

Standard Operating Procedure D

Maunakea Plant Threats, Identification, Collection & Processing Guide

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1. Purpose and Scope

This standard operating procedure (SOP) is designed to assist staff and the public with plant identification, guide efforts in documenting invasive plant threats, and demonstrate the proper collection and processing protocol for vegetation on the UH managed lands on Maunakea. The Maunakea Invasive Species Management Plan (MKISMP) (2015) identifies these functions as being appended (in this SOP) for use in prevention, early detection, monitoring, and control efforts. The identification guide portion of this SOP is not intended to be comprehensive, but rather representative of common species to facilitate identification. This SOP will typically be used for research projects and internal surveys that require a vegetation survey such as historical property surveys, quarterly perimeter searches, and the annual alien arthropod survey. A botanical text should be used under the guidance of a professional botanist if complete confidence in specimen identification is required.

2. University Management Area and Ecological Zones

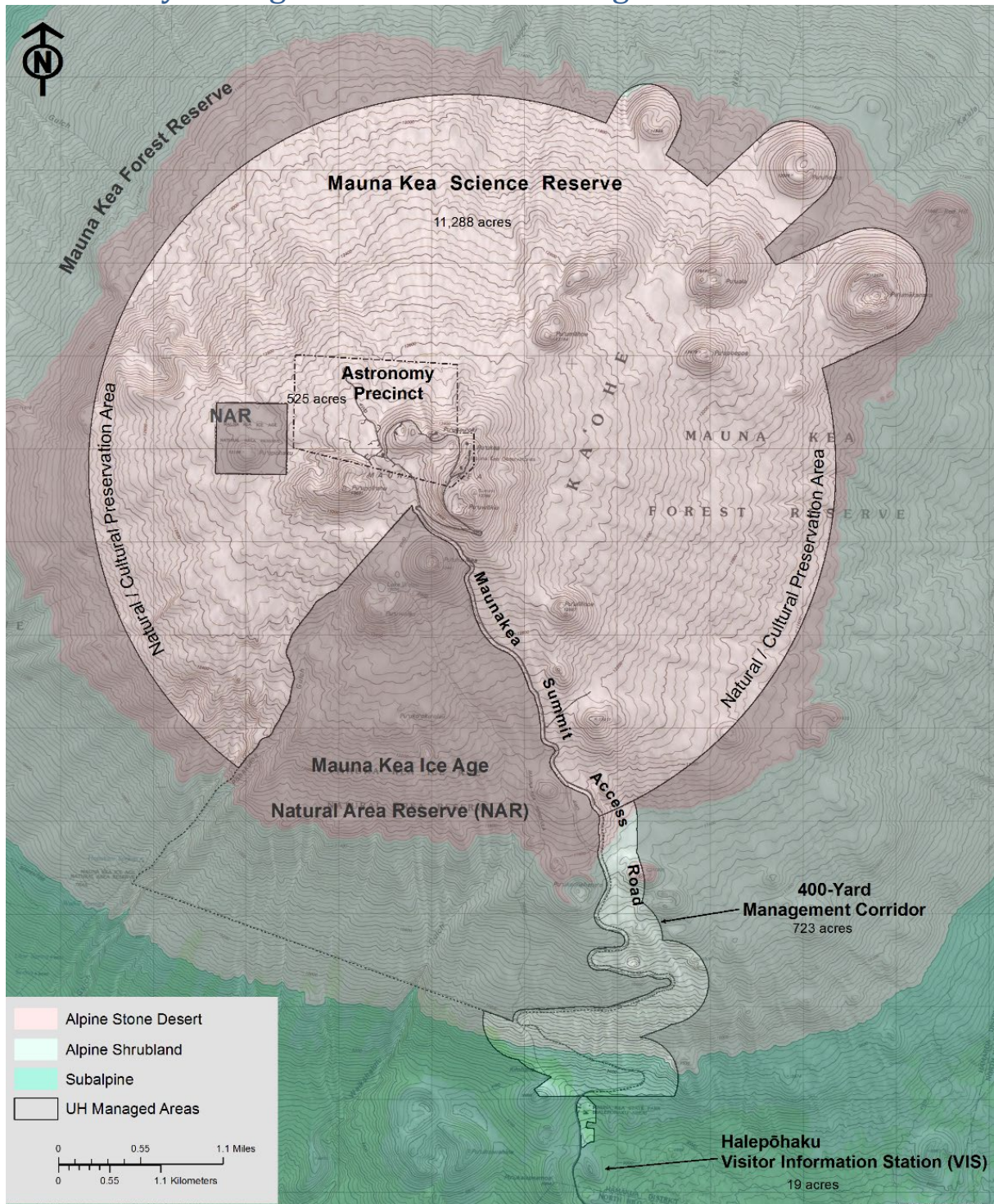


Figure 1. The Office of Maunakea Management (OMKM) manages the Mauna Kea Science Reserve (MKSR) including the Astronomy Precinct, Road Corridor, and Halepōhaku (HP) facilities. There are three community types within the UH Management Area: the Alpine Shrubland (from 2,900m to 3,400m), Alpine Grassland (3,400m to 3,900m), and the Alpine Stone Desert (3,900m to the summit).

3. Native Plant Species

Native species¹, with common name², documented within the Management Area are identified below.

Table 1. Native species in the Road Corridor and at Halepōhaku (below the MKSR).

Family	Scientific Name ¹	Common Name ²	Morphology
Aspleniaceae	<i>Asplenium adiantum-nigrum</i>	'iwa'iwa, spleenwort fern	Fern
Aspleniaceae	<i>Asplenium trichomanes</i>	'oāli'i, 'owāli'i	Fern
Asteraceae	<i>Dubautia arborea</i>	na'ena'e, Maunakea dubautia	Shrub
Asteraceae	<i>Dubautia ciliolata glutinosa</i>	na'ena'e, lava dubautia	Shrub
Asteraceae	<i>Pseudognaphalium sandwicense</i>	'ena'ena	Herb
Asteraceae	<i>Tetramolopium humile humile</i>	alpine tetramolopium	Shrub
Caryophyllaceae	<i>Silene struthioloides</i>	alpine catchfly	Shrub
Chenopodiaceae	<i>Chenopodium oahuense</i>	'āweoweo, 'āheahea	Shrub
Cyperaceae	<i>Carex macloviana</i>	St. Malo's sedge	Sedge
Cyperaceae	<i>Carex wahuensis</i>	O'ahu sedge	Sedge
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	kīlau, bracken fern	Fern
Dryopteridaceae	<i>Dryopteris wallichiana</i>	alpine woodfern	Fern
Ericaceae	<i>Leptecophylla tameiameia</i>	Pūkiawe	Shrub
Ericaceae	<i>Vaccinium reticulatum</i>	'ōhelo, 'ōhelo 'ai	Shrub
Fabaceae	<i>Sophora chrysophylla</i>	māmāne	Tree
Geraniaceae	<i>Geranium cuneatum hololeucum</i>	nohoanu, hinahina	Shrub
Juncaceae	<i>Luzula hawaiiensis</i>	Hawai'i wood rush	Rush
Lamiaceae	<i>Stenogyne microphylla</i>	little-leaf stenogyne	Vine
Lamiaceae	<i>Stenogyne rugosa</i>	mā'ohi'ohi	Vine
Oxalidaceae	<i>Oxalis corniculata</i>	yellow wood sorell	Herb
Papaveraceae	<i>Argemone glauca</i>	pua kala, Hawaiian poppy	Herb
Poaceae	<i>Agrostis sandwicensis</i>	Hawai'i bentgrass	Grass
Poaceae	<i>Deschampsia nubigena</i>	alpine hairgrass	Grass
Poaceae	<i>Lachnagrostis filiformis</i>	he'upueo, Pacific bentgrass	Grass
Poaceae	<i>Trisetum glomeratum</i>	pili uka, mountain pili	Grass
Polygonaceae	<i>Rumex giganteus</i>	pāwale	Shrub
Pteridaceae	<i>Pellaea ternifolia</i>	kalamoho	Fern
Rosaceae	<i>Osteomeles anthyllidifolia</i>	'ūlei	Shrub
Rubiaceae	<i>Coprosma ernodeoides</i>	kūkaenēnē	Shrub
Rubiaceae	<i>Coprosma montana</i>	pilo	Tree
Sapindaceae	<i>Dodonaea viscosa</i>	'a'ali'i	Tree

Table 2. Native Species in the MKSR & Astronomy Precinct.

