

EVERGLADES NATIONAL PARK
EXOTIC PLANT CONTROL NOTEBOOK

memorandum

DATE: June 28, 1983

REPLY TO
ATTN OF: Botanist, Resource Management

SUBJECT: Handbook Distribution

TO: All users of the Exotic Plant Control Handbook

This is the Resource Management Exotic Plant Control Handbook. Most of the information which you will need to conduct exotic plant control activities in your district should be contained in the handbook. Updates and revisions of the handbook will be sent out periodically. Photographs of the potential problem exotics will be taken and distributed in the near future. If you have any questions regarding the handbook or suggestions for additional information, please call me at extension 263.

Regina M. Rochefort

Regina M. Rochefort

Enclosure



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(REV. 7-76)
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IN REPLY REFER TO:

United States Department of the Interior

NATIONAL PARK SERVICE

EVERGLADES NATIONAL PARK

AND

FORT JEFFERSON NATIONAL MONUMENT

P.O. BOX 279

HOMESTEAD, FLORIDA 33030

N1617

EVER Memorandum 5287-1

JUN 29 1983

Memorandum

To: All employees, EVER, FOJE

From: Superintendent, EVER

Subject: Vegetation Management Policy

The mandate of the National Park Service is to preserve natural systems for future generations (Organic Act of 1916). Exotic plants are species which do not naturally occur in native ecosystems. Such plants, when capable of successful reproduction and dispersal, pose a major threat to the integrity of natural systems. They may out-compete native species, and completely dominate natural communities.

Everglades National Park is directed to control exotic plants under Public Law 90-583, passed 1968, "to provide for the control of noxious plants on lands under the control or jurisdiction of the Federal Government". Also, the National Park Service further established policy as a result of Executive Order 11987, Exotic Organisms, (May 24, 1977), which concerns control of exotic species. Under guidelines established in the Everglades National Park General Management Plan (August 21, 1979), it is the responsibility of the Resource Management Division to "control exotic plant and animal species when necessary to prevent disruption to native communities.

The Resource Management Specialist, Fire and Vegetation, is designated as the position responsible for the development, implementation, and regulation of Vegetation/Fire/Pesticide management programs for Everglades National Park and Fort Jefferson National Monument. In addition, the Resource Management Botanist position is identified as planning and coordinating resource management programs with particular emphasis on exotic plant control. Both positions are responsible for identifying exotic plant management problems and needs for monitoring and control in Everglades National Park and Fort Jefferson National Monument.

Year of
the
Visitor

Parkwide

The Exotic Plant Control Program is a parkwide program developed as a result of established laws, policies, and guidelines. The program encompasses all exotic plant control activities within the park by the Resource Management, Visitor Protection, Interpretation, Maintenance, Research, and Administrative Divisions. All activities relating to vegetation management will be coordinated and approved through the Resource Management Botanist in accordance with Federal, State, and County laws and NPS policies and guidelines. Management practices will be developed based on current information pertaining to exotic plant control, and native plant communities. Parkwide priorities are established for both the exotic species to be controlled and the sites to be treated. Plants targeted for control will be exotic species which are naturalized and/or show evidence of being capable of invading and dominating native plant communities. The list of target species will be continually updated and revised based on current information. This list will be available in the Everglades Exotic Plant Control Handbook. Parkwide priorities will be further refined within each area or district based on the locations and numbers of each exotic species. The Maintenance Division will be contacted prior to exotic control activities occurring in developed zones. The Interpretive Division will be notified prior to removal of any exotic vegetation which was "planted" in the old Royal Palm State Park. The parkwide guidelines on approved exotic plant control methods have been developed by Resource Management and are in the Everglades Exotic Plant Control Handbook. These guidelines and procedures encompass methods of mechanical control, chemical control (i.e. specific herbicides and application techniques), and identification and possible means for prevention of exotic plant spread. Updates and revisions of the guidelines and procedures will be based on current information regarding the efficacy, cost, and environmental ramifications of control methods for each species. These methods are reviewed and approved, by the Pest Management Coordinator, WAGO.

Developed Zones

The Division of Maintenance will design, and/or approve and implement all plantings in developed zones. These include front country visitor use areas, maintenance facilities, administrative areas, residences, and any other area or areas not designated as natural, wilderness or potential wilderness.

The plant species proposed by the Maintenance Division for landscape use will be reviewed by the Resource Management Botanist to insure the compatibility of a given species and its biogeographic location.

As species are proposed and approved for landscape use within the park, they will be compiled into planting lists (by biogeographic location) for use by the Division of Maintenance. Proposed sites for any plantings will be coordinated with appropriate personnel for safety or other possible conflicts or considerations.

Any questions regarding this policy should be directed to the Resource Management Specialist, Fire and Vegetation, or the Resource Management Botanist.

The attachments following provide a partial listing of applicable laws, policies, and guidelines, as well as literature and research findings regarding exotic plant management and control. All park policies, strategies and methods of exotic plant management are developed in accordance with these and other pertinent and applicable references.

R. B. Smith

John M. Morehead

Enclosures

LAWS, POLICIES, AND GUIDELINES

Organic Act of 1916

The service thus established shall promote and regulate the use of the Federal areas known as national parks, monuments, and reservations hereinafter specified by such means and measures as conform to the fundamental purpose of the said parks, monuments, and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. (U.S.C., title 16, sec. 1.).

Enabling Legislation, 48 Statute 816; To provide for the establishment of the Everglades National Park in the State of Florida...

Sec. 4. The said area or areas shall be permanently reserved as a wilderness, and no development of the project or plan for the entertainment of visitors shall be undertaken which will interfere with the preservation intact of the unique flora and fauna and the essential primitive natural conditions now prevailing in this area. (16 U.S.C. sec. 410c).

Public Law 90-583, 90th Congress, S.2671, October 17, 1968

"To provide for the control of noxious plants on land under the control or jurisdiction of the Federal Government."

Executive Order 11987, Exotic Organisms, May 24, 1977.

Sec. 2. (a) Executive agencies shall...restrict the introduction of exotic species into the natural ecosystems on lands and waters which they own, lease, or hold for purposes of administration; and, shall encourage the States, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the United States.

Department of the Interior, National Park Service, Management Policies, 1978.

Everglades National Park, General Management Plan, 1979.

Draft and Interim Guidelines for Pesticide Use in NPS Areas, 1981.

Everglades National Park, Resource Management Plan and Environmental Assessment, 1982, Section II, B; IV, A; V, D.

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EXOTIC PLANT CONTROL PROGRAM

Exotic Plant Control Program

There are more than 100 exotic plant species in Everglades National Park. They are classified as either: problem exotics, potential problem exotics, or innocuous exotics. Control efforts in Everglades are primarily directed toward species in the problem exotic category.

Problem exotics are plants which are considered pests because they are naturalized (can reproduce) and also have rapidly expanding, large populations. Species in this group are: Schinus terebinthifolius, Casuarina equisetifolia and C. glauca, Melaleuca quinquenervia, and Colubrina asiatica.

Potential problem exotics are naturalized but are not now pest species because they have small, slowly expanding populations. Species in this category need to be carefully monitored since they could become a problem in a very short period of time. A slight change in environmental conditions (ie. hydrologic conditions, fire regime, hurricanes...) could enable the population to explode.

Innocuous exotics are species which are not a control problem at this time. Many of these species are not yet naturalized, although they have the potential to become serious plant pests. There are approximately 130 species in this group.

Treatment Site Priorities

In order to establish each districts treatment site priorities, more information is needed on exotic plant locations and numbers of plants at each site. The exotic plant location maps which were compiled by Ingrid Olmsted illustrate the range of each exotic species, but more specific information is needed to develop control program plans.

The important information which is needed now to develop working plans is:

1. Exact locations of exotic plants.
2. Number and size of plants at each site.
3. Accessibility of each site.

There are a number of potential problem exotic plant species which warrant attention:

Ardisia solanacea (Shoebutton Ardisia)

Albizia Lebbeck (Woman's Tongue)

Bauhinia spp (Orchid Tree)

Bischofia

Brassaia (Schefflera)

Leucaena leucocephala (Lead Tree)

Thespesia populnea (Cork Tree)

In some instances, the potential problem species may be a higher treatment priority than treatment of one of the big 4 species (Casuarina, Colubrina, Melaleuca, Schinus.) This list is dynamic, species may be added or deleted as we learn more about them.

Herbicide Requests

All herbicide requests should be directed to the Resource Management Botanist. Herbicides will be transported in one gallon Nalgene containers. Specimen labels will be affixed to each container. Container tops and bottoms will also be color coded as follows:

Velpar - Black

Garlon - Red

Round-up - Green

CONTROL METHODS & APPLICATION TECHNIQUES

Control Methods and Application Techniques

Most of the control methods practiced in Everglades National Park rely on the application of an herbicide to the target plant. In this part, the use of three herbicides is authorized by SERO: Garlon 4, Round-up, and Velpar.L. Each is authorized for a specific use and application technique as described on its label. Mechanical control is only recommended in a few instances. Control methods and application techniques are summarized in the following table, and more thoroughly described later in the text.

Recommended Exotic Plant Treatment Methods

Target Species	Life Stage	Herbicide & Dilution	Application Technique
<u>Casuarina glauca</u> & <u>C. equisetifolia</u>	adult and sapling	Garlon 4 diesel: Garlon mix 50:1 or 50:2	Basal Bark spray treatment
	seedling	no herbicide	Rip up and remove from site or hang in tree
<u>Melaleuca quinquenervia</u>	adult and sapling	Velpar L undiluted	"Hack and Squirt" or Stump Treatment
	seedling	None	Rip up and re- move from site or hang in tree
<u>Schinus terebinthifolius</u>	adult and sapling	Garlon 4 diesel: Garlon mix 50:1	Basal Bark Spray Treatment
	seedling	Round-up 2% solution in water None	Foliar Spray Rip up and remove

Herbicides are safe and effective if used properly. None of the herbicides used in Everglades National Park are species specific - they will kill almost any plant they are applied to. Therefore, do not allow any herbicide to splash onto adjacent non-target trees or spill onto the ground.

Garlon 4 is a growth regulator; it causes the plant to grow so rapidly that the vascular cells swell, blocking upward movement of nutrients. Velpar L kills plants by inhibiting photosynthesis. Round-up is absorbed by the leaf then causes the plant to starve to death by stopping protein synthesis.

Garlon and Velpar are effective year-round, but highest percent kills will be obtained if the herbicide is applied when plants are actively growing and putting out new leaves. Since Round-up is used as a foliar spray, it is only effective when green foliage is present.

Plants treated with Garlon 4 or Round-up should begin to show some effects about two weeks after treatment. At that time, leaves will start to droop and turn brown; after four to six weeks, the plant should be dead. Some Garlon treated plants may put out new shoots, or retain leaves on a few branches for a couple months after herbicide application and then die. Velpar may require a little longer than Garlon to kill the plant. In fact, some plants treated with Velpar may put out new basal or crown shoots for up to one year after treatment and then eventually die.

There are few records available which describe plant characteristics following herbicide application in the Everglades. Therefore, it is important that you note observations on plant condition and time post treatment on Case Incident Reports.

Treatment and Monitoring Frequencies

Treated plants should be monitored for efficiency of treatment at between 6-12 weeks after the initial treatment. If all treated plants are dead, the site should be monitored annually for resprouts or seedlings. If untreated plants or living, previously treated plants are found, they should be treated at that time, and checked again in six weeks. Sites should be checked at six week intervals and retreatment continued until all adults are dead. At this point the site only needs to be monitored annually. On annual visits, resprouts and seedlings should be treated. Forms for recording treatment and monitoring dates and locations are enclosed to facilitate planning district control work.

Definitions of Application Techniques

Basal Bark Spray Treatment - application of herbicide to a plant by spraying the base of the intact tree stems.

"Hack & Squirt" - introduction of herbicide into a tree through cuts made in the bark; cuts are either made at 3" intervals or to completely girdle the circumference of the tree trunk.

Foliar Spray - application of herbicide to the leaves of the tree.

Rip up & remove - pulling up seedlings or small saplings by hand, then either bagging and removing the plants from the site, or hanging the plants upside down in trees to dry out their roots. Seedlings which are dropped on the ground may resprout.

Stump Treatment - Spraying or painting of freshly cut stumps with an herbicide.

STANDARD OPERATING PROCEDURES

Standard Operating Procedures

For All Treatment Methods

Required Clothing: Long Pants.
Long Sleeved Shirt.
Liquid proof gloves - worn inside shirt sleeves.
Hat.

Optional: Goggles or safety glasses.
Filter mask.
Snake leggings.

Required Safety
Equipment: Portable eyewash kit.
Water to wash off any spilled herbicide.

Cautions for
Herbicide Use: Read labels for handling directions and precautions.
Do not apply herbicides if rain is forecast for up
to six hours post treatment time. If standing water
is present, check with Botanist, Resource Management
before proceeding with basal bark spray treatments.

Velpar: Since Velpar does have herbicidal activity in the
soil, it is particularly important not to allow
any to drip onto the soil.

Basal Bark Spray Treatment

Equipment: Two gallon pressurized spray applicator or quart sprayer.

Procedure:

1. Put on all required clothing.
2. Agitate spray applicator for a few minutes to thoroughly mix dye, herbicide, and carrier.
3. When using 1½ gallon pressurized sprayer, pump it to a low pressure in order to reduce splashing of herbicide.
4. Adjust nozzle to direct stream.
5. Stand upwind of the target tree to apply herbicide.
6. Hold nozzle close to main stem, 12-15 inches above ground and apply herbicide around complete circumference of trunk until run-off at ground line is noticeable.
7. Treat every major stem which originates within 12-15 inches above the ground. Old or rough bark requires more spray than young bark.
8. Agitate spray container every ½ hour to insure proper mixing of ingredients.
9. When you have completed treatment of the site, release pressure in container by opening top. Close top and squeeze trigger on wand to empty wand of residual herbicide.

