

to be done in mechanical methods and burning. Is burning an effective control measure? When and under what conditions should it be burned? When is the best time to grub out or mow? How many times do you need to mow to keep the plant from reproducing, and how low to the ground must it be mowed? How long are poison hemlock seeds viable in the wild, and what seed reserves are present? What are the chances for reinvasion of the site? Are wildlife such as deer being injured or killed by eating poison hemlock?

A study is presently starting on biological control methods in the eastern United States, but no results are yet reported (Turner pers. comm. 1985).

VII. ADDITIONAL TOPICS

VIII. INFORMATION SOURCES

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IX. DOCUMENT PREPARATION & MAINTENANCE

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