Family	Scientific Name	Common Name	Morphology
Aspleniaceae	<i>Asplenium adiantum-nigrum</i>	'iwa'iwa, spleenwort fern	Fern
Aspleniaceae	<i>Asplenium trichomanes</i>	'oāli'i, 'owāli'i	Fern
Asteraceae	<i>Argyroxiphium sandwicense sandwicense</i>	'āhinahina	Shrub
Asteraceae	<i>Dubautia ciliolata glutinosa</i>	na'ena'e, lava dubautia	Shrub
Asteraceae	<i>Pseudognaphalium sandwicense</i>	'ena'ena	Herb
Asteraceae	<i>Tetramolopium humile humile</i>	alpine tetramolopium	Shrub
Carophyllaceae	<i>Silene struthioloides</i>	alpine catchfly	Shrub
Dennstaedtiaceae	<i>Pteridium aquilinum</i>	kīlau, bracken fern	Fern
Dryopteridaceae	<i>Cystopteris douglasii</i>	Douglas' bladderfern	Fern
Dryopteridaceae	<i>Dryopteris wallichiana</i>	alpine woodfern	Fern

¹ The scientific names used are valid and accepted (as of 2/2015) in the Integrated Taxonomic Information System (ITIS) database. Names are subject to change with updated ITIS information.

² Common names include Hawaiian and English names when known. Hawaiian name spellings confirmed in Nā Puke Wehewehe 'Ōlelo Hawai'i.

Ericaceae	<i>Leptecophylla tameiameia</i>	pūkiawe	Shrub
Ericaceae	<i>Vaccinium reticulatum</i>	‘ōhelo, ‘ōhelo ‘ai	Shrub
Juncaceae	<i>Luzula hawaiiensis</i>	Hawai‘i wood rush	Rush
Poaceae	<i>Agrostis sandwicensis</i>	Hawai‘i bentgrass	Grass
Poaceae	<i>Lachnagrostis filiformis</i>	he‘upueo, Pacific bentgrass	Grass
Poaceae	<i>Trisetum glomeratum</i>	pili uka, mountain pili	Grass
Pteridaceae	<i>Pellaea ternifolia</i>	kalamoho	Fern

4. Priority Plant Threats

Plant threats are identified using the Hawai‘i Pacific Weed Risk Assessment (HPWRA) score, which is determined by 49 questions regarding the plant’s biology, ecology, and invasive tendencies. The MKISMP identifies an HPWRA threshold score of 8 or higher for evaluation and a score of 17 or higher to be designated as a high priority species. High priority species that are not present in the Management Area are priority targets in early detection surveys. The MKISMP states that OMKM will prepare response plans for high priority threats with supporting historical presence data. Response plan efforts depend on the plant’s score, known distribution, and degree of potential impacts. Scores of established non-native plant species will aid in the determination of appropriate and feasible monitoring/response activities. If no score is available for a species, OMKM requests an assessment from [the HPWRA program](#) and further evaluates the threat based on known distribution (may require scoping surveys). Completed [HPWRA assessments](#) are stored on the OMKM server along with an [Excel spreadsheet](#) denoting the scores for all species noted in Tables 3-6.

Monitoring and control procedures will be developed for all introduced plant species currently established in the Management Area (Tables 3 & 4). It should be noted that there is a high concentration of alien plant species in the lower elevations and therefore, most of the feasible vegetation management occurs in the higher elevation environments in order to contain alien populations. The complexity, level of involvement, and resources allocated to each introduced species will be determined by their level of threat (biological, cultural, and/or aesthetic) and feasibility. Many species will see nominal control efforts, given their widespread presence on the island and threat level. High priority species are shaded and shown in **bold**. Species are grouped by management area and sorted by family, genus, and species.

Table 3. Introduced species established in the Road Corridor and at Halepōhaku (below the MKSR).

Family	Scientific Name	Common Name	Morphology	HPWRA
Asteraceae	<i>Achillea millefolium</i>	common yarrow	Herb	19
Asteraceae	<i>Bidens pilosa</i>	Spanish needle	Herb	23
Asteraceae	<i>Coreopsis lanceolata</i>	ko‘oko‘olau haole	Herb	12
Asteraceae	<i>Gaillardia pulchella</i>	Indian blanketflower	Herb	NA
Asteraceae	<i>Heterotheca grandiflora</i>	telegraph weed	Herb	14
Asteraceae	<i>Hypochaeris radicata</i>	hairy cat’s ear	Herb	16
Asteraceae	<i>Senecio madagascariensis</i>	fireweed	Herb	23
Asteraceae	<i>Senecio sylvaticus</i>	heath groundsel	Herb	9.5
Asteraceae	<i>Senecio vulgaris</i>	common groundsel	Herb	14
Asteraceae	<i>Taraxacum officinale</i>	common dandelion	Herb	20
Asteraceae	<i>Tragopogon porrifolius</i>	salsify	Herb	6.5
Brassicaceae	<i>Lepidium spp.</i>	peppergrass	Herb	10-17
Fabaceae	<i>Cytisus prolifera var. palmensis</i>	broom (tagasaste)	Shrub	14
Fabaceae	<i>Trifolium arvense</i>	lance clover	Herb	13.5
Geraniaceae	<i>Erodium cicutarium</i>	alfilaria, pin clover	Herb	14
Geraniaceae	<i>Geranium homeanum</i>	Australasian geranium	Herb	7
Lamiaceae	<i>Marrubium vulgare</i>	horehound	Herb	17
Molluginaceae	<i>Mollugo cerviana</i>	slender carpetweed	Herb	9