Foliar Spraying

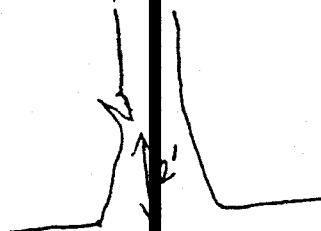
Equipment: 2 gallon pressurized spray applicator.

1. Put on all required clothing.
2. Agitate spray applicator for a few minutes to thoroughly mix dye, herbicide, and solvent.
3. Pump handle of sprayer to obtain high pressure in container.
4. Adjust nozzle to produce a fine spray.
5. Stand up wind of target plants, squeeze wand trigger, and spray foliage of target plants. It is not necessary to thoroughly soak plants, a few drops on the leaves are enough.
6. Agitate container periodically to insure proper mixing.
7. Pump tank as pressure decreases.
8. When treatment of the site is complete, release pressure in container by opening top. Close top and release residual herbicide in wand by squeezing trigger.

Hack and Squirt

Equipment: Quart spray applicator.
Machete or hatchet.

1. Put on required clothing.
2. Adjust nozzle of spray applicator to direct stream.
3. Using a hatchet or machete, make a cut into the tree trunk about two feet above the ground. The cut should be made on a downward angle and should extend into the cambium. The distance into the cambium (depth of the cut) will depend on the tree size. The cut is deep enough if a couple of the tree rings are visible.
4. In using the spray applicator, inject herbicide into the cut or frill. Apply enough herbicide to fill the frill - do not apply so much herbicide that it runs down the tree stem onto the ground.
5. Repeat steps 3 and 4 making cuts at 3 inch intervals around the tree circumference.



Safety and Emergency Procedures

Safety:

The danger of herbicides to humans depends on the toxicity of the chemical's active ingredient, and the length of exposure to the chemical. Toxicity is quantified in tests on laboratory animals and is reflected through the use of signal words on the herbicide label. Three signal words, with the following meanings, are used on herbicide labels:

<u>Signal Word</u>	<u>Toxicity</u>	<u>Approximate amount which will kill the average person</u>
Danger	Highly toxic	A taste to a teaspoonful
Warning	Moderately toxic	A teaspoonful to a tablespoonful
Caution	Low-order toxicity or comparatively free from danger	An ounce to more than a pint

Of the herbicides approved for use in the park, Garlon 4 carries the word "CAUTION" on its label, and Velpar L labels read "WARNING", reflecting this chemical's higher toxicity. Round-up is labeled with the signal word "CAUTION"; however, the signal word on new labels issued by the manufacturer will be "WARNING", due to this chemical's potential for causing eye irritation.

Most pesticide-related deaths are caused by actual ingestion of the chemical.

However, these substances may also enter the body by being inhaled or absorbed through the skin. In fact, it is possible for more herbicide

to enter the body through the skin than through accidental inhalation or ingestion of the chemical. Therefore, it is extremely important that proper safety measures be employed in the use of these herbicides.

As listed in the S.O.P.'s for herbicide use, all required clothing must be worn when working with or around herbicides...Wear trousers outside of boots to keep pesticides from getting inside. Sleeves must extend over (not tucked in) gloves. Also required, to protect the head from splatters, is a hat. While not absolutely required, goggles should be worn to protect the eyes (tissues of the eyes are readily affected by the toxic chemicals in these herbicides). Clothing worn while using herbicides, (whether one hour or one full day) must be washed prior to another wearing. Before eating at any time while using these chemicals, wash your hands with detergent and water. (A container of detergent should be a part of your safety equipment in the field.)

Emergency measures:

If a large amount of herbicide is spilled on your clothing

- remove the clothing immediately; it will only serve to hold the chemical against your skin.

If the herbicide contacts your skin

- wash the area with detergent.
- rinse with large amounts of water.

If you inhale the herbicide

- get to fresh air immediately

If the herbicide gets in your mouth or if you swallow some

- rinse with lots of water

- (do not induce vomiting if Garlon is ingested)

- call a physician and/or Poison Information Center, Parkway General Hospital, 651-1100.

If you get the herbicide in your eyes

- rinse your eyes for 15 minutes.

- call a physician.

In addition to the above emergency procedures, be aware, when using and storing these herbicides, that all three are highly combustible.

In case of fire, water, foam, CO₂, and dry chemical extinguishers are effective on these herbicides.

Trouble Shooting Guide for Pressurized Sprayers

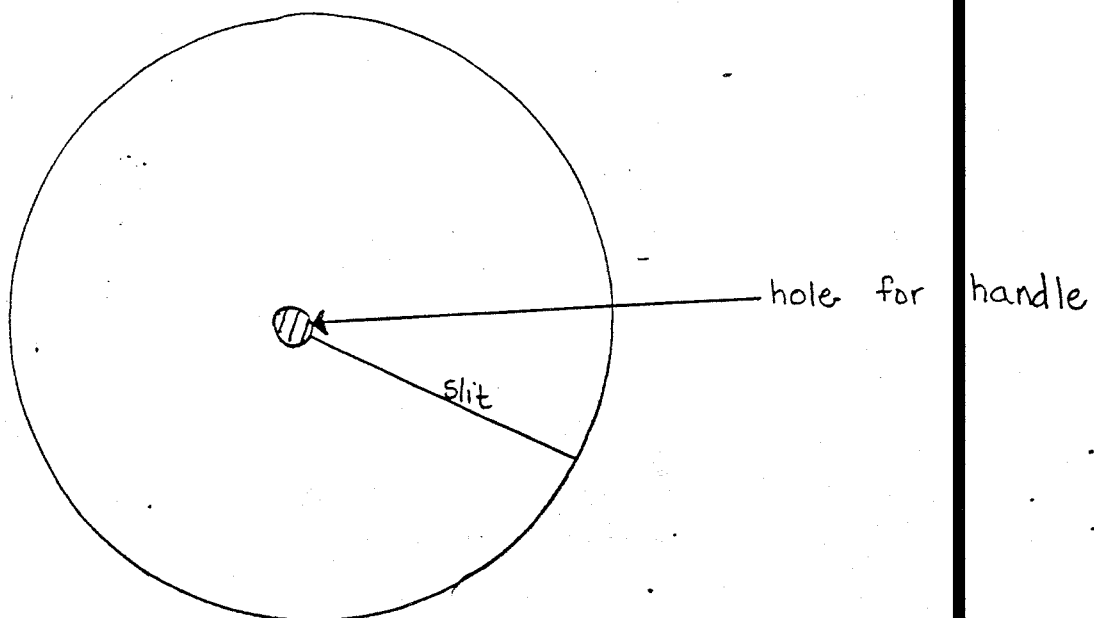
Always thoroughly clean the sprayer after each use. Wash out the tank, the hose, and the nozzle. Check the air pump cylinder and rubber valve to insure that leaves have not fallen into the pump. Lubricate the plunger rod assembly with lightweight oil and reassemble the sprayer for storage.

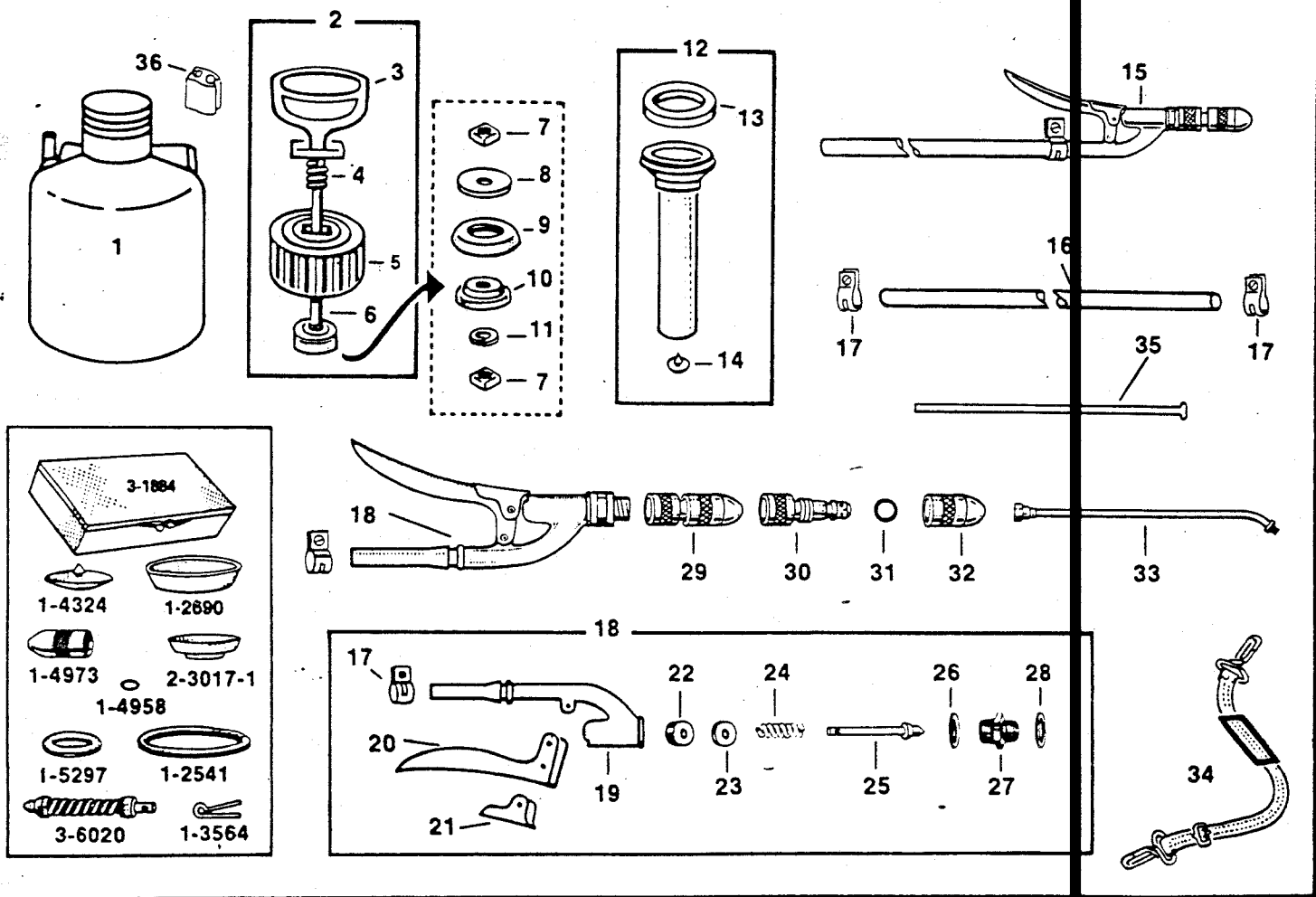
A couple of problems which have occurred with the pumps are:

- 1.) Nozzle will not spray - take the nozzle apart completely ie. unscrew the nozzle base from the handle and unscrew the nozzle cap from the nozzle base. (be careful to save the O ring) Clean out the base and cap. It may be necessary to use a pipe cleaner (a strong twig may suffice in the field) to clean out the interior of each part, the 4 holes on the top of the nozzle base, and the hole at the tip of the nozzle cap. This problem is caused by the detergent which is mixed with the dye; it seems to gel and clog the holes.
- 2.) Herbicide comes out of the holes on the top of the cap, often accompanied by a noticeable escape of air - Remove the pump barrel and clean it out. Leaves drop in through the air holes at the top of the cap and settle in the bottom of the plunger. The leaves often get caught between the valve and pump barrel, breaking the suction

seal; the herbicide is then pulled up through the pump
and out the cap openings.

Prevention measure - you can make a cover for the intake holes by
cutting a disc out of a plastic coffee can cover.





Note: If part required not shown, order complete assembly, of which it is a part, or Part Kit No. 3-1884 for replacement of washers, valves, gaskets and plunger cup.

PART LIST

Key No.	Part No.	Description	Key No.	Part No.	Description
1	3-1772	Replacement Tank (151)	19	2-3561	Body only for Shut-off
1	3-1773	Replacement Tank (152)	20	2-3631	Lever for Shut-off
1	3-1774	Replacement Tank (153)	21	2-4554	Trigger for Lever of Shut-off
2	3-8838	Plunger Rod Assy. (151) (152)	22	1-3636	Packing for Stem
2	3-8835	Plunger Rod Assy. (153)	23	1-3635	Washer for Stem
3	2-5580	D-Handle	24	1-3634	Spring for Stem
4	1-2931	Coil Spring, Plunger	25	3-6010	Valve Stem
5	1-2601-2	Cap	26	1-3632	Fibre Gasket
6	2-8510	Rod, only (151) (152)	27	1-4570	Bushing for Shut-off
6	2-8511	Rod, only (153)	28	1-5297	Fibre Gasket
7	1-2249	Nut	29	3-6000	Adjustable Nozzle Complete
8	2-2252	Backing Washer	30	1-4974	Base for Adjustable Nozzle
9	1-2690	Plunger Cup	31	1-4958	O-Ring for Adjustable Nozzle
10	2-3017-1	Disc Spreader	32	1-4973	Cap for Adjustable Nozzle
11	1-3087	Lock Washer	33	3-7701	12" Curved Brass Extension (152) (151)
12	3-7038	Pump Barrel with Valve and Gasket (151) (152)	33	3-7711	18" Curved Brass Extension (153)
12	3-7039	Pump Barrel with Valve and Gasket (153)	34	1-3354-1	Carrying Strap with Pad (153 only)
13	1-2541	O-Ring, Pump	35	2-2600-5	Outlet Tube (151)
14	1-4324	Rubber Valve for Pump	35	2-2600-3	Outlet Tube (152)
15	3-6327	30" Hose with Clamp Shut-off and Nozzle	35	2-2600-4	Outlet Tube (153)
16	3-6132	30" Vinyl Hose with 2 Clamps	36	1-2619-2	Ext. Tube Clip
17	1-4622	Hose Clamp	3-1884		Repair Parts Kit (Parts as Illustrated)
18	3-1866	Shut-off, less nozzle, with Clamp			

R. E. CHAPIN MFG. WORKS, INC.

29 Liberty Street Batavia, New York 14020 U.S.A.

REPORTING PROCEDURES

Reporting Procedure

All exotic plant control work should be reported on a Supplementary Case Incident Record, Form No. 10-344; and on an attached location map. A separate 10-344 should be completed for each visit to any one treatment site and for each different treatment site. If you treat two discrete sites (such as two keys), you must fill out two Case Incident forms. Attach a location map to the Case Incident form. The map does not have to be a masterpiece but should include north arrow, landmarks, bearings, distances, etc. so that the exotic plant location can be determined in the field using this map.

