

Oregon Department of Agriculture
Noxious Weed Pest Risk Assessment for
African rue
Peganum harmala
Zygophyllaceae, Caltrop
January 2009, Revised 2010

Findings of Review and Assessment: African rue has been determined to be a category “A” listed noxious weed as defined by the Oregon Department of Agriculture (ODA) Noxious Weed Policy and Classification System. This determination is based on two independent risk assessments following a literature review. Using a rating system adapted from United States Department of Agriculture, Animal and Plant Health Inspection Services, Plant Protection and Quarantine (USDA-APHIS PPQ) Weed Risk Assessment Guidelines, African rue scored 61 out of a potential score of 89. Using the ODA Noxious Weed Rating system, African rue scored number 16.

Introduction: African rue is a USDA federally listed noxious weed. A member of the Caltrop family and native to the deserts of Africa and Southern Asia, it has been introduced and become invasive in parts of the Southwest United States. The seeds yield a red dye (“Turkish red” or “Syrian red”) long used in Persian carpets. It was introduced and has naturalized in parts of New Mexico, Arizona, Texas, California, and Washington. In Oregon, infestations occur in Crook and Harney Counties. Until 2008, the Crook County site was the only confirmed Oregon infestation.



African rue in Harney County

Reproduction: African rue is a bushy, herbaceous perennial with short creeping roots. Mature plant stems are stiff, erect, highly branched, angled above, and glabrous. Leaves are alternate, fleshy, bright green, 2-5 cm long, irregularly divided 3 times or more into linear segments. Stipules are bristle-like. African rue flowers in late spring to early fall. Flowers are white, 2.5 cm in diameter and solitary on stalks 2-5 cm long or more in the leaf axils. Sepals are 5, linear, 1.5 cm long. Petals are 5, oblong, 1.5 cm long. Seed Capsules spherical, leathery, 7-15 mm in diameter, orange-brown at maturity, 3-chambered, and opening by 3 valves at the apex to release numerous dark brown to black angular seeds that are 3-4 mm long. The plant exhibits a bushy appearance and dies back to the crown each winter. New shoots arise from the crown or lateral roots and extend in a radial fashion from the main taproot.

African rue reproduces primarily by seed, but roots can produce new shoots, especially when severed. Most seed falls near the parent plant, but some seed is dispersed by water, human activities, and machinery, or by adhering to the feet, fur, or feathers of animals. Seeds can germinate under fairly saline conditions. Germination starts in early spring and is sporadic throughout the growing season when adequate moisture is available (Abbott et al. 2007). Seedlings emerge from soil depths to 3 cm, but most emergence occurs from the upper 0.5 cm. Success of African rue in desert environments can be attributed in part to the ability of seedlings to survive and recover from drought events (Abbott et al. 2008). It is often found in soils with high salinity and generally thrives in arid to semi-arid environments from the Southwest to the Northern Great Basin desert.

Factors Effecting Establishment: Agricultural activities can be considered the chief cause of local and long distance dispersal. Contaminated hay and livestock movement are likely factors. Burning, tilling or any disturbance of infested sites without a follow-up plan for treatment can quickly expand infestations (Davidson and Wargo). It thrives in disturbed sites such as roadsides and field edges, putting it in contact with right-of-way maintenance activities. Some seed movement may be possible in shipments of contaminated seeds and grains. It is not clear if local movement can be attributed to small mammals and birds.

Probability of Detection: African rue is well adapted to a wide range of climate and soil conditions. It thrives in the hot climates of the southwest yet does equally well throughout the drier cold climate of the Great Basin desert. The potential acreage susceptible to invasion is enormous. The remoteness of many acres of great basin lands may make early detection of this species problematic. The plant is not showy and may be growing in locations where detection may not happen for years. Education of land managers and ranchers is an important tool for early detection.