Family	Scientific Name	Common Name	Morphology	HPWRA
Myrtaceae	<i>Eucalyptus</i> spp.	eucalyptus	Tree	-3-11
Onagraceae	<i>Epilobium billardierianum</i>	willow herb	Herb	7
Onagraceae	<i>Oenothera stricta</i>	evening primrose	Herb	10
Papaveraceae	<i>Eschscholzia californica</i>	California poppy	Herb	14
Poaceae	<i>Anthoxanthum odoratum</i>	sweet vernalgrass	Grass	11
Poaceae	<i>Bromus catharticus</i>	rescue grass, prairie grass	Grass	19
Poaceae	<i>Bromus diandrus</i>	ripgut grass, giant brome	Grass	18
Poaceae	<i>Pennisetum clandestinum</i>	kikuyu grass	Grass	18
Poaceae	<i>Dactylis glomerata</i>	orchard grass	Grass	18
Poaceae	<i>Ehrharta calycina</i>	perennial veldtgrass	Grass	18
Poaceae	<i>Holcus lanatus</i>	velvet grass	Grass	20
Poaceae	<i>Lolium</i> spp.	rye grass	Grass	9
Poaceae	<i>Nassella cernua</i>	nodding/foothill needlegrass	Grass	9
Poaceae	<i>Poa annua</i>	annual bluegrass	Grass	25
Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass	Grass	14
Poaceae	<i>Rytidosperma semiannulare</i>	wallaby grass	Grass	2.5
Poaceae	<i>Vulpia bromoides</i>	brome fescue	Grass	18
Polygonaceae	<i>Rumex acetosella</i>	sheep sorrel	Herb	18
Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	Herb	11
Scrophulariaceae	<i>Verbascum virgatum</i>	wand mullein	Herb	9
Verbenaceae	<i>Verbena litoralis</i>	ōwī	Herb	15

Table 4. Introduced species established in the MKSR & Astronomy Precinct.

Family	Scientific Name	Common Name	Morphology	HPWRA
Asteraceae	<i>Hypochaeris radicata</i>	hairy cat's ear, gosmore	Herb	16
Asteraceae	<i>Senecio madagascariensis</i>	fireweed	Herb	23
Asteraceae	<i>Senecio sylvaticus</i>	woodland ragwort	Herb	9.5
Asteraceae	<i>Taraxacum officinale</i>	common dandelion	Herb	20
Geraniaceae	<i>Erodium cicutarium</i>	alfalaria, pin clover	Herb	14
Myrtaceae	<i>Eucalyptus</i> spp.	eucalyptus	Tree	2-11
Onagraceae	<i>Epilobium billardierianum</i>	willow herb	Herb	7
Poaceae	<i>Anthoxanthum odoratum</i>	sweet vernal grass	Grass	11
Poaceae	<i>Bromus catharticus</i>	rescue grass	Grass	19
Poaceae	<i>Holcus lanatus</i>	velvet grass	Grass	20
Poaceae	<i>Poa pratensis</i>	Kentucky bluegrass	Grass	14
Poaceae	<i>Rytidosperma semiannulare</i>	wallaby grass	Grass	2.5
Scrophulariaceae	<i>Verbascum thapsus</i>	common mullein	Herb	11
Scrophulariaceae	<i>Verbascum virgatum</i>	wand mullein	Herb	9

Table 5. A selection of introduced species on adjacent lands. Table includes non-native plants currently growing in areas adjacent to the Management. These species are to be targeted in early detection/monitoring surveys. High priority species found on adjacent lands are shaded and shown in bold.

Family	Scientific Name	Common Name	Morphology	HPWRA
Anacardiaceae	<i>Schinus terebinthifolius</i>	Christmas berry	Shrub	19
Aquifoliaceae	<i>Ilex aquifolium</i>	English holly	Tree	17
Asteraceae	<i>Erigeron bonariensis</i>	hairy fleabane	Herb	17
Asteraceae	<i>Delairea odorata</i>	German ivy	Vine	14
Caprifoliaceae	<i>Lonicera japonica</i>	Japanese honeysuckle	Vine	12
Caryophyllaceae	<i>Cerastium fontanum</i>	mouse-ear chickweed	Herb	11.5
Caryophyllaceae	<i>Stellaria media</i>	Chickweed, stitchwort	Herb	15
Cupressaceae	<i>Cryptomeria japonica</i>	sugi pine	Tree	5
Chenopodiaceae	<i>Salsola kali</i>	Tumbleweed	Shrub	18.5
Fabaceae	<i>Ulex europaeus</i>	common gorse	Shrub	20
Juncaceae	<i>Juncus effusus</i>	Japanese mat rush, soft rush	Grass	21

Family	Scientific Name	Common Name	Morphology	HPWRA
Onagraceae	<i>Fuchsia spp.</i>	fuchsia	Shrub	15
Passifloraceae	<i>Passiflora tarminiana</i>	banana poka	Vine	24
Pinaceae	<i>Pinus spp.</i>	pine	Tree	-1-13
Poaceae	<i>Andropogon virginicus</i>	broomsedge, yellow bluestem	Sedge	20
Poaceae	<i>Axonopus fissifolius</i>	carpetgrass	Grass	16
Poaceae	<i>Ehrharta stipoides</i>	weeping grass, meadow ricegrass	Grass	19
Poaceae	<i>Paspalum dilatatum</i>	dallis grass	Grass	12
Poaceae	<i>Agrostis stolonifera</i>	creeping bent grass	Grass	21
Ranunculaceae	<i>Anemone hupehensis</i>	Japanese anemone	Herb	8
Rosaceae	<i>Rubus argutus</i>	Florida blackberry	Shrub	21.5

Table 6. A selection of introduced species on the island of Hawai'i. This abbreviated list is limited to a) species previously eradicated from the Management Area, b) species identified as invasive by adjacent land owners, and/or c) other species that potentially can survive and reproduce in the high elevation environment. High priority species are shaded and shown in bold.

Family	Scientific Name	Common Name	Morphology	HPWRA
Asclepiadaceae	<i>Gomphocarpus physocarpus</i>	balloonplant	Herb	8
Asteraceae	<i>Cirsium vulgare</i>	bull thistle	Herb	18.5
Crassulaceae	<i>Kalanchoe delagoensis</i>	chandelier plant	Succulent	19
Cucurbitaceae	<i>Coccinia grandis</i>	ivy gourd	Vine	21
Cyatheaceae	<i>Cyathea cooperi</i>	Australian tree fern	Tree	8
Euphorbiaceae	<i>Ricinus communis</i>	castor bean	Herb, Shrub	21
Marattiaceae	<i>Angiopteris evecta</i>	mule's foot fern	Herb	8
Myriaceae	<i>Morella faya</i>	firetree	Shrub	17
Oleaceae	<i>Fraxinus uhdei</i>	tropical ash	Tree	11
Passifloraceae	<i>Passiflora tarminiana</i>	banana poka	Vine	24
Plantaginaceae	<i>Lophospermum erubescens</i>	creeping gloxinia	Vine	10
Poaceae	<i>Cenchrus setaceus</i>	fountain grass	Grass	26
Proteaceae	<i>Grevillea robusta</i>	silky oak	Tree	5
Rosaceae	<i>Rubus ellipticus</i>	yellow Himalayan raspberry	Shrub	18
Solanaceae	<i>Nicotiana glauca</i>	tree tobacco	Shrub, Tree	15
Solanaceae	<i>Solanum pseudocapsicum</i>	Jerusalem cherry	Shrub	16

5. Vegetation Identification & Collection

Vegetation will need to be confidently identified with some cases requiring detailed photographs or sample collection to confirm identification. A confirmed ID will allow OMKM to determine if the plant species poses a resource threat and therefore be able to produce an appropriate and effective response plan. Hence, proper IDs and collection protocol are vital for effective early detection.

5.1. Priority Plant Threats

If the plant species is established within the Management Area and is a high priority plant threat, refer to the response plan³ for that particular species. All introduced species within the MKSR and high priority plant threats within the road corridor and HP are to be recorded (scientific name, quantity, maturity, and location - GPS if possible) and pulled if confident in identification. Be sure to pull the entire root to prevent re-sprouting. Once pulled, place the plant in a sealed bag and dispose of the bag in a trash receptacle to prevent further dispersal.