Directions for Completing 10-344

Organization - Everglades National Park.

Case/Incident Number - obtain a number for each report from the Entrance Station.

Location of Incident - date work was performed.

Nature of Incident - Exotic Plant Control.

Complainants Name - names of individuals involved in treatment.

Species - check species treated.

Herbicide Application: Fill in this section only if a site was treated.
Check if initial treatment or retreatment.

Count the number of trees you treat and estimate the number remaining if you do not treat all plants at the site. If trees are marked, check method used. Also check treatment method used, and herbicide and dilution used. All containers should be marked with herbicide, dilution, and mixing date. All Garlon used on Schinus is the 1:50 dilution, the 2:50 mix is only used in some areas on Casuarina.

In addition, check if you notice seedlings of the exotic plant and whether or not you treat them.

Monitoring Effects

Enter the number of weeks following initial treatment and the number of trees which are dead at this time. Check if the leaves are on or off the tree and write the color of leaves which are still on the tree. Check if exotic seedlings are present or absent.

"Bookkeeping"

Enter the amount of the herbicide mixture used and number of man hours required to complete the job.

Comments:

Check if non-target trees were affected (killed) by the herbicide and the species, if you can identify them. Write the distance between the target tree and non-target trees and number of non-target trees killed.

Other Comments:

Write any observations which may aid in developing future treatment guidelines or may explain your observations. Such as:

- possible explanations for ineffective treatment such as old herbicide, not enough herbicide applied.
- vigor of target plant at different time intervals past treatment.
- native plants seeding into treatment sites.

Exotic Plant Locations Maps

Each exotic is represented by different symbols on the original exotic maps. In order to standardize the maps, the following symbols should be used when updating:

A1 *Albizia lebbbeck* (Woman's Tongue)

Ar *Ardisia solanacea*

Ca *Casuarina*

Co *Colubrina*

L *Leucaena*

M *Melaleuca*

Ps *Psidium guajava* (Guava)

S *Schinus*

Dates of plant discovery and treatment should be added in this form:

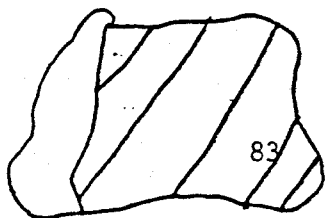
t82 (t82 = treatment and year treated.)

Ca

81 (81 = year discovered.)

If an entire key or sizeable area (more than five acres) is checked and has no exotic species present, please mark it with hatch marks and note the year checked within the hatching.

Ex:



Church key

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME <u>EVERGLADES NAT'L PARK</u>		CASE INCIDENT NUMBER <table border="1"><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>						
LOCATION OF INCIDENT <u>HIDDEN LAKE (GATE 13)</u>		DATE OF INCIDENT MO DA YR <table border="1"><tr><td>0</td><td>4</td><td>2</td><td>2</td><td>8</td><td>3</td></tr></table>	0	4	2	2	8	3
0	4	2	2	8	3			
NATURE OF INCIDENT <u>Exotic Plant Control</u>								
COMPLAINANT'S NAME <u>BRIAN CAREY</u>	COMPLAINANT'S ADDRESS <u>ENVIRONMENTAL INTERPRETATION</u>							

RESULTS OF INVESTIGATION (Please attach location map)

SPECIES: Casuarina sp. Melaleuca quinquenervia
Colubrina asiatica X Schinus terebinthifolius
Other: GUAVA

---HERBICIDE APPLICATION: X Initial treatment Retreatment

Est. number of plants treated: 75
Est. number of plants untreated: 10
Treated trees marked by:
X paint or dye,
flagging, or
not marked.

Treatment method:
X Basal bark spraying
Girdle
Pull up
"Hack & squirt"
X Foliar spray (seedlings)
Stump treated with herbicide

Herbicide type and dilution:
X Velpar, full strength
X Garlon:diesel, 1:50
Garlon:diesel, 2:50
2% Roundup in water
No herbicide applied.

Exotic species seedlings:
X present absent
X treated not treated

SAMPLE

---MONITORING EFFECTS

Number of weeks following initial treatment . Leaves on tree. Color:
Percent of treated trees which are now dead . Leaves off tree.

Resprouts:
 present absent
 from crown on trunk or stump
 leaves deformed leaves normal

Color of resprout leaves:

Exotic species seedlings:
 present absent

---"BOOKKEEPING"

Amount of herbicide mixture used 3 gallons. Man hours spent on project 3.

---COMMENTS

Were non-target plants affected by the treatment? yes What species? poison ivy
How far from target tree? on it How many non-target trees affected (est.)? 56

Other comments: many of the schinus were large, so the many stems were sprayed as opposed to spraying the thick, small, trunk. Some seedlings

SUBMITTED BY (SIGNATURE AND DATE)

APPROVED BY (SIGNATURE AND DATE)

Royal Palm

+

← Hidden Lake

X X X
X X X
X X X
X X X
X X X

GATE 13

Key

Xx - Schinus sprayed

O - Schinus untreated

OLD INGRAHAM HIGHWAY

[illegible]

Exotic Plant Control Summary

[illegible]



[illegible]

EVERGLADES CITY DISTRICT

Gulf Coast District

Casuarina and Schinus are the major exotic plant control problems in the Gulf Coast District. Both species will be treated in 1983.

Schinus will be treated with a 2% solution of Garlon 4 in diesel (1:50), applied by the basal bark spray treatment. Areas scheduled for treatment are:

- 1.) Watson Place - after burning the grass in the center of the site, the perimeter will be treated for Schinus.
- 2.) Highland Beach - adult Schinus and seedlings. Seedlings will be treated with a foliar spray of Round-up (2%) and water.

Casuarina will also be treated with a basal bark spray application of Garlon 4. In order to find the most effective control method, four treatment regimes will be documented:

- 1.) 2% (1:50) solution of Garlon 4 in diesel
- 2.) 4% (2:50) solution of Garlon 4 in diesel
- 3.) 2% Garlon 4: 3% Cide-kick: 95% diesel
- 4.) 4% Garlon 4: 3% Cide-kick: 93% diesel

The four treatment regimes were chosen in order to determine:

- 1.) the optimum dilution of Garlon 4 and 2.) whether or not an adjuvant (Cide-kick), in addition to the diesel carrier, is necessary for the herbicide to penetrate Casuarina bark.

Study sites will be located on two spoil banks in Chokoloskee Bay. All the trees on each spoil bank will be treated. Each treated tree will be flagged, tree diameters at breast height (dbh) will be measured, and heights will be estimated. Sites will be monitored six weeks post-treatment for efficacy of treatment. At that time, any live trees will be remeasured and retreated.

Additional Casuarina treatment sites scheduled for 1983 are:

- 1.) Indian Pass, Marker 17,22
- 2.) Hog Key
- 3.) Mormon Key
- 4.) Plover Key
- 5.) Turkey Key
- 6.) Wood Key

Trees at these sites will be treated by basal bark spray application of Garlon 4.

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
North Highland Beach	Casuarina		60	1979		C4
Plover Key	Casuarina		25	1979 & 1980		B4
Storter Bay	Casuarina		1	1979 & 1980		B3
Jack Daniel SW	Casuarina		1	1979 & 1980		A2
Jack Daniel SE	Casuarina		2	1979 & 1980		A2
Russel Key (Everglades City)	Casuarina		1	1979 & 1980		A2
Indian Key, Marker 17	Casuarina		300	1979 & 1980		A2
Indian Key, Marker 20	Casuarina		10	1979 & 1980		A2
Indian Key, Marker 21	Casuarina		250	1979 & 1980		A2
Camp Lulu Key, Site 1	Casuarina		5	1979 & 1980		A2W
Camp Lulu Key, Site 2	Casuarina		2	1979 & 1980		A2W
Spoil Bank East	Casuarina		325	1979 & 1980		A2
Spoil Bank Middle	Casuarina		250	1979 & 1980		A2
Spoil Bank West	Casuarina		250	1979 & 1980		A2
Daniels Point	Casuarina		5	1979 & 1980		A2
Gulf Coast District	Casuarina		1,806	1977		F6
Jims Point	Casuarina		4	1974		F6
Lostman's Station	Casuarina		67			C4

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Tiger Key	<i>Casuarina</i>			1979		A2
Kingston Key	<i>Casuarina</i>		14	1980		A2
Watson Place Camping Area	<i>Schinus</i>		6	1982		C3
Rabbit Key	<i>Casuarina</i>			1979		A2
Demijohn Key	<i>Casuarina</i>			1979		A2
Jewell Key	<i>Casuarina</i>					A2
Comer Key	<i>Casuarina</i>					A2
Kingston Key	<i>Casuarina</i>					A2
Indian Key	<i>Casuarina</i>			1979		A2
Picnic Key, SW	<i>Casuarina</i>		1			A2
Picnic Key, NE	<i>Casuarina</i>					A2
Indian Key Pass, 1½ mile NW of Sandfly Island	<i>Casuarina</i>		372 2 Locations	1972 & 1979		A2
Indian Key Pass, 1½ mile NW of Sandfly Island	<i>Schinus</i>					
Chokoloskee Bay, entering Indian Key Pass	<i>Casuarina</i>		2	1980		A2
Bear Island	<i>Casuarina</i>		1			A2
Barron River, ¼ mile upstream of mouth	<i>Schinus</i>		2 Locations			A2

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
E.C. Ranger Station, north of (100 yds.)	<i>Schinus</i>					A2
E.C. Ranger Station, north of (100 yds.)	<i>Casuarina</i>					A2
Shore, 3/4 mile SE of E.C. Ranger Station	<i>Casuarina</i>					A2
Highway 29, 1 mile north of E.C.	<i>Schinus</i>					A2
Highway 29, 1½ mile north of E.C.	<i>Schinus</i>					A1
Highway 29, 2½ mile north of E.C.	<i>Schinus</i>					A1
Ferguson Bay, W. shore	<i>Schinus</i>					A1
Ferguson Bay, 1 mile NE	<i>Schinus</i>					A1
Huston Bay NW corner	<i>Schinus</i>					B2
House Hammock Bay, E&W shores	<i>Schinus</i>					B2
1 mile NW of House Hammock Bay	<i>Schinus</i>		Many sightings			B2
1 mile NW of Lopez Campsite	<i>Schinus</i>		High conc.			B2
Sunday Bay, ENE shore	<i>Schinus</i>		Many sightings			B2
Cross Bays, WSW shore	<i>Schinus</i>					B2
Mud Bay, SE shore	<i>Schinus</i>					B2
Barnes Creek, 1½ mile upstream	<i>Schinus</i>					B2

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Cross Bays, 1 mile N	<i>Schinus</i>		Many sightings			B2
Hells Half Acre, 3/4 mile SE	<i>Schinus</i>					B2
Turner River, 1 mile upstream on E. shore	<i>Schinus</i>					B2
Chokoloskee Island	<i>Casuarina</i>					B2
Turner River, mouth, N shore	<i>Casuarina</i>					B2
Chokoloskee Bay, N shore SE of E.C.	<i>Schinus & Casuarina</i>					B2
Plantation Island, 1/2 mile S	<i>Schinus & Casuarina</i>		Many sightings			B2
Plantation Island, 1 mile NE	<i>Schinus & Casuarina</i>		Many sightings			B2
Plantation Island, 1 mile E	<i>Schinus & Casuarina</i>		Many sightings			B2
Buzzard Key, S shore	<i>Casuarina</i>			1979		B3
Turkey Key, S shore	<i>Casuarina</i>			1979		B3
New Turkey Key	<i>Casuarina</i>		2	1979		B3
Clam Point	<i>Casuarina</i>			1979		B3
Mormon Key, S shore	<i>Casuarina</i>		17	1979 & 1980		B3
~~Huston Bay, S shore~~	~~<i>Schinus</i>~~		~~High conc.~~			~~B3~~
Pavilion Key	<i>Casuarina</i>		2 Locations	1979		B3
Huston Coves	<i>Casuarina</i>		2 Locations	1979		B3
Duck Rock Cove	<i>Casuarina</i>					B3

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Tamiami Trail (Highway 41) (N of Gator Hook Swamp)	<i>Casuarina, Schinus and Melaleuca</i>		Many sightings			C2
Huston Bay, 1½ miles N & E	<i>Schinus</i>		Many sightings			C2
Plate Creek Bay 1 mile W	<i>Schinus</i>		2 Locations			C3
Alligator Bay, W shore	<i>Schinus</i>					C3
Cannon Bay, W shore	<i>Schinus</i>		High conc.			C3
Chevelier Bay, E & W shores	<i>Schinus</i>		High conc.			C3
Deer Island, and E of Sweetwater Bay	<i>Schinus</i>					C3
Sweetwater Bay	<i>Schinus</i>					C3
Southwater Bay	<i>Schinus</i>					C3
Chatham River, N of mouth	<i>Schinus</i>					C3
Last Huston Bay, SW shores	<i>Schinus</i>		Many sightings			C3
Key McLaughlin	<i>Schinus</i>		Many sightings			C4
Johnsons Mound	<i>Schinus</i>					C4
Johnsons Mound, 1½ miles ESE	<i>Colubrina</i>					C4
Highland Beach, shore	<i>Casuarina</i>		460	1980		C4
Highland Point, N	<i>Casuarina</i>		Many sightings			C4
Leon Hamilton Place	<i>Casuarina</i>		25			C4

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Little Creek, mouth of	Casuarina					C4
Lostmans Key	Casuarina					C4
Lostmans River Ranger Station	Casuarina		7	1979 & 1980		C4
Hog Key	Casuarina		5	1979		C4
Wood Key Cove, SW	Casuarina			1979		C4
Porpoise Point	Casuarina			1979		C4
Wood Key, SE	Casuarina		25	1979 & 1980		C4
Bogges Point	Casuarina			1979		C4
Lostmans River, mouth, N shore	Casuarina			1979		C4
Second Bay, 1 mile west	Schinus		High conc.			
Onion Key Bay, 3 miles west	Schinus					C4
Broad River, 2½ miles upstream, south shore	Schinus					C5
Middle Cape, shore	Casuarina		27	1978 & 1982		C7
Middle Cape, inland	Schinus					C7
Middle Cape Canal	~~Casuarina~~			1978		C7
Middle Cape Canal, 1½ miles N	Schinus					C7
Northwest Cape, 1 mile N	Casuarina		3	1982		C7
Middle Cape Canal, 1 mile NNE	Schinus					C7

District: Everglades City

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Rodgers River, N shore	Schinus		Many sightings			D4
Cabbage Island, N	Schinus					D4
Lostmans Creek, N shore	Schinus					D4
Rocky Creek, E shore	Schinus					D4
Lost Lake, W shore	Schinus					D4
Parrot Bay, E shore	Schinus					D4
Cabbage Bay, NE corner	Schinus					D4

FLAMINGO DISTRICT

Flamingo District

The exotic plant species targeted for treatment in the Flamingo District during FY 83 are Schinus terebinthifolius, Casuarina sp., and Leucaena leucocephala. Colubrina asiatica is a widespread exotic pest plant, but effective methods for its control have not yet been determined. A pilot Colubrina control program will be established in FY 84.