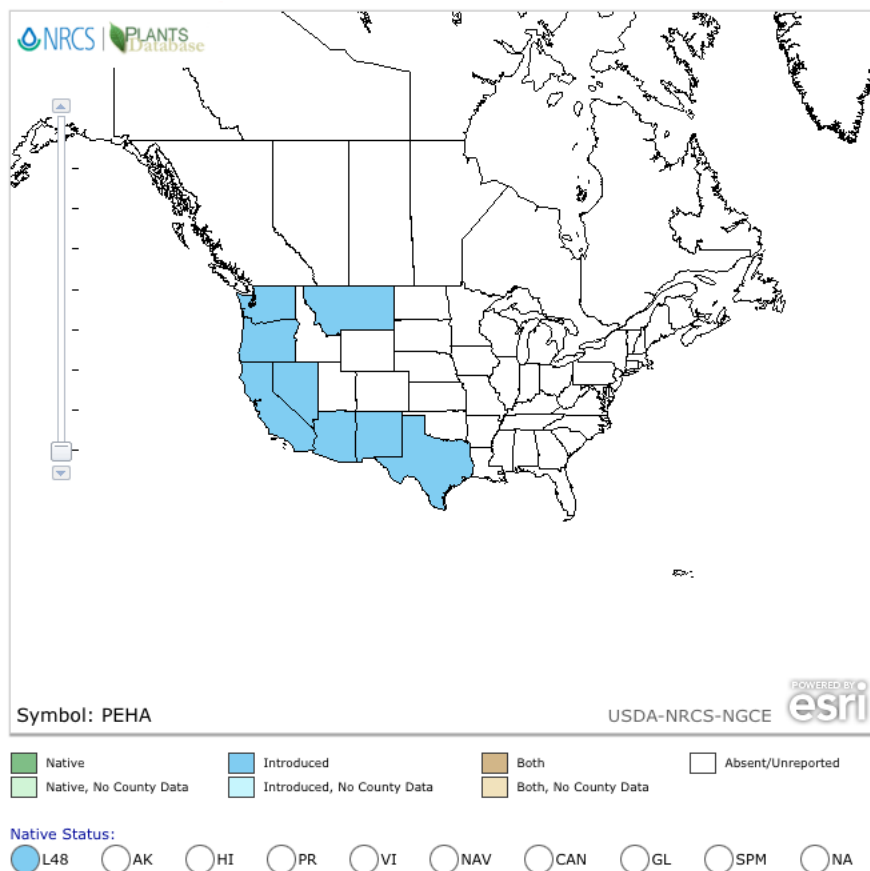
Distribution in Oregon: Introduced from the Mediterranean region and Middle East in the early 1900s. It was introduced and has naturalized in parts of New Mexico, Arizona, Texas, California, and Washington. In Oregon, infestations occur in Crook and Harney Counties.

Environmental Impacts: African rue weeds are primarily problems in degraded rangeland habitats or waste areas along roadsides. This noxious weed displays robust vegetative growth that crowds out desirable plants altering rangeland, pasture, and native habitats. African rue contains allelopathic chemicals that act as natural herbicides and reduce growth of surrounding plants giving it a competitive edge.

Economic Impacts: African rue contains numerous alkaloids and all plant parts are toxic. Seed coats contain the alkaloid harmine and are especially toxic when ingested. However, livestock seldom consume plants because of the bitter taste (Colorado agriculture). Toxicity symptoms in guinea pigs include weakness and paralysis of the hindquarters. In the absence of control measures, expanding populations of African rue would be expected to degrade rangeland, reducing the amount of edible grasses available to livestock. In livestock dependent communities, this would pose increasing economic hardship.

Dehulled seeds yield edible oil similar to cottonseed oil. Plants are still used medicinally in the Old World for a variety of ailments as analgesic and antiinflammatory agents and for treatment of depression. Seeds are also used to produce a red dye used in Persian rugs, clothing and for tattoo ink in the Middle East and other countries (Wikipedia).