Any non-native vegetation not documented as established within the UH Management Area, but observed or possibly observed on UH lands shall be recorded with a GPS point and a photo. You may also collect a small representative sample (branch, flower, seed head, leaves, etc.), but you **must** be sure that you have a Ziploc bag or sealed container to prevent dispersal. Take as many notes as possible about the plant's characteristics, surrounding area, maturity, and quantities.

Any collected vegetation samples can go in the refrigerator until they can be confidently identified to species. All recorded data, GPS coordinates/general locations, and photos are entered into the OMKM Incipient Plant Control Activity Log. If a response plan is required, more intensive record keeping may be required along with extra surveying requirements.

5.2. Native Plant Species

If the species is endangered (i.e. Maunakea silversword) and tags are not observed near the base of the individual, take a few photos, a GPS point, and observational notes about the area and plant characteristics. New endangered species locations should be reported to the Hawai'i Island Division of Forestry and Wildlife staff (DoFAW). Known endangered species locations with confident native IDs should be recorded. If the native species is not endangered, it should still be recorded along with pertinent observations about the plant and surrounding area.

If not confident in a plant's identification, try to determine nativity using this SOP. Otherwise, you can take photographs, record details about the plant, and note its location with a GPS point. Collecting samples that could possibly be native are highly discouraged (the species could be rare). If confident that the species is introduced, see *Section 5.1* above. If confident that the species is native, note the proper plant ID along with the recorded data in the associated project spreadsheet because typically, native species will only be recorded during specific surveys and not incidentally. However, if an interesting native plant observance is found incidentally, then it can be recorded in the OMKM Incipient Plant Control Activity Log.

6. Vegetation Processing & Reporting

Potential vegetation threats should be reported to the OMKM Natural Resource Program Manager (NRPM) within 24 hours and identified within 1 week of observation. Vegetation can be identified using this SOP, books, experts, websites, and other resources. Photos and descriptions can also be sent to a

³ Response plans for each individual species established within the UH Management area are currently being developed. More information about response plan criteria can be found within the Maunakea ISMP.

State botanist, or the Big Island Invasive Species Committee (BIISC) for identification confirmation. The NRPM will decide whether to involve the Emergency Response Management Committee (ERMC). See *Section 5. Rapid Response* in the MKISMP.

Native and non-native vegetation data is analyzed annually for the OMKM Annual Invasive Species Report. Statistics are conducted by survey type or activity. Continued monitoring and mapping of high priority plant threats and rare native species remains ongoing. This SOP will continue to be updated as the landscape and vegetation changes.

7. Revision History Log

New Version #	Version Date	Author	Changes Made	Reason for Change
1.0	8/17/15	JK	Original version.	
2.0	10/21/15	DY	Updated with general BIISC staff comments	Needed outside opinion
2.1	01/19/16	DY	Updated with Springer comments and general minor edits & re-org.	Technical review of SOP
2.2	03/28/16	DY	Updated with HPWRA scores	Required HPWRA scores for all spp.
Add rows as needed for each change or set of changes associated with each version.				

8. Recommended Citation

Kirkpatrick, J, Yogi, D., Klasner, F, & Nakatsu, K. 2016. *Standard Operating Procedure D, Maunakea Plant Threats, Identification, Collection & Processing Guide*. V2.2. 35 pp. In: Vanderwoude, C., F. Klasner, J. Kirkpatrick and S. Kaye. 2015. Maunakea Invasive Species Management Plan. Technical Report No. 191. Pacific Cooperative Studies Unit, University of Hawai'i, Honolulu, Hawai'i.

Appendices: Plant Identification Guides



Appendix A: Vegetation Terminology




- **Achene:** a small, dry, one- seeded, indehiscent fruit, deriving from a one-chambered ovary, typical of *Asteraceae*
- **Adaxial:** situated on the side toward the axis
- **Apex:** the tip of a plant part
- **Attenuate:** tapering gradually to a narrow extremity
- **Awns:** a bristle-like appendage of a plant, especially on the glumes of grasses
- **Blunt leaves:** having an obtuse, thick, or dull edge or point; rounded; not sharp
- **Capitulum:** a raceme consisting of tightly packed head of almost stalk-less flowers, as in the *Asteraceae*.
- **Cauline:** attached to or referring to the stem, as opposed to basal, often used to describe a leaf
- **Chevron:** V-shaped pattern
- **Compound:** made up of two or more similar parts, as in a leaf which has leaflets
- **Conduplicate:** leaf in the bud, folded lengthwise with the upper face of the blade within
- **Corolla:** collective term for the petals of a flower
- **Crenate:** with shallow roundish or bluntish teeth on the margin, scalloped
- **Culms:** the stem of grasses, sedges, and rushes
- **Cyme:** a broad, flat- topped inflorescence in which the central flower is the first to open
- **Decumbent:** flat at the base but ascending at the end
- **Decussate:** arranged in pairs along the stem with each pair at right angles to the one above and below
- **Drupe:** a fleshy indehiscent fruit enclosing a nut or hard stone containing generally a single seed as a peach or cherry
- **Elliptic:** broadest near the middle and tapering gradually to both ends
- **Filiform:** 1) Threadlike 2) A type of flower in the *Asteraceae* which is pistillate has a very slender, tubular corolla
- **Foliolate:** having leaflets
- **Glabrous:** smooth, without hairs
- **Glandular:** with glands, sticky dots or secretions
- **Globoid:** having a globe- like shape
- **Indehiscent:** not opening by itself, said of a seed pod
- **Inflorescence:** the discrete flowering portion or portions of a plant; a flower cluster
- **Keel:** the two lower petals of most pea flowers, united or partially joined to form a structure similar to the keel of a boat
- **Lanceolate:** significantly longer than wide and widest below the middle, gradually tapering towards the apex.
- **Lobed:** more or less deeply cut but not as far as the midrib
- **Mucronate:** having a short projection at the tip, as a leaf
- **Node:** a point on a stem where leaves or branches originate
- **Oblanceolate:** inversely (direct opposite) lanceolate
- **Oblong:** two or four times longer than broad with nearly parallel sides, but broader than linear
- **Obtuse:** blunt or rounded at the apex
- **Ovate:** egg-shaped, wider below the middle




- **Panicles:** a compound inflorescence in which the branches are racemose and the flowers are pedicelled on the branches
- **Paniculate:** arranged in panicles
- **Pedicel:** the stalk of a single flower that is part of an inflorescence
- **Pinnae:** one of the primary divisions of a pinnate leaf
- **Pinnate:** with separate segments which are arranged feather-like on either side of a common axis
- **Pinnatifid:** so deeply cleft or cut as to appear pinnate
- **Pistillate:** a female flower that has two or more pistils but no functional stamens
- **Puberulent:** minutely pubescent
- **Pubescent:** Hairy
- **Raceme:** inflorescence in which flowers are borne on short pedicels lying along a common axis, or in which the short pedicels with single flowers of the simple raceme are replaced by racemes.
- **Racemose:** having the form of a raceme
- **Ray Florets:** a tiny flower at the circumference of a composite disk having a showy ray or strap
- **Rhizomes:** an underground stem capable of producing new stems or plants at it's nodes
- **Rosette:** a cluster of leaves in a circular arrangement at the base of a plant, often called the basal rosette
- **Scabrous:** having a rough surface because of minute points or projections
- **Scadent:** climbing
- **Serrate:** having sharp, forward-pointing teeth on the margin
- **Sheathing:** protective outer covering
- **Solitary:** flowers that grow singly
- **Sori:** plural of sorus, a cluster of spore producing receptacles on the underside of a fern frond
- **Spike:** An unbranched inflorescence in which the flowers are along an elongate axis
- **Spikelets:** A secondary or small spike
- **Spores:** An asexual propagule in a discriminate space found on ferns and fern allies
- **Subglabrous:** nearly glabrous
- **Sub-racemose:** growing in the form of a raceme
- **Terete:** circular in cross-section
- **Terminal:** at the end of a branch or stem
- **Verticillaster:** a whorl or flowers of one cluster, but composed of two opposite axillary cymes, as in mint
- **Whorls:** a circle of three or more structures radiating outward from the same node




Appendix B: Native Species within the Management Area



Pictorial and brief narrative guide to common native plant species found within the management area, organized by morphology (grass, fern, shrub, etc.) and sorted alphabetically by scientific name.