Casuarina control will be aimed at individual trees as their locations are discovered. All known, large stands of Casuarina have been treated.

A stand of approximately 300 Leucaena trees is located on Cape Sable, east of Middle Cape. Ninety-six trees were treated in April with a basal bark spray application of Garlon 4. If this treatment is effective the remainder of the stand will be treated with it in 1983.

Schinus will be treated with Garlon 4, applied as a basal bark spray. Schinus stands in natural areas are high priority, stands in developed areas will be treated when weather conditions prohibit travel to and/or work in natural areas, sites which have been designated for treatment are:

- 1.) Schinus stand on Cape Sable
- 2.) Schinus along the Coastal Prairie Trail

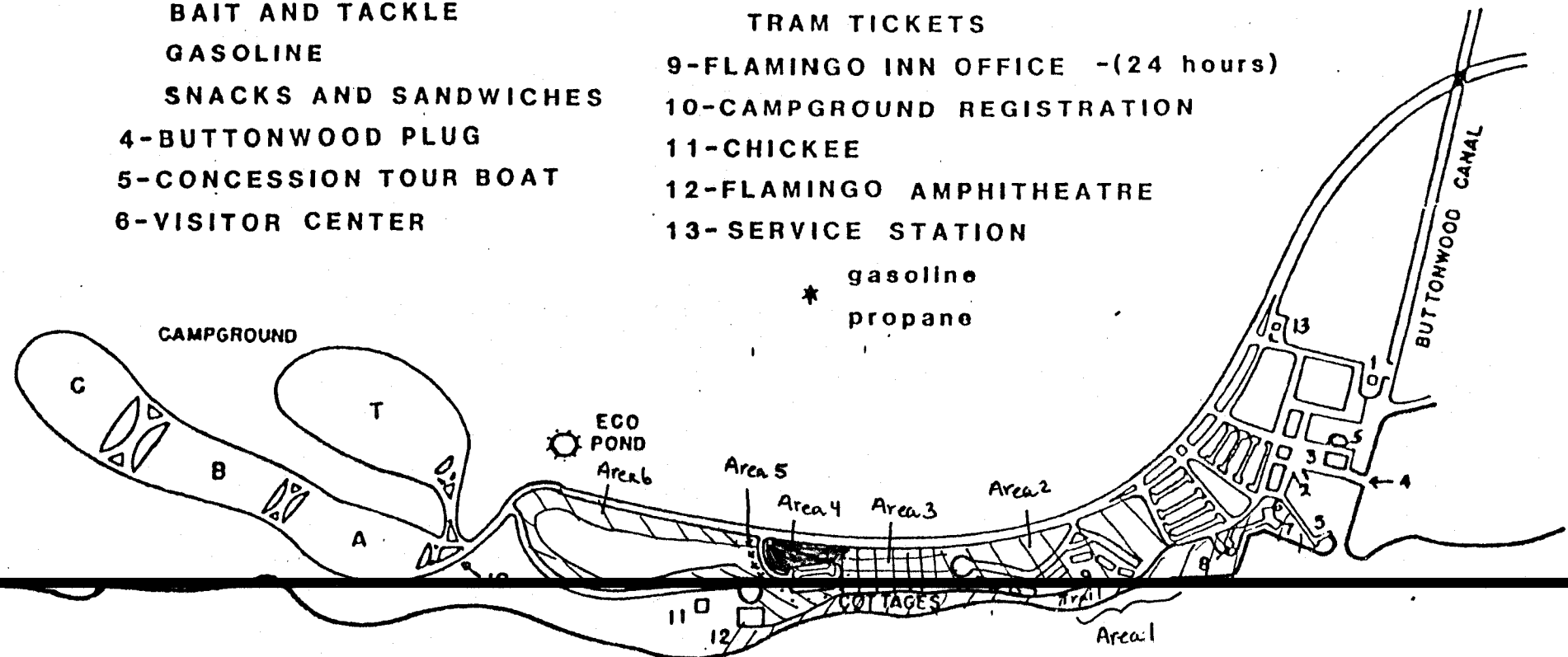
Treatment sites in developed areas:

- 1) Visitor Center/Amphitheater Trail - area south of the trail to the Bay
- 2) Flamingo Inn - Schinus between main road and Amphitheater Trail
- 3) Area between cottages and Flamingo Inn
- 4) Area north of cottages to the road - Schinus
monoculture: trees will be treated, cut, and burned. Area will be replanted with native plants
- 5) Thespesia along road into cottages
- 6) Area along main road to amphitheater
- 7 Road edges from Buttonwood Canal through the Campground - a detailed map of work sites will be compiled in June, 1983

FLAMINGO

- 1-INLAND BOAT RAMP
FISH CLEANING AREA
- 2-FLORIDA BAY BOAT RAMP
- 3-MARINA-
TOUR BOAT TICKETS
GENERAL STORE
BOAT AND CANOE RENTAL
BAIT AND TACKLE
GASOLINE
SNACKS AND SANDWICHES
- 4-BUTTONWOOD PLUG
- 5-CONCESSION TOUR BOAT
- 6-VISITOR CENTER

- 7-MUSEUM
- 8-DINING ROOM-seasonally operated
BUTTONWOOD LOUNGE-seasonally operated
SNACKS AND SANDWICHES
(Both located on west end of Breezeway)
- GIFT SHOP-
STAMPS AND MAILDROP ONLY
TRAM TICKETS
- 9-FLAMINGO INN OFFICE -(24 hours)
- 10-CAMPGROUND REGISTRATION
- 11-CHICKEE
- 12-FLAMINGO AMPHITHEATRE
- 13-SERVICE STATION



FLORIDA BAY

* IF NOT OPEN ,GASOLINE AVAILABLE AT MARINA

District: Flamingo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Old River, 6 miles upstream (below Mud Lakes)	<i>Schinus</i>		Many sightings			D5
Mud Lakes, 1½ miles south	<i>Colubrina</i>					D5
Barney River, 1-2 miles S (Mangrove fringe)	<i>Schinus</i>		Heavily invaded			D5
Shark River, Wilderness Waterway, 1½ miles NE of Shark Cutoff	<i>Schinus</i>					D6
Lake Ingraham, 5 miles N	<i>Schinus</i>		Many sightings			D7
East Cape, 2 miles NW	<i>Casuarina</i>					D7
Little Fox Lake, 1 mile NE	<i>Schinus</i>		High conc.			D7
Joe River, S shore, 3 miles S of campsite	<i>Schinus</i>					D7
East Cape, 2 miles NE	<i>Casuarina & Schinus</i>		1	1982		D7
Coastal Prairie Trail	<i>Schinus</i>		Many sightings	1982		D7
Rodgers Creek, headwaters	<i>Schinus</i>					E4
Broad River, headwaters, S shore	<i>Schinus</i>					E5
Halls Bay Campsite	<i>Schinus</i>					E6
Lane Bay	<i>Schinus</i>		Many sightings			E6
Roberts River, 3 miles upstream	<i>Schinus</i>		Many sightings			E6
Joe Kemp Key (possible <i>Leucaena</i> location)	<i>Colubrina</i>					E7

District: Flamingo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Christian Point	<i>Colubrina</i>		High conc.			E7
Flamingo, road to housing area	<i>Schinus</i>					E7
Flamingo, road to campground	<i>Schinus & Colubrina</i>					E7
Coast, from Flamingo to East Cape	<i>Schinus</i>		Many sightings			E7
Gibby Point, & N along shore	<i>Colubrina</i>					E7
Christian Point to Gibby Point (along shore)	<i>Colubrina</i>					E7
West Lake, 3 miles NW	<i>Casuarina</i>					F7
Road to Flamingo, 6 miles from Flamingo	<i>Schinus</i>		High conc.			F7
West Lake, west shore	<i>Schinus</i>		High conc.			F7
West Lake, north shore	<i>Schinus</i>					F7
Cuthbert Lake, N shore	<i>Schinus</i>					F7
Snake Bight Canal	<i>Colubrina & Casuarina</i>					F7
Crocodile Point Trail, N of Garfield Bight	<i>Casuarina & Colubrina</i>		High conc.			F7
The Lungs, west shore	<i>Schinus</i>					F7
Shark Point	<i>Colubrina & Schinus</i>		Many			F7
Umbrella Key	<i>Colubrina</i>					F7
Alligator Creek, mouth	<i>Colubrina</i>					F7

District: Flamingo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Porpoise Point	<i>Colubrina/Schinus</i>		Many			F7
Rankin Key, NW side	<i>Colubrina</i>					F7
East Cape Sable	<i>Casuarina</i>		1	1977		D8
Harney R. mouth Island	<i>Casuarina</i>		3	1977 & 1982		C5
Harney R., S Beach Ridge	<i>Casuarina</i>		2	1977 & 1982		C5
Ponce De Leon Bay, N shore	<i>Casuarina</i>		7	1977 & 1982		D6
Middle Cape, 2 miles E	<i>Casuarina</i>		1	1977		D7
Beach between E. Cape Canal and House Ditch	<i>Casuarina</i>		2	1977		D7
South Sandy Key, middle of W side	<i>Casuarina</i>		1	1977		D8
5 miles S. of NW Cape	<i>Casuarina</i>		Many	1977		C7
1/2 mile NW of Middle Cape Canal	<i>Schinus</i>					F5
1/2 mile E of NW Cape	<i>Schinus</i>		2	1982		
2 miles W of Middle Cape Canal	<i>Schinus</i>		150	1982		
Clubhouse Beach, W end	<i>Casuarina</i>		3	1982		D7
Middle Cape, NW Cape Bight area	<i>Schinus</i>		.1 acres	1982		C7

KEY LARGO DISTRICT

Key Largo Control Program

The main exotic plant pest in the Key Largo District is Australian Pine (Casuarina equisetifolia). Most of the trees within the district were treated in the large Casuarina Control Program of 1978-80. Since that program was terminated, exotic plant control funds have been limited, control efforts have been sporadic, and many of the keys have either been re-invaded by Casuarina or, trees which were treated in the 70's have resprouted. Beginning in the spring of 1983, keys within the district will be systematically searched for Casuarina and then retreated. Schinus may also be present on some keys; it will be treated and locations mapped at the same time.

In the 1970's most Casuarina were treated with 2,4-D. Trees were either cut down and the stumps were treated with the herbicide or the trees were girdled and the 2,4-D was applied in the wound. Since 1981 most Casuarina within Everglades National Park have been treated with either Garlon 4 or Velpar L. Garlon 4 has been applied as a basal bark spray treatment or by the "hack and squirt" method. Velpar L has been applied by "hack and squirt" or as a stump treatment after the trees were cut. Velpar L seems to be very effective on any size Casuarina. Unfortunately, initial treatments and follow-ups were not well documented and the effectiveness of Garlon is unclear.

In 1983, control techniques will be standardized and well documented in order to obtain a reliable estimate of the effectiveness of each herbicide. Velpar L is more toxic than Garlon 4 and does have herbicidal activity when applied to the soil. In light of these facts, it is hoped that Garlon 4 will prove to be as effective as Velpar L and that we will be able to discontinue using Velpar L for Casuarina control. Data collected in this year's program will be used to evaluate each herbicide and application method.

Three treatments will be documented; undiluted Velpar L applied in incisions in the trunk and two dilutions of Garlon 4 (in diesel oil) applied as a basal bark spray. A treatment site will be defined as a key; all trees on the key will be treated by the same method initially and on any necessary follow-up treatments. Diameter at breast height (trees greater than 1" D.B.H.) and height will be recorded for each tree treated, each tree will be flagged, and a map of the key and treatment sites will be made. Treatment sites will be checked six weeks after the initial treatment. On each successive visit, any trees which are retreated will be treated with the same method as the initial treatment, height and D.B.H. will be recorded and the tree will be reflagged.

The Three Treatment Regimes are:

1. Undiluted Velpar L applied by the "Hack & Squirt" method (incision made at 3" intervals around the circumference of the tree trunk).
2. 1:50, Garlon: diesel mixture applied as a basal bark spray treatment.
3. 2:50, Garlon: diesel mixture applied as a basal bark spray treatment.