Control: Mechanical removal is a difficult task. The strong, deep taproot and lateral roots must be removed for control. Plants may be cut back to the crown, but regrowth will occur. Tillage will only serve to spread infestations by severing and dragging rootstocks to new areas. Longevity in the seed bank is unknown. Grazing is not an effective control option, due to non-palatability or toxic effects. There are also no available biocontrol agents for this weed. The most effective control strategy is herbicide, applied to the foliage of actively growing plants in the bud stage. It is necessary to repeat this, possibly several times until the plants are completely killed. Nonselective right-of-way herbicide products have provided good roadside control. Refer to the herbicide labels for rates and precautions (New Mexico extension 2006).



US distribution of African rue

Noxious Weed Qualitative Risk Assessment 3.8
Oregon Department of Agriculture

Common Name: African rue
Scientific Name: *Peganum harmala*
Family: Zygophyllaceae

For use with plant species that occur or may occur in Oregon to determine their potential to become serious noxious weeds. For each of the following categories, select the number that best applies. Numerical values are weighted to increase priority categories over less important ones. Choose the best number that applies, intermediate scores can be used.

Total Score: 60 Risk Category: A

GEOGRAPHICAL INFORMATION

1) 6 **Invasive in Other Areas**

- 0 Low- not known to be invasive elsewhere.
- 2 Known to be invasive in climates dissimilar to Oregon's current climates.
- 6 Known to be invasive in geographically similar areas.

Comments: Highly invasive in arid to semi-arid environments similar to those in eastern Oregon.

2) 6 **Habitat Availability:** Are there susceptible habitats for this species and how common or widespread are they in Oregon?

- 1 *Low* – Habitat is very limited, usually restricted to a small watershed or part of a watershed (e.g., tree fern in southern Curry County).
- 3 *Medium* – Habitat encompasses 1/4 or less of Oregon (e.g., oak woodlands, coastal dunes, eastern Oregon wetlands, Columbia Gorge).
- 6 *High* – Habitat covers large regions or multiple counties, or is limited to a few locations of high economic or ecological value (e.g., threatened and endangered species habitat).

Comments: Available habitat is vast.

3) 0 **Proximity to Oregon:** What is the current distribution of the species?

- 0 *Present* – Occurs within Oregon.
- 1 *Distant* – Occurs only in distant US regions or foreign countries.
- 3 *Regional* – Occurs in Western regions of US but not adjacent to Oregon border.
- 6 *Adjacent* – Weedy populations occur adjacent (<50 miles) to Oregon border.

Comments: Occurs in Oregon

4) 10 **Current Distribution:** What is the current distribution of escaped populations in Oregon?

- 0 *Not present* – Not known to occur in Oregon.
- 1 *Widespread* – Throughout much of Oregon (e.g., cheatgrass).
- 5 *Regional* – Abundant (i.e., occurs in eastern, western, central, coastal, areas of Oregon) (e.g., gorse, tansy ragwort).
- 10 *Limited* – Limited to one or a few infestations in state (e.g., kudzu).

Comments: Limited to two infestations in the state.

BIOLOGICAL INFORMATION

- 5) **3** **Environmental Factors:** Do abiotic (non-living) factors in the environment effect establishment and spread of the species? (e.g., precipitation, drought, temperature, nutrient availability, soil type, slope, aspect, soil moisture, standing or moving water).
- 1 *Low* – Severely confined by abiotic factors.
 - 2 *Medium* – Moderately confined by environmental factors
 - 4 *High* – Highly adapted to a variety of environmental conditions (e.g., tansy ragwort, Scotch broom).

Comments: Highly adapted to arid and semi-arid climates, may not thrive in wetter zones.