Native Species		
Common Name (Scientific Name)	Physical Description	Image
Native Grasses		
Hawai'i bentgrass <i>(Agrostis sandwicensis)</i>	Grass, densely clumped, scabrous leaf blades are 30-50 cm long, 1-2 mm wide. Has numerous spikelets that are often tinged purple. Seed heads are not robust.	 <p>(Forest & Kim Starr)</p>
He'upueo, Pacific bentgrass <i>(Lachnagrostis filiformis)</i>	Annual or perennial grass. Rhizomes present, short. Leaf-blades filiform, flat, or conduplicate. Inflorescence compound, a panicle with spikelets clustered towards branch tips.	 <p>(University of California, UHM, AUSGrass)</p>



Native Species			
Common Name (Scientific Name)	Physical Description	Image	
Pili uka, Mountain pili (<i>Trisetum glomeratum</i>)	Grass, stems less than 1 m in height with smooth leaves sheathing at base. The leaf blades 2-10mm wide. Has a spike-like structure at the top of the stem with many loose spikelets. Robust seed heads.	 <p>(Forest & Kim Starr)</p>	
Native Ferns			
'Iwa'iwa, Spleenwort fern (<i>Asplenium adiantum-nigrum</i>)	Fern, thick triangular leaf blades divided into segments. 20 cm X 6 cm fronds. The undersides of leaves have sori arranged in chains, that are usually brown- orange in color.	 <p>(Amber Stillman, 2013)</p>	
'Oāli'i, 'Owāli'i (<i>Asplenium trichomanes</i>)	Fern, long and narrow (20 cm X 1.5 cm) fronds with small oblong leaves. Has a dark, wiry leaf stalk. The undersides of leaves have long narrow sori.	 <p>(Forest & Kim Starr)</p>	

Native Species			
Common Name (Scientific Name)	Physical Description	Image	
<p>Douglas' bladderfern (<i>Cystopteris douglasii</i>)</p>	<p>Fern, leaf blades are feathery and ovate with obtuse tips. The stems are slightly winged, especially towards the tips.</p>		
<p>Alpine woodfern (<i>Dryopteris wallichiana</i>)</p>	<p>Fern, grows in a distinctive crown shape. The stalk is covered with golden scales. The glossy rich green fronds are divided twice with deeply lobed pinnae. Spores are arranged in clusters between the leaf margin and midrib at the end of small veins.</p>		
(Kim & Forest Starr)			
<p>Kalamoho (<i>Pellaea ternifolia</i>)</p>	<p>Fern, with thin, straight, dark, compact stems (10-50 cm) with clustered linear-ovate leaves (2.5-8 cm).</p>		<p>(C. H. Lamoureux)</p>




Native Species			
Common Name (Scientific Name)	Physical Description	Image	
Kīlau, Bracken fern (<i>Pteridium aquilinum</i>)	Fern, slightly glossy, with bright green fronds that are divided three times. Stalks are stiff, shiny, and golden colored. Fronds grow as creeping subterranean rhizomes rather than in clusters.	 <p>(Forest & Kim Starr)</p>	
Native Herbs			
Pua Kala, Hawaiian poppy (<i>Argemone glauca</i>)	Perennial herb covered with yellow, stiff prickles and white flowers. Flowers have 6 broad, crinkled, white petals with numerous yellow stamens, and a dark purple, lobed stigma. Leaves are glaucous blue-green with whitish veins, alternate, deeply pinnately lobed, and covered in spines.	 <p>(Wildlife of Hawai'i)</p>	
Hawai'i wood rush (<i>Luzula hawaiiensis</i>)	Perennial herb, basal leaves with densely pubescent margins. Terminal inflorescences pale yellowish, brown, and or dark brown.	 <p>(Forest & Kim Starr)</p>	


Native Species			
Common Name (Scientific Name)	Physical Description	Image	
'Ena'Ena (<i>Pseudognaphalium sandwicense</i>)	Herb, often fragrant or resinous-smelling. Modestly to very densely woody. Leaves are hairy, with lower leaves often forming a rosette. The flowers are terminal cluster of heads.		
Native Vines			
Little-leaf stenogyne, (<i>Stenogyne microphylla</i>)	Scandent vines up to several meters long. Square stem, small, simple, glabrous leaves 0.4-1.3 cm long, margins crenate or lobed, usually greenish purple in color. Flowers 2(4-6) per verticillaster; calyx lobes obtuse or acute but not lanceolate; corolla tube greenish yellow, lobes brownish green to pinkish brown.		
			(Hear.org)

Native Species			
Common Name (Scientific Name)	Physical Description	Image	
<p>Mā`ohi`ohi, (<i>Stenogyne rugosa</i>)</p>	<p>Decumbent vines or erect herbs, 2-7dm tall, spreading by rhizomes. Square stem, leaf surfaces are glabrous or densely tomentose, margins finely or coarsely serrate, apex acute. Flowers 2-16(-24) per verticillaster; wide at base, corolla dark to dull red, or green with brown inged corolla lobes. Extremely variable, hybridize with <i>S.microphylla</i>.</p>	 <p style="font-size: small; margin-top: 5px;">(Forest & Kim Starr)</p>	
Native Shrubs			
<p>‘Āhinahina, Maunakea silversword, (<i>Argyroxiphium sandwicense sandwicense</i>)</p> <p>ENDANGERED</p>	<p>Rosette that has narrow pointed leaves (forms a sphere). Leaves are covered by a dense silver hair. Adults have a flowering stalk that produces yellow to maroon sunflower-like flowers and the stock can reach up to 2 m.</p>	 <p style="font-size: small; margin-top: 5px;">(OMKM)</p>	

Native Species			
Common Name (Scientific Name)	Physical Description	Image	
<p>ʻĀweoweo, ʻĀheahea (<i>Chenopodium oahuense</i>)</p>	<p>Grows as a shrub to a small tree 2-8 ft. tall with light blue – green leaves that are in the shape of a goose’s foot. Leaves smell like fish.</p>		
(Kim & Forest Starr)			
<p>Naʻenaʻe, Maunakea dubautia, (<i>Dubautia arborea</i>)</p>	<p>Large shrubs or small trees up to 6 m tall. Young shoots somewhat long-hirsute and also rather appressed pubescent as well as conspicuously glandular, often somewhat sooty in appearance. Leaves ternate chartaceous, foetid when fresh, elliptic-lanceolate to elliptic-oblong, 3-9 cm long, .8- 2.4 cm wide, usually 5 nerved. Heads 5-30, arranged racemously or subverticillately. Florets 9-45 per head, corollas yellowish orange.</p>		
(Forest & Kim Star, OMKM)			