Casuarina Locations in Key Largo District
sighted in 1981

- 1.) Alligator Bay SW interior near south end of eastern peninsular
- 2.) Black Betsy Keys* a.) south & NE tips of Little Black Betsy
b.) north interior of Big Black Betsy
- 3.) Blackwater Sound* NW shore just south of Little Lackwater Pass
- 4.) Brush Keys* SWtip West Brush Key, SW end of East Brush Key
- 5.) Cowpens* north side in a stand of old Casuarina
- 6.) Davis Cove west shore, interior
- 7.) Fan Palm Hammock west side, south from Dynamite Pass
- 8.) Key south of Jimmy Channel east side
- 9.) Lake Key* east shore
- 10.) Little Madeira Bay east shore, north form Dynamite Pass
- 11.) Long Sound west end of north shore
- 12.) Madeira Bay east shore, north from Dynamite Pass
- 13.) North Nest Key west side
- 14.) Pass Key* east shore
- 15.) Shell Key (Shell Creek Key) shoreline 30° from Dock to
Shell Creek
- 16.) Stump Pass west shore of Trout Cove
- 17.) Trout Cove south tip of big island

* - indicates keys which need to be walked over, to ascertain either
extent of Casuarina population or if there are any trees at all

Casuarina sites sighted by Sonny Bass

Osprey nest flight 11-3-82

- 1.) Black Betsy north to northeast
- 2.) Deer Key
- 3.) Lake Key
- 4.) Park Key
- 5.) Pass Key
- 6.) Tern Key

Locations of Casuarina treated in 1981

Key Largo District

- 1.) Baker Cut Spoilbank island west of sign
- 2.) Balls Bay (N. of Long Sound) north shore
- 3.) Big Key west side, south of pilings
- 4.) Big Madeira NE shore, NW shore, east shore
- 5.) Bob Key south side of smallest key
- 6.) Bottle Key island off SE tip
- 7.) Club Key south shore, west end
- 8.) Deer Key SW shore
- 9.) Eagle Key west side
- 10.) East Creek in Long Sound
- 11.) Little Butternut west side
- 12.) Long Sound north shore across from Long Pass
- 13.) Madeira Beach NW shore
- 14.) Manatee Key east end in cove
- 15.) Middle Butternut south shore
- 16.) Tern Key east side and south side
- 17.) Shell Key near Bottle Pass, west side, 1/2 mile
north of Pass

District: Key Largo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
				1979		J7
Jimmies Key	Casuarina					
Baker Cut	Casuarina		4	1980 & 1981		G7
Madeira Beach	Casuarina			1980		G7
Blackwater Sound	Casuarina		15	1978		J7
Club Key	Casuarina		50	1978		G8
Little Bob Key	Casuarina		1	1981		H8
Twin Backbay	Casuarina		3	1981		
Stump Pass, N side	Casuarina		1	1983		H7
Nest Keys	Casuarina			1979		H7
Bottle Key	Casuarina		20	1978, 1980 & 1981		H8
Cowpens Cut	Casuarina		250	1978 & 1983		H8
Long Sound (Tree Islands)	Casuarina		150	1980 & 1981		J7
Little Blackwater Sound	Casuarina		100	1978		J7
	Casuarina		15	1978 & 1981		H8
Manatee Key	Casuarina		16	1978, 1979 & 1983		H8
Butternut Key	Casuarina					
Stake Key	Casuarina		8	1978, 1979 & 1983		H8

District: Key Largo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Shell Key	<i>Casuarina</i>		9	1978, 1979, 1980, 1981		J7
Low Key	<i>Casuarina</i>		10	1978 & 1979		H8
SE Park Boundary next to U.S. 1	<i>Casuarina</i>		350	1978 & 1979		J6
Santini Bight, shore	<i>Colubrina</i>		Many sightings			F7
Seven Palm Lake, NE, S & E shores	<i>Schinus</i>					G7
Crocodile Point	<i>Colubrina</i>		High conc.			G7
Big Key	<i>Colubrina</i>					G7
Terrapin Point, E shore	<i>Colubrina</i>					G7
Madeira Hammock	<i>Colubrina</i>		Many sightings			G7
Black Betsy Keys	<i>Casuarina</i>		75	1978, 1979 & 1980		G7
Madeira Point, E shore	<i>Casuarina</i>		150	1978 & 1979		G7
Little Madeira Hammock	<i>Schinus & Colubrina</i>		High conc.			G7
Little Madeira Hammock, E shores	<i>Schinus & Colubrina</i>					G8
Bob Allen Keys	<i>Casuarina</i>					G8
Spy Key	<i>Casuarina</i>					G8
Black Betsey Keys, E shore	<i>Casuarina</i>			1978 & 1980		G8
Russell Key, E shore	<i>Casuarina</i>			1978, 1979 & 1980		G8

District: Key Largo

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Trout Cove, shore	Casuarina & Schinus		38	1972, 1978 & 1980		H7
Davis Cove, shore	Casuarina & Schinus		129	1972,, 1979, 1980 & 1982		H7
Alligator Bay, shore	Casuarina & Schinus			1980		H7
Joe Bay	Schinus		5	1978		H7
Little Madeira Bay	Schinus & Casuarina		30	1972		H7
Eagle Key	Casuarina		75	1978, 1980 & 1981		H7
Pass Key	Casuarina		163	1978, 1980, & 1983		H7
Lake Key	Casuarina		115	1978, 1979, & 1980		H7
Park Key	Casuarina			1978, 1979, & 1980		H7
Tern Keys	Casuarina		2	1981		H7
Deer Key	Casuarina		38	1979 & 1981		H7
Alligator Beach	Casuarina		100	1979		H7
Fan Palm Hammock	Casuarina		100			H7
Cat Track Beach	Casuarina		100			H7
Snipe Point	Casuarina			1979		J7

District: Pine Island

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
SSE Corner of Park	<i>Casuarina & Schinus</i>					J6
Pahay Okee Lookout Tower	<i>Schinus</i>					F5
Pouratis Pond, 1 3/4 miles SW	<i>Schinus</i>					F6
Pouratis Pond, 2 miles W	<i>Schinus</i>					F6
Mahogany Hammock Turnoff	<i>Melaleuca</i>					F6
Mahogany Hammock Turnoff, 1 1/2 miles ESE	<i>Casuarina</i>					F6
E. Boundary, 4 miles N of Corner (see Map G4)	<i>Schinus</i>					G4
Research Center, 3 miles W	<i>Schinus</i>					G5
Research Center, 3 miles W	<i>Casuarina</i>					G5
Road by Research Center	<i>Schinus</i>					G5
Boy Scout Camp	<i>Casuarina & Schinus</i>			1981		G5
Turnoff to Long Pine Key	<i>Casuarina</i>					G5
Turnoff to Long Pine Key	<i>Schinus</i>					G5
Old Ingraham Highway	<i>Casuarina</i>		25	1979 & 1982		G6
Donut	<i>Schinus</i>					G6
Pine Island, housing area	<i>Schinus</i>		3	1983		H5
Pine Island, housing area	<i>Casuarina</i>		31	1979		H5

District: Pine Island

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Pine Island Visitor Center	Casuarina					H5
Royal Palm Ranger Station	Schinus					H5
Road to Research Center	Schinus					H5
East Boundary, General (south)	Schinus & Casuarina					H5
SE of Royal Palm Ranger Station	Schinus & Casuarina					H6
NW Taylor Slough	Casuarina		1	1980		H6/G6
SE Boundary, U.S. 1	Casuarina		43	1980		J6
SE Boundary, U.S. 1	Melaleuca		3	1980		J6
Aero Jet Area	Casuarina		4,000	1980		H5
Block D Fire Rd, 1 mile N	Casuarina		4	1979		G5
150 Yds. NE of V.C.	Casuarina		91	1979		H5
E. Boundary, S of Rte 27	Casuarina		74	1979		H5
E. Boundary, S of Rte 27	Melaleuca		3	1979 & 1981		H5
~~18 Mile Causeway~~	~~Melaleuca~~		~~1~~	~~1982~~		~~F4~~
Entrance Station, 50' south	Melaleuca		1	1981		H5
½ mile W of L-31W	Melaleuca		25	1980		H5
Main Park Road, 2 miles S of Flamingo Wells	Melaleuca		1	1980		F6
Highway 1, boundary	Melaleuca		8	1980		J6

District: Pine Island

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Aero Jet Area	Melaleuca		4,000	1980		H5
Rock Reef Pass	Melaleuca		1	1980		F5
West Taylor Slough	Casuarina		1	1981		G6
Gate #11, Main Park Road	Casuarina		10	1982		
Boy Scout Camp Parking Lot	Melaleuca		2	1981		G5
Unit 5, Sub-unit 7	Casuarina		1,877	1977		
Unit 5, Sub-unit 7	Casuarina		11,793	1978		
Site: R37S, T57½S	Casuarina		15	1978		
Site: T57S, R36E	Casuarina		339	1978		
Site: R37E, T57S	Casuarina		317	1978		
Unit 6, Sub-unit 2	Casuarina		5	1978		
N of MPR from Gate 9 to Rock Reef Pass	Casuarina		7	1978		F5
3/4 mile W of L31W, 1 mile S of Lucille Buggy Trail	Casuarina		76	1977 & 1982		
3.5 miles N of Well on Context Road, on E Boundary	Casuarina		7	1977		
1½ miles S of "A" Battery Lower Site	Casuarina		1	1977		
Research Center Garden	Schinus		1	1983		G5
Anhinga Trail	Schinus		4	1983		H5

District: Pine Island

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
						H5
Old Ingraham Highway between PI and Royal Palm	<i>Schinus</i>					
Pine Block L, Prairie West	<i>Casuarina</i>		14	1980		H5
Pine Block H, behind Gate 2	<i>Casuarina</i>		34	1982		G5
Pine Block X	<i>Casuarina</i>		15	1982		H5

PINE ISLAND DISTRICT

Pine Island

A number of exotic plant species will be treated in the Pine Island District. Treatment sites are located in developed and natural zones.

Species targeted for control in FY 83 include:

<u>Albizia lebbeck</u>	Woman's tongue
<u>Ardisia solanacea</u>	Shoebutton Ardisia
<u>Bauhinia</u> spp.	Orchid Tree
<u>Bischofia</u> sp.	
<u>Brassaia</u>	Schefflera
<u>Carica papaya</u>	Papaya
<u>Casuarina</u> spp.	Australian Pine
<u>Leucaena leucocephala</u>	Lead tree
<u>Melaleuca quinquenervia</u>	
<u>Psidium guajava</u>	Guava
<u>Schinus terebinthifolius</u>	Brazilian pepper
<u>Thespesia populnea</u>	Cork tree

All species will be treated by basal bark spray application of Garlon 4.

Treatment sites will include:

Pine Island residence area

Areas adjacent to the Old Ingraham Highway, Pine Island

Service road

Long Pine Key Campground

Royal Palm - road to the Old Royal Palm site

Pine Blocks E, C, J, K - after summer prescribed burn in order to facilitate access and to take advantage of increased growth of Schinus after scorching (this will also increase uptake of the herbicide)

Area surrounding Headquarters

Boundaries

Environmental Ed Center at Hidden Lake

Donut

Boy Scout Camp - Schinus will be treated by Evergalde's employees and removed, when dead, by the Boy Scouts. A map of Schinus locations is included.

Pine Block H - Casuarina will be treated with basal bark spray application of Garlon 4.

More exotic plant populations may be added to this list as they are discovered and evaluated (as to treatment priority).

main gate

LONG PINE KEY ROAD

QUAIL

PARKING

MAINT.
BLDG.

SPARROW

SECRET

HERON

ORIOLE

DOVE

HAWK

OWL

JAY

camp everglades

PARKING

CROW

SINK HOLE

FARM ROAD



- - 1 Bragelini Pepper
 (14) - large number.
 fairly solid
 □ SHELTER
 * PUMP
 ○ LATRINE

District: Tamiami

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Indian Camp Creek, headwaters	<i>Schinus</i>					E4
Forty Mile Bend, north side of Highway 41	<i>Casuarina</i>					F2
Forty Mile Bend, Loop Road first 2 miles	<i>Schinus</i>					F2
Forty Mile Bend, Loop Road Junction	<i>Casuarina</i>					F2
Highway 41, from Tamiami R.S.T. Indian Village	<i>Casuarina & Melaleuca</i>					F2
Shark Valley Lookout Tower	<i>Casuarina</i>			1979		F3
Road to Shark Valley Lookout Tower, 1½ miles from Highway 41	<i>Melaleuca</i>					F3
East Slough, 1 mile from Highway 41	<i>Melaleuca</i>					F3
Papaya Hammock	<i>Schinus</i>					F5
Levee 67, 1½ miles S of Highway 41	<i>Schinus</i>					G3
Vulture Hammock	<i>Schinus</i>					G3
Irongrape Hammock, 1 mile W	<i>Melaleuca</i>					G4
Black Hammock 2 miles SSE	<i>Casuarina</i>					G4
U.S. 41, Tamiami	<i>Melaleuca</i>		80	1982		F2
Inside Trail 1½ mile SW of Hammock 55	<i>Melaleuca</i>		1	1982		
Structure D, S side Highway 41	<i>Melaleuca</i>		350	1981 & 1982		F2

District: Tamiami

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
200 Yds. of LPK CPG Sign and 1 mile N of MPR	<i>Casuarina</i>		7	1977.		G5
Unit 6, Sub-unit 7	<i>Casuarina</i>		650	1977		G5
1 mile NE Sweet Bay Pond	<i>Casuarina</i>		27	1977		F6
N & E Park Boundary	<i>Casuarina</i>		30	1979 & 1982		G3
N & E Park Boundary	<i>Melaleuca</i>		1	1979		G3
East Park Boundary	<i>Melaleuca</i>		25	1979, 1981 & 1982		G4
Papaya Hammock	<i>Schinus</i>			1983 not complete		F5
Miccosukee Strip	<i>Melaleuca</i>		4	1981 & 1982		F2
Bobby Tiger's Pad	<i>Melaleuca</i>					
Highway 41, N & S sides	<i>Melaleuca</i>		153	1981		F2
West Tram Rd, W side	<i>Melaleuca</i>		1	1981		F2,3
N. Boundary, Old 41	<i>Melaleuca</i>		2	1980		F2
W. Loop Rd., Shark Alley	<i>Melaleuca</i>		1	1980		F2,3
W. Tram Road, Shark Valley	<i>Melaleuca</i>		1	1980		F3
E. Tram Road, Shark Valley	<i>Melaleuca</i>		2	1980		F2,3
Miccosukee Strip, 500 yds. SE	<i>Melaleuca</i>		4	1978		F2
Miccosukee Strip, East End	<i>Melaleuca</i>		4	1974		F2