- 6) **5** **Reproductive Traits:** How does this species reproduce? Traits that may allow rapid population increase both on and off site.
- 0 *Negligible* – Not self-fertile, or is dioecious and opposite sex not present.
 - 1 *Low* – Reproduction is only by seed, produces few seeds, or seed viability and longevity are low.
 - 3 *Medium* – Reproduction is vegetative (e.g., by root fragments, rhizomes, bulbs, stolons).
 - 3 *Medium* – Produces many seeds, and/or seeds of short longevity (< 5 years).
 - 5 *High* – Produces many seeds and/or seeds of moderate longevity (5-10 years) (e.g., tansy ragwort).
 - 6 *Very high* – Has two or more reproductive traits (e.g., seeds are long-lived >10 years and spreads by rhizomes).

Comments: Produces many seeds of moderate longevity.

- 7) **4** **Biological Factors:** Do biotic (living) factors restrict or aid establishment and spread of the species? (What is the interaction of plant competition, natural enemies, native herbivores, pollinators, and pathogens with species?)
- 0 *Negligible* – Host plant not present for parasitic species.
 - 1 *Low* – Biotic factors highly suppress reproduction or heavily damage plant for an extended period (e.g., biocontrol agent on tansy ragwort).
 - 2 *Medium* – Biotic factors partially restrict or moderately impact growth and reproduction, impacts sporadic or short-lived.
 - 4 *High* – Few biotic interactions restrict growth and reproduction. Species expresses full growth and reproductive potential.

Comments: Plant unaffected by feeding or grazing.

- 8) **2** **Reproductive Potential and Spread After Establishment - Non-human Factors:**
How well can the species spread by natural means?
- 0 *Negligible* – No potential for natural spread in Oregon (e.g., ornamental plants outside of climate zone).
 - 1 *Low* – Low potential for local spread within a year, has moderate reproductive potential or some mobility of propagules (e.g., propagules transported locally by animals, water movement in lakes or ponds, not wind blown).
 - 3 *Medium* - Moderate potential for natural spread with either high reproductive potential or highly mobile propagules (e.g., propagules spread by moving water, or dispersed over longer distances by animals) (e.g., perennial pepperweed).

- 5 *High* – Potential for rapid natural spread throughout the susceptible range, high reproductive capacity and highly mobile propagules. Seeds are wind dispersed over large areas (e.g., rush skeletonweed).

Comments: Seeds have little potential for movement. Moving water and animals, birds may be important factors.

- 9) **4** **Potential of Species to be Spread by Humans.** What human activities contribute to spread of species? Examples include: interstate or international commerce; contaminated commodities; packing materials or products; vehicles, boats, or equipment movement; logging or farming; road maintenance; intentional introductions of ornamental and horticultural species, or biofuel production.

- 1 *Low* – Potential for introduction or movement minimal (e.g., species not traded or sold, or species not found in agricultural commodities, gravel or other commercial products).
- 3 *Medium* – Potential for introduction or off-site movement moderate (e.g., not widely propagated, not highly popular, with limited market potential; may be a localized contaminant of gravel, landscape products, or other commercial products) (e.g., lesser celandine, Canada thistle).
- 5 *High* – Potential to be introduced or moved within state high (e.g., species widely propagated and sold; propagules common contaminant of agricultural commodities or commercial products; high potential for movement by contaminated vehicles and equipment, or by recreational activities) (e.g., butterfly bush, spotted knapweed, Eurasian watermilfoil).

Comments: Potential to be introduced by interstate movement of agricultural products.

IMPACT INFORMATION

- 10) **5** **Economic Impact:** What impact does/can the species have on Oregon’s agriculture and economy?

- 0 *Negligible* – Causes few, if any, economic impacts.
- 1 *Low* - Potential to, or causes low economic impact to agriculture; may impact urban areas (e.g., puncture vine, pokeweed).
- 5 *Medium* – Potential to, or causes moderate impacts to urban areas, right-of-way maintenance, property values, recreational activities, reduces rangeland productivity (e.g., English ivy, Himalayan blackberry, cheatgrass).
- 10 *High* – Potential to, or causes high impacts in agricultural, livestock, fisheries, or timber production by reducing yield, commodity value, or increasing production costs (e.g., gorse, rush skeleton weed, leafy spurge).

Comments: Plants can invade and reduce the productivity of rangelands.