Native Species			
Common Name (Scientific Name)	Physical Description	Image	
<p>Na'ena'e, Lava dubautia (<i>Dubautia ciliolata glutinosa</i>)</p>	<p>Erect, many-branched shrub. 0.4-3 cm long leaves ternate, opposite, or alternate near inflorescence, narrowly elliptic. Apex usually acute, base usually rounded, sessile. Flowers have 4-18 florets per head, yellow petals.</p>	<p style="font-size: small; text-align: right;"> <i>Dubautia ciliolata</i> subsp. <i>glutinosa</i> Asteraceae © G. D. Carr </p> <p style="font-size: x-small; text-align: right;"> © G. D. Carr </p>	
<p>Nohoanu, Hinahina (<i>Geranium cuneatum hololeucum</i>)</p>	<p>Compact, erect, many branches 3-10 dm tall. Leaves are alternate, oblong cunteeate, silvery and covered with silky hairs. The leaf edges have 3 triangular teeth. Stems and branches are reddish to black. Flowers with white or cream colored with visible veins.</p>	<p style="text-align: right;">(OMKM, Kim & Forest Starr)</p>	
<p>Pūkiawe, (<i>Leptecophylla tameimeiaie</i>)</p>	<p>Small, narrow, sharply pointed leaves; dull green color on the topside, and pale silvery, white underneath. The fruits are small, round red to white drupes.</p>		


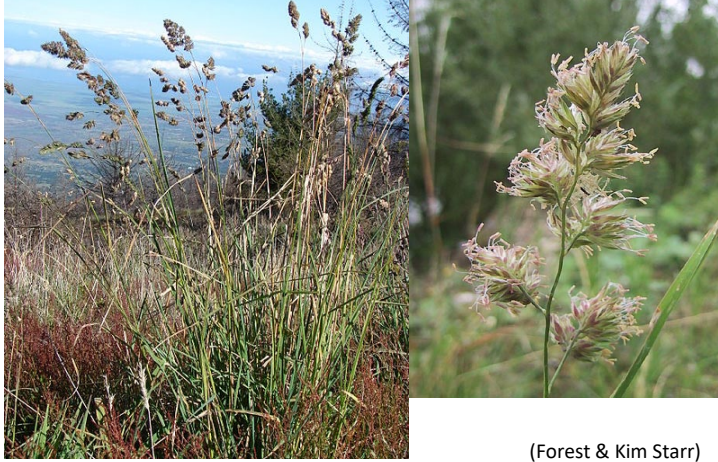

Native Species			
Common Name (Scientific Name)	Physical Description	Image	
Alpine catchfly (<i>Silene strutioloides</i>)	Shrub, with many branches that come from the base. Leaves are rigid, ascending to erect, glabrous or sometimes sparsely puberulent on young leaves. Flowers in elongate, narrow, paniculate or subracemose cymes. Seeds are reddish brown.		
		(Kim & Forest Starr)	
Alpine tetramolopium (<i>Tetramolopium humile humile</i>)	Dwarf shrub, has linear-oblong leaves. Flower heads are solitary, florets are white or tinged lavender. Petals are tubular, pink to purple, sometimes yellow.		
		(Forest & Kim Starr)	
'Ōhelo, 'Ōhelo 'ai (<i>Vaccinium reticulatum</i>)	Shrub with leathery oval leaves that are red when young, and green or green with reddish patches when adults. Flowers are tubular-bell-shaped, and red, yellow, or pink. The fruit is an edible berry that is red, orange, or yellow.	(Michael Kesi)	
Native Trees			


Native Species		
Common Name (Scientific Name)	Physical Description	Image
Māmane (<i>Sophora chrysophylla</i>)	Yellow pea-like flowers clustered at the branch tips. Leaves are green, drooping, and pinately compound with paired oval leaflets. The 3-5 inch long brown seed pods are rigid along the edges and contain small, rounded, bright yellow to orange colored seeds.	 <p>(OMKM)</p>

Appendix C: Introduced Species within Management Area




Pictorial and brief narrative guide to common introduced plant species found within the Management Area, organized by morphology (grass, fern, shrub, etc.) and sorted alphabetically by scientific name. The HPWRA score and priority for each species is displayed if available. Within the MKSR, all introduced species, regardless of priority, are removed when encountered.



Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Introduced Grasses		
Sweet vernal grass (<i>Anthoxanthum odoratum</i>) HPWRA:11 Priority: Med	Grass, stems are around 25-40 cm tall, with short broad green leaves that are slightly hairy. The flower spikes have spikelets that are oblong shaped. The seedhead is bright yellow. It has a sweet scent.	 <p>(Rolv Hjelstad, Forest & Kim Starr)</p>
Rescue grass (<i>Bromus catharticus vahl</i>) HPWRA: 19 Priority: High	Grass, grows up to 1 m. Has linear leaves oriented opposite of each other. It has flat, pointed spikelets that are often tipped with awns. Its flower is yellow.	 <p>(Paulo Schwirkowski, Gary P. Flemming)</p>
Ripgut grass (<i>Bromus diandrus</i>) HPWRA: 18 Priority: High	Up to 1 m high with hairy, leaves about 1 cm wide. The hairs face backwards, and are barb-like. The wide seed head has a large, splayed spikelet.	 <p>(Carol W. Witham)</p>




Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Kikuyu grass⁴ (<i>Chenchrus clandestinus</i>)</p> <p>HPWRA:18 Priority: Med</p>	<p>Spreads by producing a network of thick, fleshy stems that root at the nodes, often form a thick mat above the surface or an underground network of rhizomes. Leaf blades are pointed at the tips, light green, and flat. Leaves and stems are slightly hairy.</p>	 <p>(Forest & Kim Starr)</p>
<p>Cocksfoot, Orchard grass (<i>Dactylis glomerata</i>)</p> <p>HPWRA: 18 Priority: High</p>	<p>Has leaves 20-50 cm long and 1.5 cm broad. Has a tufted triangular flowerhead which may be green, red, or purple, or pale grey-brown at maturity. The spikelets contain two-five flowers. Has a stem base that is flattened.</p>	 <p>(Forest & Kim Starr)</p>
<p>Velvet grass (<i>Holcus lanatus</i>)</p> <p>HPWRA: 20 Priority: High</p>	<p>Velvety grey-green leaves. The shoots are round, and the bases are white with pink stripes. The flower is robust and often tinged purple.</p>	 <p>(Forest & Kim Starr, James K. Lindsey)</p>



Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Needlegrass (<i>Nassella cernua</i>) HPWRA: 9 Priority: Med	Grass forms a tufted bunch, and flower stems can be up to 1 m tall with numerous basal leaf blades. The seed heads are thin, purplish, and dry to silver.	
Annual bluegrass (<i>Poa annua</i>) HPWRA: 25 Priority: High	Slightly creeping, fibrous rootstock with triangular shaped branching structures. The spikelets are stalked and awnless and sometimes tinged purple. The leaves are short and blunt, soft and drooping, and are finely serrated. The stem has long sheaths.	
Kentucky bluegrass (<i>Poa pratensis</i>) HPWRA: 14 Priority: Medium	Grass, broad, blunt leaves at the base, forming close mats. Conical flower with 3-5 branches in the basal whorls, and the oval spikelets have 2-5 florets that are purplish-green or grey.	