TAMiami DISTRICT

District: Tamiami

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
Indian Camp Creek, headwaters	<i>Schinus</i>					E4
Forty Mile Bend, north side of Highway 41	<i>Casuarina</i>					F2
Forty Mile Bend, Loop Road first 2 miles	<i>Schinus</i>					F2
Forty Mile Bend, Loop Road Junction	<i>Casuarina</i>					F2
Highway 41, from Tamiami R.S.T. Indian Village	<i>Casuarina & Melaleuca</i>					F2
Shark Valley Lookout Tower	<i>Casuarina</i>			1979		F3
Road to Shark Valley Lookout Tower, 1½ miles from Highway 41	<i>Melaleuca</i>					F3
East Slough, 1 mile from Highway 41	<i>Melaleuca</i>					F3
Papaya Hammock	<i>Schinus</i>					F5
Levee 67, 1½ miles S of Highway 41	<i>Schinus</i>					G3
Vulture Hammock	<i>Schinus</i>					G3
Irongrape Hammock, 1 mile W	<i>Melaleuca</i>					G4
Black Hammock 2 miles SSE	<i>Casuarina</i>					G4
U.S. 41, Tamiami	<i>Melaleuca</i>		80	1982		F2
Inside Trail 1½ mile SW of Hammock 55	<i>Melaleuca</i>		1	1982		
Structure D, S side Highway 41	<i>Melaleuca</i>		350	1981 & 1982		F2

District: Tamiami

<u>Location</u>	<u>Species</u>	<u>Priority</u>	<u>No. of Trees</u>	<u>Year Treated</u>	<u>Year Monitored</u>	<u>Map I.D. No.</u>
200 Yds. of LPK CPG Sign and 1 mile N of MPR	Casuarina		7	1977		G5
Unit 6, Sub-unit 7	Casuarina		650	1977		G5
1 mile NE Sweet Bay Pond	Casuarina		27	1977		F6
N & E Park Boundary	Casuarina		30	1979 & 1982		G3
N & E Park Boundary	Melaleuca		1	1979		G3
East Park Boundary	Melaleuca		25	1979, 1981 & 1982		G4
Papaya Hammock	Schinus			1983 not complete		F5
Miccosukee Strip	Melaleuca		4	1981 & 1982		F2
Bobby Tiger's Pad	Melaleuca					
Highway 41, N & S sides	Melaleuca		153	1981		F2
West Tram Rd, W side	Melaleuca		1	1981		F2,3
N. Boundary, Old 41	Melaleuca		2	1980		F2
W. Loop Rd., Shark Alley	Melaleuca		1	1980		F2,3
W. Tram Road, Shark Valley	Melaleuca		1	1980		F2
E. Tram Road, Shark Valley	Melaleuca		2	1980		F2,3
Miccosukee Strip, 500 yds. SE	Melaleuca		4	1978		F2
Miccosukee Strip, East End	Melaleuca		4	1974		F2

SAMPLE LABELS

GENERAL USE PESTICIDES
If a pesticide will harm the applicator or the environment very little or not at all when used exactly as directed, it can be called a general use pesticide. The label on these products will say "General classification."

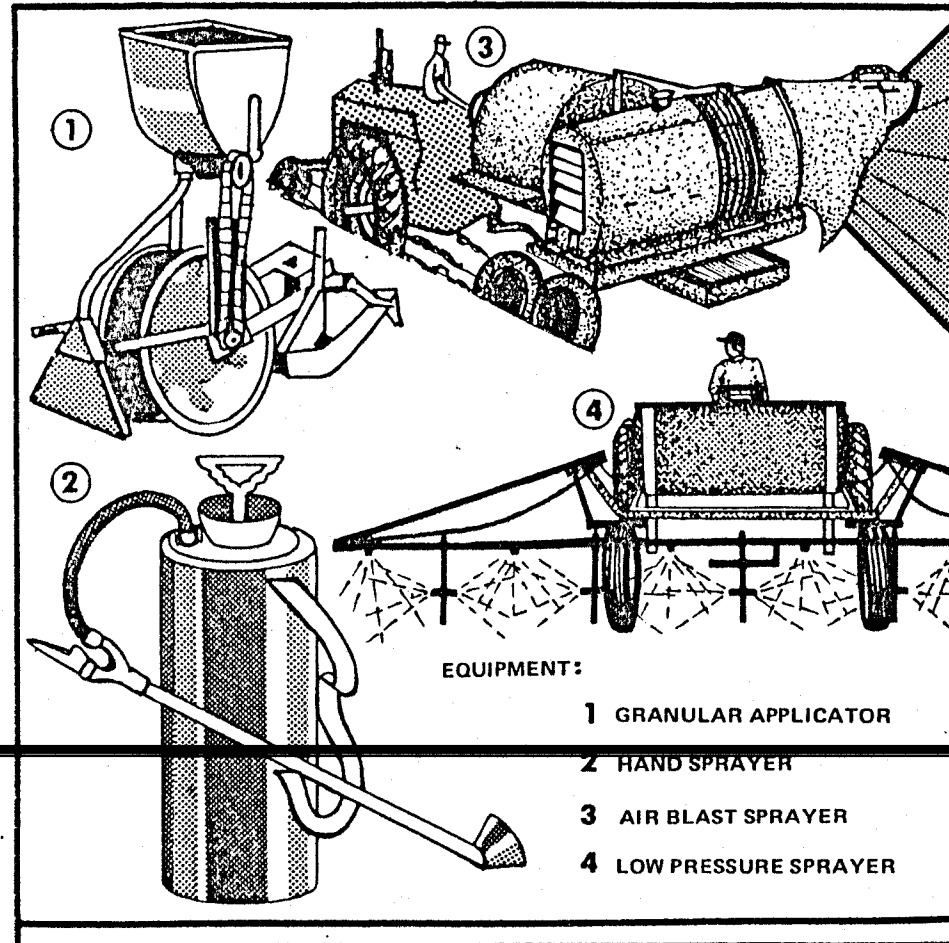
RESTRICTED USE PESTICIDES

A restricted use pesticide is one which could cause some human injury or environmental damage even when used as directed on the label. The label on these products will say:

RESTRICTED USE PESTICIDE

FOR RETAIL SALE TO AND APPLICATION ONLY BY
CERTIFIED APPLICATORS OR PERSONS UNDER THEIR
DIRECT SUPERVISION

The restricted use statement must be at the top of the front panel of the label.



This public document was promulgated at an annual cost of \$459.15, or 2.3¢ per copy to inform Florida producers of proper pesticide use.

11-20M-75

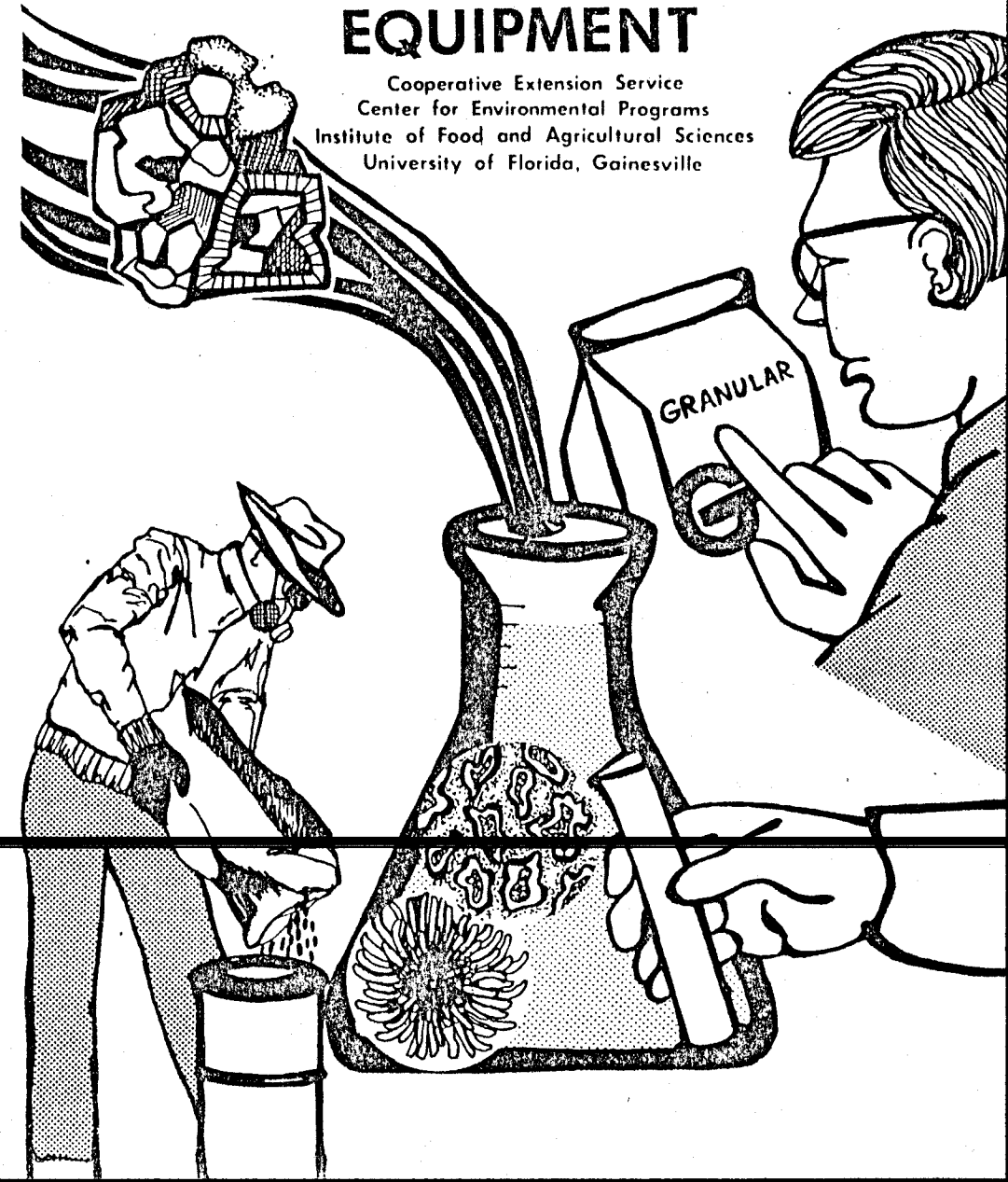
PESTICIDES

FORMULATIONS

AND

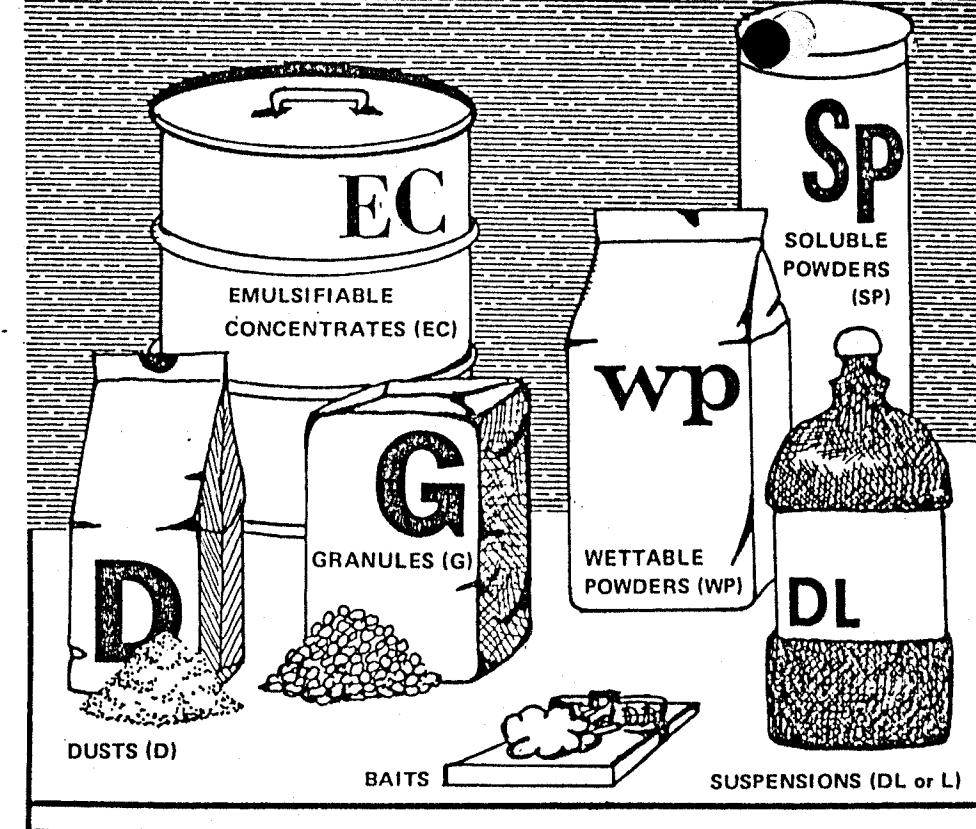
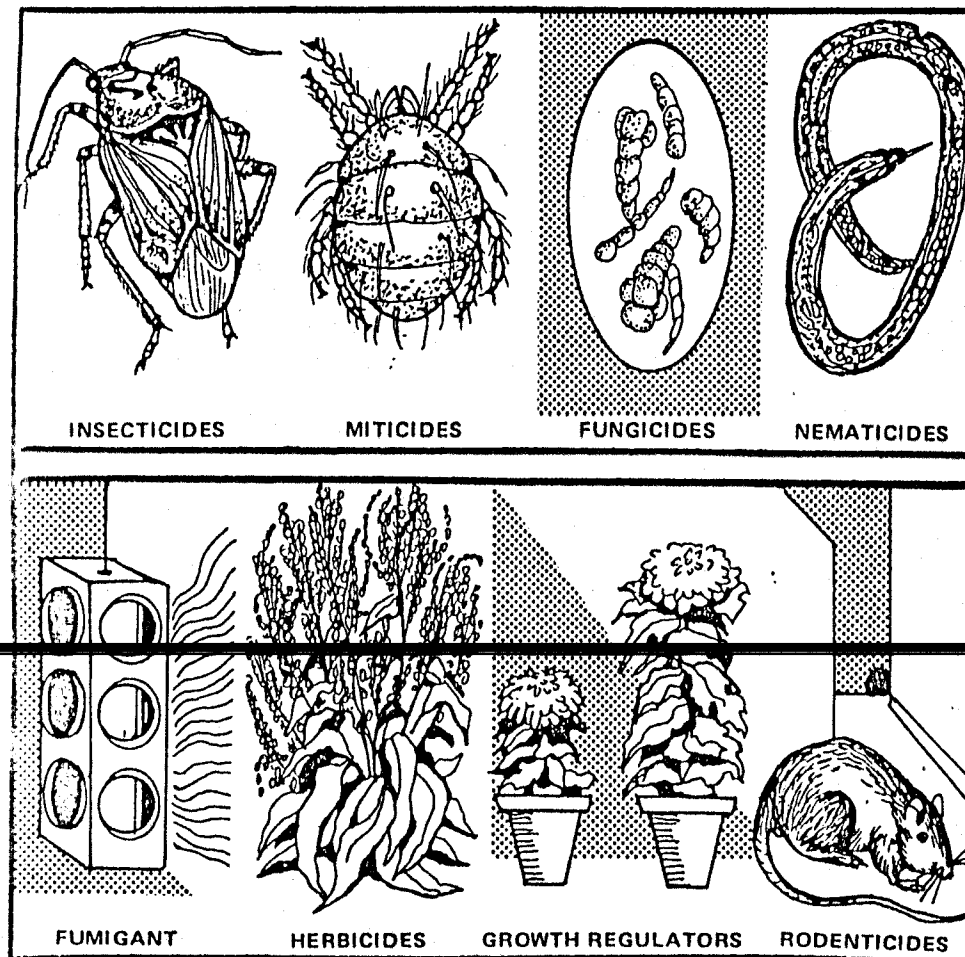
EQUIPMENT