- 11) **3** **Environmental Impact:** What risks or harm to the environment does this species pose? Plant may cause negative impacts on ecosystem function, structure, and biodiversity of plant or fish and wildlife habitat; may put desired species at risk.

- 0 *Negligible* – None of the above impacts probable.
- 1 *Low* – Can or does cause few or minor environmental impacts, or impacts occur in degraded or highly disturbed habitats.
- 4 *Medium* – Species can or does cause moderate impacts in less critical habitats (e.g., urban areas, sagebrush/ juniper stands).
- 6 *High* – Species can or does cause significant impacts in several of the above categories. Plant causes severe impacts to limited or priority habitats (e.g., aquatic, riparian zones, salt marsh; or T&E species sites).

Comments: Species can cause moderate impacts in rangeland species diversity and productivity.

- 12) 0 **Impact on Health:** What is the impact of this species on human, animal, and livestock health? (e.g., poisonous if ingested, contact dermatitis, acute and chronic toxicity to livestock, toxic sap, injurious spines or prickles, causes allergy symptoms).
- 0 *Negligible* – Has no impact on human or animal health.
 - 2 *Low* – May cause minor health problems of short duration, minor allergy symptoms (e.g., leafy spurge).
 - 4 *Medium* – May cause severe allergy problems, death or severe health problems through chronic toxicity, spines or toxic sap may cause significant injury. (e.g., giant hogweed, tansy ragwort).
 - 6 *High* – Causes death from ingestion of small amounts, acute toxicity (e.g. poison hemlock).

Comments: Health impacts negligible.

CONTROL INFORMATION

- 13) 8 **Probability of Detection at Point of Introduction:** How likely is detection of species after introduction and naturalization in Oregon?
- 1 *Low* – Grows where probability of early detection is high, showy and easily recognized by public; access to habitat not restricted (e.g., giant hogweed).
 - 5 *Medium* – Easily identified by weed professionals, ranchers, botanists; some survey and detection infrastructure in place. General public may not recognize or report species (e.g., leafy spurge).
 - 10 *High* – Probability of initial detection by weed professionals low. Plant shape and form obscure, not showy for much of growing season, introduction probable at remote locations with limited access (e.g., weedy grasses, hawkweeds, skeletonweed).

Comments: Plants are low growing and often not showy during growing season. Can escape detection for many years. May require weed professionals for identification.

- 14) 5 **Control Efficacy:** What level of control of this species can be expected with proper timing, herbicides, equipment, and biological control agents?
- 1 *Negligible* – Easily controlled by common non-chemical control measures (e.g., mowing, tillage, pulling, and cutting; biocontrol is very effective at reducing seed production and plant density) (e.g., tansy ragwort).
 - 2 *Low* – Somewhat difficult to control, generally requires herbicide treatment (e.g., mechanical control measures effective at preventing flowering and but not reducing plant density; herbicide applications provide a high rate of control in a single application; biocontrol provides partial control).
 - 4 *Medium* – Treatment options marginally effective or costly. Tillage and mowing increase plant density (e.g., causes tillering, rapid regrowth, spread from root fragments). Chemical control is marginally effective. Crop damage occurs or significant non-target impacts result from maximum control rates. Biocontrol agents ineffective.
 - 6 *High* – No effective treatments known or control costs very expensive. Species may occur in large water bodies or river systems where containment and complete control are not achievable. Political or legal issues may prevent effective control.

Comments: Control is expensive and long-term. Herbicide control success is often erratic.

Category Scores:

22 Geographic score (Add scores 1-4)

18 Biological Score (Add lines 5-9)

8 Impact Score (Add lines 10-12)

13 Control Score (Add Lines 13-14)

60 Total Score (Add scores 1-14 and list on front of form)

Risk Category: 55-89 = A 24-54 = B < 24 = unlisted.

This Risk Assessment was modified by ODA from the USDA-APHIS Risk Assessment for the introduction of new plant species.