(Kim & Forest Starr)



Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Wallaby grass (<i>Rytidosperma semiannulare</i>) HPWRA: 2.5 Priority: Low	Perennial grass, culms erect, mid-culm nodes glabrous. Leaf-sheaths and blades glabrous on surface. Inflorescence solid, panicle lanceolate. Spikelets pedicelled, many flowers.	 (Kim & Forest Starr)
Brome fescue (<i>Vulpia bromoides</i>) HPWRA: 18 Priority: High	Annual grass, culms erect or decumbent, leaf sheaths without keel, smooth, glabrous on surface. Leaf- blade surface pubescent, hairy adaxially. Leaf-blade margins scabrous, apex attenuate. Panicle inflorescence, open or contracted, lanceolate or oblong, scabrous.	 (Forest & Kim Starr)
Introduced Herbs		
Common yarrow (<i>Achillea millefolium</i>) HPWRA: 19 Priority: High	Perennial herb, leaves lanceolate to linear. Flowers are ray florets usually 3- 5 per head, rays white to pink, 10-20 disk florets per head.	 (Forest & Kim Starr)




Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Spanish needle (<i>Bidens pilosa</i>)</p> <p>HPWRA: 23 Priority: High</p>	<p>Erect herb up to 100cm tall, with slender, stiff, 4-angled stems and spreading branches. Leaves decussately opposite, pinnately 3-5 foliolate, up to 15 cm long, sometimes lower leaves are simple without stipules. Leaflet blade ovate-lanceolate, margins usually serrate or crenate-serrate. Ray flowers absent or 4-8, disk flowers tubular, yellow corolla; stamens infused. Fruit is a linear achene.</p>	 <p>Photo: R.R. Schippers</p> <p>(Forest & Kim Starr, database.prota.org)</p>
<p>Willow herb (<i>Epilobium billardierianum</i>)</p> <p>HPWRA: 7 Priority: Low</p>	<p>Erect herb, grows up to 100 cm high. The stems are hairy and often woody at the base. The leaves are linear-ovate, and may be toothed. The flowers are small, purplish pink or white.</p>	 <p>(Forest & Kim Starr)</p>




Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Alfilaria, Pin clover (<i>Erodium cicutarium</i>)</p> <p>HPWRA: 14 Priority: Med</p>	<p>Herb, stems decumbent, slender. Leaves are pinnately compound, leaflets pinnatifid, stipules lanceolate. Flowers are peduncles, apex mucronate with white bristles, petals rose lavender, stiffly pubescent, the apical portion is glabrous. Seeds are dull brown and ellipsoid.</p>	 <p>(Forest & Kim Starr)</p>
<p>California poppy (<i>Eschscholzia californica</i>)</p> <p>HPWRA: 14 Priority: Med</p>	<p>Feathery, highly-dissected, blue green leaves. Leaves are ternate with 3 finely divided lobes, and are nearly glabrous. Flowers are solitary with 4 petals, long stalks, and vary in color from orange to yellow. Presence of torus rim.</p>	 <p>(Forest & Kim Starr)</p>
<p>Telegraph weed (<i>Heterotheca grandiflora</i>)</p> <p>HPWRA: 14 Priority: Med</p>	<p>Herb, tall and bristly, densely foliated in hairy to spiny toothed or lobed leaves. The leaves are smaller and more widely spaced toward the top of the stem. Stems and leaves covered in fine, white sticky hairs. Leaves emit a characteristic odor when crushed. The flowers are small and daisy-like, that matures into a white puff of seeds.</p>	 <p>(Forest & Kim Starr)</p>



Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Hairy cat's ear, Gosmore (<i>Hypochaeris radicata</i>) HPWRA: 16 Priority: Med	Herb, leaves that may grow up to 20 cm, forming a low-lying rosette. The forked stems have bright yellow flower heads that mature into a white puff of seeds. Has a milky sap when cut.	
Chilean evening primrose (<i>Oenothera stricta</i>) HPWRA: 10 Priority: Med	Erect herb, basal leaves green, oblanceolate with conspicuous mid-rib, inconspicuous veins base often attenuate, sessil; cauline leaves lanceolate, margins shallowly toothed, apex acute, sessile. Flower petals yellow, often with red at base.	

(Queensland Gov.)

Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Sheep sorrel (<i>Rumex acetosella</i> L.)</p> <p>HPWRA: 18 Priority: High</p>	<p>Perinneal herb, arrowhead-shaped leaves and red-tinted deeply rigid stems that are branched at the top. The female flowers are maroon. The male flowers are yellowish-green.</p>	 <p>(Arich Tal, Forest & Kim Starr)</p>
<p>Fireweed (<i>Senecio madagascariensis</i>)</p> <p>HPWRA: 23 Priority: High</p>	<p>Daisy-like herb that generally grows low and can have a single main stem or several. Alternately arrange simple leaves narrow and elongated. Leaf margins are usually toothed or serrated, but may be lobed. The yellow flowers have thirteen petals, and mature into a white puff of seeds. Toxic, and should not be eaten. Stems and leaves are hairless or purbulent.</p>	 <p>(Forest & Kim Starr)</p>




Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Woodland ragwort (<i>Senecio sylvaticus</i>) HPWRA: 9.5 Priority: Med	Annual herb, erect, sparsely crinkly pubescent. Leaves oblanceolate to oblong, pinnately veined. Flower are yellow with heads in terminal, paniculate cymes. Slimmer, longer internodes, capitulum is narrow and erect compared to <i>S.vulgaris</i> .	 <p>(Kim & Forest Starr, virboga.de.htm)</p>
Common groundsel (<i>Senecio vulgaris</i>) HPWRA: 14 Priority: Med	Annual herb, either erect or ascending, sparsely crinkly pubescent to subglabrous. Leaves oblanceolate in outline, pinnately veined, coarsely pinnatifid. Yellow, disk corollas flower heads are in terminal.	 <p>(Kim & Forest Starr)</p>
Common dandelion (<i>Taraxacum officinale</i>) HPWRA: 20 Priority: High	Herb, stems are typically 5-40 cm tall, generally unbranched, and can be tinted purplish. The stems produce yellow flower heads that mature into a white puff of seeds. The leaves are 5-45 cm long and 1-10 cm wide, and are oblong in shape and are often lobed/toothed.	




Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Lance clover (<i>Trifolium arvense</i>)</p> <p>HPWRA: 13.5 Priority: Med</p>	<p>Erect to ascending stems are medium green, hairy, and terete. Alternate trifoliate leaves occur at intervals along stems. Leaves are elliptic and have short hairy petioles, with smooth and ciliate margins, sometimes tiny teeth are towards the tip. Flower heads are pinkish gray with a fuzzy- hair appearance and are globoid to short-cylindrical in shape.</p>	 <p>(Forest & Kim Starr)</p>
<p>Common mullein (<i>Verbascum thapsus</i>)</p> <p>HPWRA: 11 Priority: Med</p>	<p>Biennial hairy herb that can grow up to 2 m or more. Has small, yellow flowers that are densely grouped on a tall stem, which bolts from a large rosette of leaves.</p>	
<p>Virgate/ Wand mullein (<i>Verbascum virgatum</i>)</p> <p>HPWRA: 9 Priority: Med</p>	<p>Biennial herb, hairs forked or simple. Basal leaves obovate. Flowers in clusters of 1-5 per node, corolla yellow, lobes pubescent externally, upper 3 staminal filaments densely white or violet villous, the lower 2 violet villous.</p>	 <p>(Mark Imhof, Victorian Resources Online)</p>

Introduced Species within UH Management Area		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Introduced Shrubs		
Broom (tagasaste), <i>(Cytisus prolifera palmensis)</i> HPWRA: 14 Priority: Med	Can grow up to 4 m tall; branches long, leafy, tomentose. Leaflets narrowly elliptic. Flower corolla white or pale yellow 15-20mm long. Pods linear- falcate, brown pubescent. Seeds oblong, ellipsoid slightly laterally flattened.	 <p style="text-align: right;">(Forest & Kim Starr)</p>
Introduced Trees		
Eucalyptus <i>(Eucalyptus spp.)</i> HPWRA: -3-11 Priority: Med	Evergreen tree with alternate or opposite, simple, smooth-margined leaves. Flowers in small clusters, four petals with many stamens. The fruit is a many-seeded capsule. Poisonous leaves and bark.	 <p style="text-align: right;">(Kim & Forest Starr)</p>

Appendix D: Selection of Introduced Plants on Adjacent lands

Pictorial and brief narrative guide of targeted introduced plant species found on lands adjacent to the Management Area. These species are not currently on UH managed lands, but are **likely to be invasive** on Maunakea if they become established. Some of the species have been previously eradicated from the Management Area and are indicated as “HISTORIC.” This table is organized by morphology and sorted alphabetically by the scientific name.

Introduced Species on adjacent land and on Island		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
Introduced Grasses		
Fountain grass, (<i>Cenchrus setaceus</i>) HPWRA: 26 Priority: High HISTORIC	Grass, reaches 1 m in height, and has many purple, fluffy flower spikes with long, arching leaves.	 <p>(Forest & Kim Starr)</p>
Introduced Herbs		
Mouse-ear chickweed, (<i>Cerastium fontanum</i>) HISTORIC HPWRA: 11.5 Priority: Med	Mat forming herb with tear-shaped, hairy leaves that grow opposite to one another in a star pattern. The stems are round and hairy, and are ascending to widely spreading. Small, terminal, white flowers.	 <p>© 2002 Janet Novak</p>
Fleabane (<i>Erigeron bonariensis</i>) HISTORIC HPWRA: 17 Priority: High	Herb, erect stem that branches extensively at the base with tapered, narrow leaves covered in stiff hairs. Stem also has stiff hairs. The flower head looks like a white flower bud, and opens up into a white puff of seeds.	 <p>(Luigi Rignanesi)</p>

Introduced Species on adjacent land and on Island		
Common Name (<i>Scientific name</i>)	Physical Description	Image(s)
<p>Common chickweed (<i>Stellaria media</i>)</p> <p>HISTORIC HPWRA: 15 Priority: Med</p>	<p>Herb, stems across the ground, with the upper portion erect or branching. The leaves are arranged oppositely, and are elliptic. The flowers are small, white, and terminal. Distinguished from Mouse-ear chickweed by single band of fine hairs on stem. (Mouse-ear has dense hair everywhere)</p>	 <p style="text-align: right; font-size: small;">© 2002 Janet Novak</p>
Introduced Shrubs		
<p>Gorse (<i>Ulex europaeus</i>)</p> <p>HPWRA: 20 Priority: High</p>	<p>Evergreen shrub with very small leaves. Has many long thorns and yellow flowers. The fruit is a purplish-brown legume.</p>	 <p style="text-align: right; font-size: small;">(Forest & Kim Starr)</p>
Introduced Trees		
<p>Lodgepole pine (<i>Pinus contorta</i>)</p> <p>HISTORIC</p>	<p>Evergreen shrub/tree that is rounded at the top. The egg-shaped growth buds are reddish-brown and very resinous. The needles are dark and serrated, and are in pairs on short shoots. The cones have prickles on their scales.</p>	 <p style="text-align: right; font-size: small;">(Walter Siegmund)</p>

Appendix E: Plant Identification Overview of Established Species

Native Species

Grasses

He'upueo
Lachnagrostis filiformis



- Spikelets pale green, 2-5mm long
- Leaves hairless or with rough sheath at the base

Hawai'i Bentgrass
Agrostis sandwicensis



- Culms solitary or a few clustered together, glabrous
- Reduced seed heads compared to *Trisetum*.

Pili Uka
Trisetum glomeratum



- Culms densely tufted, robust, glabrous or pubescent

Lava dubautia
Dubautia ciliolata glutinosa



- Leaves are narrowly elliptic
- Many branches

Maunakea dubautia
(*Dubautia arborea*)



- Leaves look sooty, and are either elliptic lanceolate to elliptic oblong
- Multiple heads branch from main stem

Herbs

'Ena'Ena
Pseudognaphalium sandwicensium



- Fragrant, woody stem
- Hairy leaves

Shrubs

Alpine Catchfly
Silene struthioloides



- Flowers usually w 5 petals

Alpine Tetramolopium
Tetramolopium humile humile



- Flowers look like asters (sunflowers)

Ferns

Douglas' Bladderfern
Cystopteris douglasii



- Sori are usually rounded

'Iwa'Iwa –
Asplenium adiantum-nigrum



- Spores arranged in chevron pattern.

Vines

Mā`ohi`ohi
Stenogyne rugosa



- Square stem
- Leaf margins with sharp pointed teeth

Little-leaf Stenogyne
Stenogyne microphylla



- Square stem
- Leaf margins round-toothed or lobed
- Green and purple in color

Introduced Species

Ripgut Grass
Bromus catharticus



- Spikelets compressed laterally, pubescent

Brome Fescue -- *Vulpia bromoides*



- Spikelets with long awns
- Flower heads appear brush-like

Sweet Vernalgrass
Anthoxanthum odoratum



- Inflorescence spike-like

Grasses

Common Groundsel
Senecio vulgaris



- Usually has no ray florets.
- Lacking fragrance
- Sparsely haired, glabrous, bristly
- Irregular branching

Heath Groundsel
Senecio sylvaticus



- Ray florets
- Strong fragrance
- Straight or glandular hairs
- Branching from top

Common yarrow
Achillea millefolium



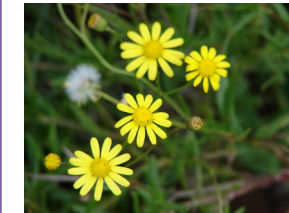
- Flat top rounded cluster of flowers
- Feather-like leaves

California poppy
Eschscholzia californica



- Flowers with 4 petals and usually orange
- Feather-like leaves

Fireweed – *Senecio madagascariensis*



- Flowers have 13 rayed florets

Chilean Evening Primrose
Oenothera stricta



- Stigma of flower has 4 branches in the shape of an X

Hairy Cat's Ear
Hypochaeris radicata



- Hairy texture to leaf surfaces
- Underside of flower, burnt orange in color
- Flower stalks are hairless
- Stems are slimmer than *T. officinale* and not hollow

Common Dandelion – *Taraxacum officinale*



- Flower stalks may have hair
- Leaves are generally glabrous or smooth surface except for hairs on lower surface midrib
- Hollow stem, milky

Spanish needle
Bidens pilosa



- Fruit is linear achene
- Leaf margins serrate