Cooperative Extension Service
Center for Environmental Programs
Institute of Food and Agricultural Sciences
University of Florida, Gainesville



What is a pesticide? It is a chemical used to control a pest. The most important kinds of pesticides are listed below.

- INSECTICIDES:** Insecticides control insects and their relatives the spiders, and similar pests.
- MITICIDES:** A miticide controls mites, a close relative of insects.
- FUNGICIDES:** A fungicide is used to prevent or control a plant disease caused by a fungus.
- NEMATICIDES:** This type of pesticide controls nematodes.
- FUMIGANT:** This pesticide controls pests by giving off a gas or vapor.
- HERBICIDES:** This group of pesticides controls unwanted plants (weeds). Herbicides are often called "weed killers."
- GROWTH REGULATORS:** These pesticides change the growing or fruiting habits of a plant.
- RODENTICIDES:** Rodenticides control rodents.



PESTICIDE FORMULATIONS

There are several forms (also called formulations) of pesticides.

Dusts (D) and Granules (G) are dry pesticides that are already mixed and ready to apply when you buy them.

Wettable Powders (WP) or Soluble Powders (SP) may look like dust, but they are not used like a dust. While a dust is ready to use when you buy it, a wettable powder or soluble powder must be mixed with water before using. Wettable powders usually form a cloudy liquid after being mixed, while soluble powders are usually clear in water. Wettable powders need to be constantly stirred or shaken during use to avoid settling out.

Baits kill pests that feed on them. Some are bought ready-to-use, but others must be mixed with a dry or wet substance to attract the pests to them.

Emulsifiable Concentrates (EC) and Suspensions (DL or L) are liquids that are mixed with water or oil to form a suspension.

Here are some ways pesticide formulations appear on the label and what they mean:

Formulations	Meaning
5D	5% Dust
10G	10% Granular
50WP or 50W	50% Wettable Powder
6EC or 50E	6 pounds per gallon Emulsifiable Concentrate
4DL or 4L	4 pounds per gallon Suspension
90EC - Fumigant	90% active (turns into gas)

A pesticide will have little or no effect on the applicator or the environment very little or not at all when used exactly as directed, it can be considered a general use pesticide. The label on these products will say "General Classification."

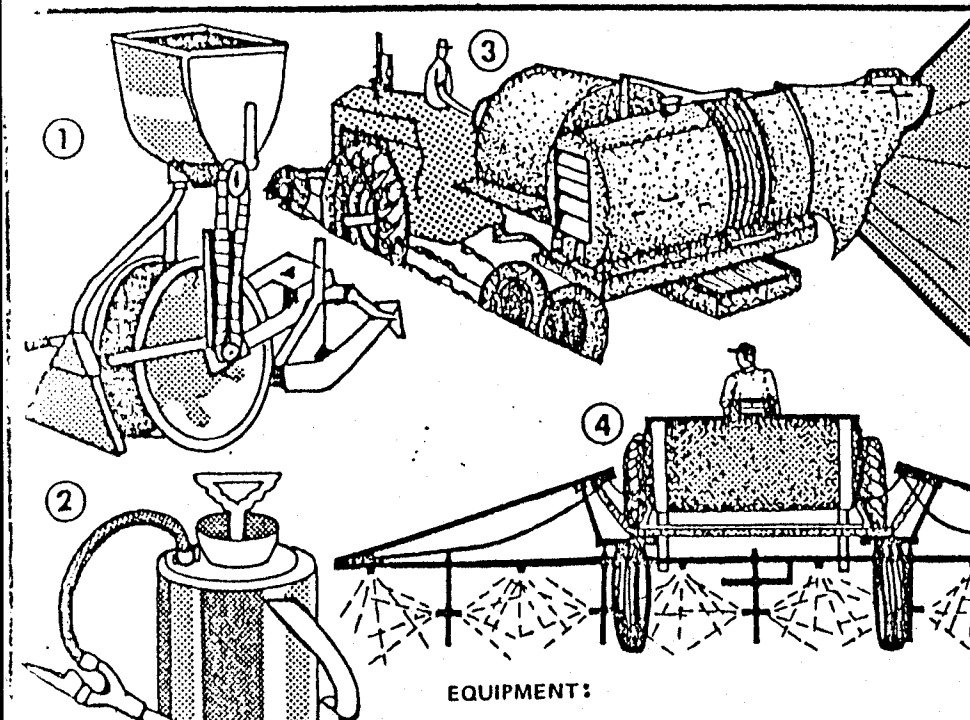
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- 1 GRANULAR APPLICATOR
- 2 HAND SPRAYER
- 3 AIR BLAST SPRAYER
- 4 LOW PRESSURE SPRAYER



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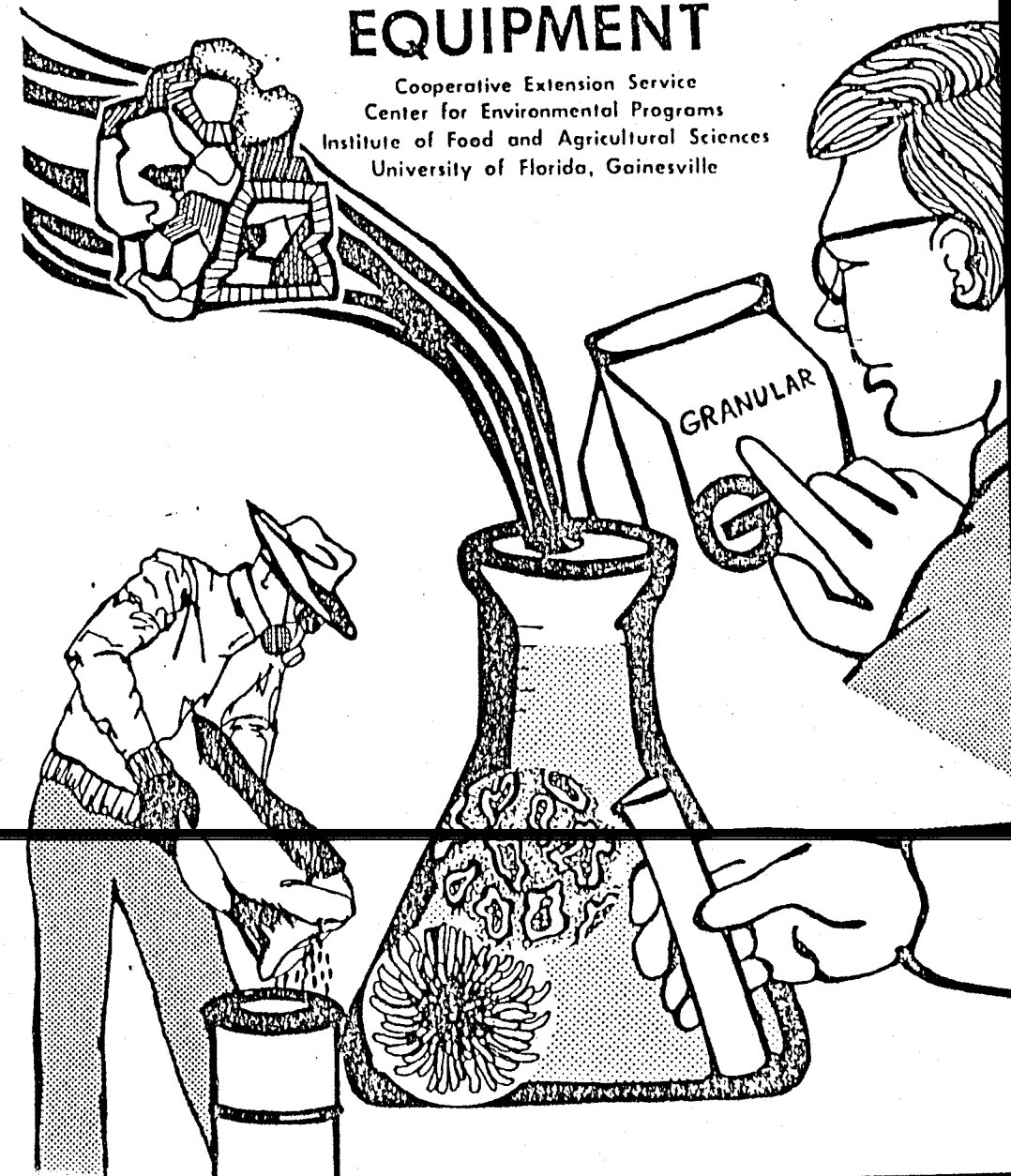
PESTICIDES

FORMULATIONS

AND

EQUIPMENT

Cooperative Extension Service
Center for Environmental Programs
Institute of Food and Agricultural Sciences
University of Florida, Gainesville



GENERAL INFORMATION: Du Pont "Velpar" L Weed Killer is a water-dispersible liquid to be mixed in water and applied as a spray for selective control of certain weeds in Christmas tree plantations and reforestation areas and for non-selective weed and brush control on non-cropland areas. It may also be applied undiluted as a basal soil treatment for brush control on non-cropland areas. It is non-corrosive to equipment.

"Velpar" L is an effective general herbicide providing both contact and residual control of many weeds. At rates recommended for noncropland areas, it provides control of many annual and biennial weeds, brush, woody vines, and, except for johnsongrass, is effective for control of most perennial weeds. It is absorbed through the roots and foliage. For brush control, soil application is most effective.

Moisture is required to activate "Velpar" L in the soil. Best results are obtained when weeds are less than 2 inches in height or diameter, soil is moist at time of application and 1/4 to 1/2 inch of rainfall occurs within 2 weeks after application. Foliar application to weeds is most effective under conditions of high temperature (above 80° F.), high humidity and good soil moisture. Foliar application when vegetation is dormant or semi-dormant may not be effective.

On herbaceous plants, symptoms usually appear within 2 weeks after application under warm humid conditions, while 4 to 6 weeks may be required when weather is cool. If rainfall after application is inadequate to activate "Velpar" L in the soil, plants may recover from contact effects and continue to grow.

On woody plants, symptoms usually appear within 3 weeks after sufficient rainfall has carried the herbicide into the root zone, during periods of active growth. Defoliation and subsequent re-foliation may occur, but susceptible plants are killed. The degree of control and duration of effect will vary with the amount of chemical applied, rainfall, temperature, weed and brush species, soil texture and other conditions.

NOTICE OF WARRANTY

Du Pont warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with the use of this product. Ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials or the manner of use or application, all of which are beyond the control of Du Pont. In no case shall Du Pont be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the Buyer. DU PONT MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling.

For broadcast treatments using ground equipment, apply "Velpar" L as a spray just before or soon after weed emergence. Do not apply to frozen or snow-covered soil. Before spraying, calibrate equipment to determine the quantity of water necessary to uniformly and thoroughly cover the vegetation and soil in a measured area to be treated. Use at least 5 gallons of water for each gallon of "Velpar" L.

Add the proper amount of "Velpar" L to a spray tank filled with the amount of water to be used and mix thoroughly. A surfactant such as Du Pont Surfactant WK may then be added at the rate of 1 quart per 100 gals. of spray to improve wetting and/or contact activity. After thoroughly mixing the spray solution, a suitable defoaming agent such as DOW Corning "Antifoam" A or "Hodag"

Defoamer F-1 may also be added at the rate of 1 to 5 ozs. per 1,000 gals. of spray should foaming become a problem. Agitate thoroughly to disperse the defoaming agent.

For fixed boom sprayer properly calibrated to a constant speed and rate of delivery. When used in conifer plantings, avoid overlapping and shut off spray booms while starting, turning, slowing, or stopping or injury to the conifer trees may result. Application with a handgun sprayer (non-cropland areas only), use sufficient water (50 to 200 gals. per acre) for thorough coverage. For treating small non-cropland areas, a tank-type hand sprayer or sprinkling can may be used.

BROADCAST AND BRUSH CONTROL—NONCROPLAND AREAS: Railroad, Highway, Utility and Pipeline Right-of-Ways, Farms, Storage Areas, Industrial Plant Sites, Drainage Ditchbanks and other similar areas.