V3.8 2/19/2016

Oregon Department of Agriculture
Noxious Weed Rating System

Common Name: African rue

Scientific Name: *Peganum harmala*

Point Total: **16**

Rating: **A**

1) Detrimental Effects: Check all that apply, add number of checks

- 1. *Health*: causes poisoning or injury to humans or animals
- 2. *Competition*: strongly competitive with crops, forage, or native flora
- 3. *Host*: host of pathogens and/or pests of crops or forage
- 4. *Contamination*: causes economic loss as a contaminate in seeds and/or feeds
- 5. *Interference*: interferes with recreation, transportation, harvest, land value, or wildlife and livestock movement

2) Reproduction & Capacity for Spread: Check the number that best describes, enter that number

- 1. Few seeds, not wind blown, spreads slowly
- 2. Many seeds, slow spread
- 3. Many seeds, spreads quickly by vehicles or animals
- 4. Windblown seed, or spreading rhizomes, or water borne
- 5. Many wind-blown seeds, high seed longevity, spreading rhizomes, perennials

3) Difficulty to Control: Check the number that best describes, enter that number

- 1. Easily controlled with tillage or by competitive plants
- 2. Requires moderate control, tillage, competition or herbicides
- 3. Herbicides generally required, or intensive management practices
- 4. Intensive management generally gives marginal control
- 5. No management works well, spreading out of control

4) Distribution: Check the number that best describes, enter that number

- 1. Widely distributed throughout the state in susceptible habitat
- 2. Regionally abundant, 5 or more counties, more than 1/2 of a county
- 3. Abundant throughout 1- 4 counties, or 1/4 of a county, or several watersheds
- 4. Contained in only 1 watershed, or less than 5 square miles gross infestation
- 5. Isolated infestation less than 640 acres, more than 10 acres

5) Ecological Impact: Check the number that best describes, enter that number

- 1. Occurs in most disturbed habitats with little competition
- 2. Occurs in disturbed habitats with competition
- 3. Invades undisturbed habitats and crowds out native species
- 4. Invades restricted habitats (i.e. riparian) and crowds out native species

16

TOTAL POINTS

Note: Noxious weeds are non-native plants with scores of 11 points or higher. Any plants in 4.1, 4.2, and 4.3 should not be classified as “A” rated weeds. Ratings: 16+ = A, 15 – 11 = B
ODA Weed Rating System 2/22/16 V3.8

References:

Abbott, L. B., Lepak, D., & Daniel, D. L. (2007). Vegetative and reproductive phenology of african rue (peganum harmala) in the northern chihuahuan desert. *Southwestern Naturalist*, 52(2), 209-218.

Abbott, L. B., Bettmann, G. T., & Sterling, T. M. (2008). Physiology and recovery of african rue (peganum harmala) seedlings under water-deficit stress. *Weed Science*, 56(1), 52-57.

African Rue Control, Ground Applications: Individual plant & broadcast spray treatment for African rue control. Jun 06 available from New Mexico Brush Busters, College of Ag & Home Economics Coop. Extension Service publication. Available from: http://aces.nmsu.edu/pubs/_b/BC-6.pdf

African rue Id & Management. CO Dept. of Ag, CSD available from: www.colorado.gov/ag/weed

Davidson J. and Wargo M. Recognition and control of african rue in Nevada Fact Sheet FS-01-45 <http://www.unce.unr.edu/publications/files/nr/2001/FS0145.pdf>

Harmala. Wikipedia 2010. available from <http://en.wikipedia.org/wiki/Harmal>

Parsons, W. T. and Cuthbertson, E. G. 1992. Noxious weeds of Australia. Melbourne, Inkata Press.

USDA Plants Database: <http://plants.usda.gov/java/=peganum+harmala>

Rasmussen B., Oregon Department of Agriculture, 2009

Reported by: Glenn Miller, ODA

US Plant Hardiness Zone, <http://planthardiness.ars.usda.gov/PHZMWeb/>