Use the lower levels of the recommended dosage ranges under the following conditions: on hard-to-kill species; on fine-textured soils (clay, clay loam); on soils containing more than 5% organic matter or carbon; and, on coarse-textured soils (loamy sand, gravelly soils) where rainfall exceeds 40 inches per year. Use the lower levels of the dosage range if the growing season is short.

Control—Apply 3 to 6 gals. per acre for season long control of many annual, biennial and perennial weeds including grasses*, bermudagrass*, bluegrass, broomsedge, camphorweed, Canada thistle*, chickweed, clovers, dewberry, dogfennel*, fescue*, fingergrass, foxtail, guineagrass, heath aster, honeysuckle, lantana, marehail*, natagrass, plantain, prickly pear, ragweed, smutgrass, Spanish needle, vasegrass, wild blackberry* and wild carrot.

Short-term control (up to 3 months) of the above weeds, apply 1 to 2 1/2 gals. per acre. Application at 1 to 2 1/2 gals. per acre provides short-term control of many annual, biennial and perennial weeds including barnyardgrass, bindweed*, bouncet*, bromegrass, butelgrass*, burdock, cocklebur, crabgrass, crown vetch, curly dock*, dandelion*, dogbane*, fiddlehead*, fleabane, goatsbeard vine, goldenrod, kochia, lespedeza, milkweed*, mustard, nutsedge*, orchardgrass*, paragrass, pigweed, purslane, quackgrass, ryegrass, smartweed, spurge, trumpet creeper*, wild oats, wild parsnip and wild star thistle.

Small areas—Three fl. ozs. "Velpar" L per 250 sq. ft. is approximately 4 gals. per acre.

Soil Control—Apply to soil during the period between late winter and early summer for control of blackgum, black cherry, flowering dogweed, green ash, hawthorn, hickory, oaks (except liveoak), persimmon, sumac, sweetgum, and willow. In areas where the soil normally remains frozen during the winter, and spring rains are usually inadequate for soil activation, a winter treatment may be applied before the soil freezes.

For effective brush control and prevention of damage to desirable vegetation; do not apply to brush standing in water; do not use water from treated ditches for irrigation; do not use where desirable trees or shrubs are immediately adjacent to treated area.

Broadcast Treatment—Apply 2 to 4 gals. of "Velpar" L per acre as a coarse spray with water. Direct the spray to the beneath woody plants to be controlled.

Diluted Basal Soil Treatment—Apply "Velpar" L undiluted with an exact delivery hand gun applicator. This equipment delivers a thin stream of a predetermined volume when triggered. Apply at the rate of 4 to 8 milliliters for every 2" of stem diameter. Direct the treatment to the soil near the root collar of woody plants to be controlled. When treating large trees and more than one delivery of "Velpar" L is needed per stem, make applications on opposite sides of the stem.

ACTIVE WEED CONTROL—CHRISTMAS TREE PLANTATIONS AND REFORESTATION AREAS: "Velpar" L is recommended for control of certain weeds in Christmas tree plantations where Scotch Pine, Douglas Fir (west of the Rocky Mountains only), Austrian Pine, Grand Fir, Sitka Spruce, and Noble Fir are grown. It is also recommended for use in reforestation where Scotch Pine, Douglas Fir (west of the Rocky Mountains only) Loblolly Pine, Ponderosa Pine, Austrian Pine, Grand Fir, Sitka Spruce and Noble Fir are grown.

The effect of "Velpar" L on conifers varies with soils, uniformity of application, and environmental conditions. It is suggested that growers limit their first use to small areas.

Because injury to conifers may result: Do not use in nurseries, seedbeds or ornamental plantings; do not use on trees showing signs of stress because of insect, disease or winter injury, or show symptoms of other stress conditions; do not add "Velpar" L to the top of conifers; do not use on poorly drained soils. In addition, conifer injury may result where winter stress, disease, or insect damage follows application, or heavy rains occur soon after application. Do not use for control in conifers in the state of Texas.

Considered hard-to-kill.

When used as directed, "Velpar" L controls annual bluegrass, barnyardgrass, bentgrass, bromegrass, catbark, common groundsel, common ragweed, false-dandelion, fleabane, foxtail, oxeye daisy, Pennsylvania smartweed, velvetgrass and wild carrot. Treatment provides partial control of curly dock, dandelion, willowweed (fireweed), fescue, goldenrod, horseweed, orchardgrass and ryegrass. Rates expressed are broadcast. For band application, use proportionately less; for example use 1/2 of the broadcast rates when treating a 3 ft. band where row spacing is 6 ft.

Apply as a broadcast spray in the spring prior to conifer bud break. If application is made after bud break, use directional spray equipment and prevent contact of conifer foliage or injury may result.

Soil Texture**	FIRST YEAR PLANTATIONS† Pints "Velpar" L Per Acre††	ESTABLISHED PLANTATIONS Pints "Velpar" L Per Acre††
Gravelly or Rocky Soils, Exposed Subsoils, Clay Knobs, Sand, or Sandy Soils with 85% or more Sand	Do Not Use	Do Not Use
Loamy Sand and Sandy Loam (50-85% Sand)	4	4-5
Loam, Silt Loam, Silt and Sandy Clay Loam	4-5	5-7
Silty Clay Loam, Clay Loam, Sandy Clay, Silt, Clay, and Clay	5-6	7-8

** Do not use on any soil containing less than 1% organic matter; do not use on loamy sand or sandy loam with less than 2% organic matter.

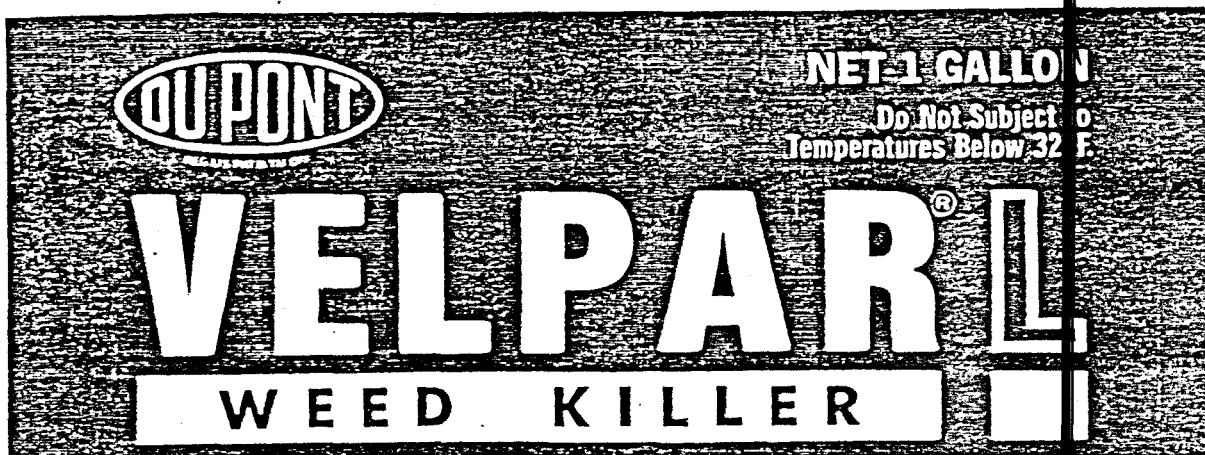
† Apply only to transplant stock that is 2 years old (2-0) or more (1 year old for loblolly pine). Allow at least two months after transplanting before applying "Velpar" L. Then apply only if rainfall has settled the soil around the base of the transplants.

†† Use of rates in excess of those specified for the soil texture may result in injury to the conifers.

Notice to Buyer: Purchase of this material does not confer any rights under patents of countries outside of the United States.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal. Do not re-use container. Bury empty container, or product that cannot be used, in a safe place away from water supplies, or dispose of by alternative procedures recommended by federal, state or local authorities. Open dumping is prohibited.



WATER DISPERSIBLE LIQUID • 1 GALLON CONTAINS 2 LBS. HEXAZINONE

ACTIVE INGREDIENT		
Hexazinone [3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione]		25%
INERT INGREDIENTS		75%
U.S. Pats. 3,902,887 & 3,983,116	EPA Est. 5905-AR-1	EPA Reg. No. 352-392

Keep out of reach of children
Precautionary Statements
Hazards to Humans and Domestic Animals

DANGER! CAUSES EYE DAMAGE. FLAMMABLE.

Do not get in eyes. Wear goggles or face shield and rubber gloves when handling. Avoid contact with skin and clothing. Avoid breathing spray mist. Harmful if swallowed. Keep away from heat, sparks and open flame. Keep container closed.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. For eyes, call a physician. Get medical attention if skin irritation persists. Remove and wash contaminated clothing before re-use.

Environmental Hazards

Keep out of any body of water. Do not apply where runoff is likely to occur. Do not contaminate water by cleaning of equipment or disposal of wastes.

IMPORTANT—Injury to or loss of desirable trees or other plants may result from failure to observe the following: Do not apply except as recommended or drain or flush equipment on or near desirable trees or other plants, or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots. Do not use on lawns, walks, driveways, tennis courts, or similar areas. Prevent drift of spray to desirable plants. Keep from contact with fertilizers, insecticides, fungicides, and seeds.

Thoroughly clean all traces of "Velpar" L from application equipment immediately after use. Flush tank, pump, hoses and boom with several changes of water after removing nozzle tips and screens (clean these parts separately).

E. I. DU PONT DE NEMOURS & CO. (INC.), BIOCHEMICALS DEPT, WILMINGTON, DE

SPECIMEN LABEL

ROUNDUP

Monsanto

Controls weeds that are hard to control with many annual and perennial grasses and broadleaf weeds.

AVOID CONTACT WITH DESIRABLE PLANTS AND CROPS SINCE SEVERE INJURY OR DESTRUCTION MAY RESULT.

CAUTION

READ PRECAUTIONS ON EACH OF CAN

FOR LIMIT OF WARRANTY AND LIABILITY. MONSANTO MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY.

CAUTION

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Keep out of reach of children.

CAUTION!

MAY CAUSE IRRITATION.

HARMFUL IF SWALLOWED.

Avoid contact with eyes or prolonged contact with skin.

FIRST AID: IN CASE OF CONTACT, immediately flush with water for at least 15 minutes. Call a physician. Flush skin with water.

Avoid contamination of seed, feed and food stuffs.

LIMIT OF WARRANTY AND LIABILITY

Monsanto Company warrants that this material conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the directions for use. This product is sold subject to the understanding that the buyer assumes all risks of use or handling which may result in loss or damage which are beyond the control of the seller, such as for example incompatibility with other products, the manner of its use or application, or the presence of other products or materials in or on the soil or plant. MONSANTO MAKES NO OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS OR MERCHANTABILITY. The exclusive remedy of the user or buyer, and the limit of the liability of Monsanto Company or any other seller for any and all losses, injuries or damages resulting from the use or handling of this product shall be the purchase price paid by the user or buyer for the quantity of this product involved. The buyer and all users are deemed to have accepted the terms of this notice which may not be varied by any verbal or written agreement.

GENERAL INFORMATION

DO NOT APPLY THIS PRODUCT USING AERIAL SPRAY EQUIPMENT.

Roundup, a water soluble liquid, mixes readily with water to be applied as a foliage spray for the control or destruction of many herbaceous plants. It may be applied through standard industrial or field type sprayers after dilution and thorough mixing with water in accordance with label instructions.

Roundup is translocated from the point of foliage contact to and into the root system. Visible effects on most annual weeds occur within 2 to 4 days but on most perennial weeds may not occur until 7 to 10 days. Visible effects are a gradual wilting and yellowing of the plant which advances to complete browning and deterioration of plant tissue. Rainfall occurring up to 6 hours after application may reduce effectiveness. Heavy rainfall within 2 hours after application may wash the chemical off of the foliage and a repeat treatment may be required. DO NOT ADD ADDITIONAL SURFACTANT since this formulation contains sufficient wetting agents for the purposes described.

Do not mix with any herbicides, pesticides, herbicidal oils or any other materials.

Delay application until vegetation has emerged to the stages described for control of such vegetation under the "Weeds Controlled" Section of this label to afford adequate leaf surface to receive the spray. Unemerged leaf tissue arising from underground rhizomes or root stocks of perennials will not be affected by the spray and will continue

obtained when treatment is made at late stages approaching maturity. For best results, spray coverage should be uniform and complete. Do not spray weed foliage to the point of runoff.

ATTENTION

AVOID DRIFT. EXTREME CARE MUST BE USED WHEN APPLYING THIS PRODUCT TO PREVENT INJURING DESIRABLE PLANTS AND CROPS. Do not allow spray mist to drift since even minute quantities of spray can cause severe damage or destruction to nearby crops, plants or other areas on which treatment is not intended, or may cause other unintended consequences. Do not apply when winds are gusty or in excess of 5 miles per hour or when other conditions, including lesser wind velocities, will allow drift to occur. When spraying, avoid combinations of pressure and nozzle type that will result in fine particles (mist) which are more likely to drift.

NOTE: Use of this product in any manner not consistent with this label may result in injury to persons, animals or crops, or other unintended consequences. Keep container closed to prevent spills and contamination.

Clean sprayer and parts immediately after using this product by thoroughly flushing with water. Do not contaminate water by disposal of wastes or cleaning of equipment.

Do not reuse container. Destroy when empty.

Do not use this product with galvanized (zinc coated) spray equipment.

MIXING AND APPLICATION INSTRUCTIONS

This herbicide mixes readily with water. NOTE: REDUCED RESULTS MAY OCCUR IF WATER CONTAINING SOIL IS USED, e.g., WATER FROM PONDS AND UNLINED DITCHES. For ground or industrial type sprayers fill the spray tank with one half the required amount of water. Add the proper amount of herbicide (See Directions for Use) and mix well before filling the remaining portion of water. Place the filling hose below the surface of the liquid solution to prevent excessive foaming. Remove hose from tank immediately to avoid back siphoning into water source. Do not use mechanical agitators.

For use in knapsack type sprayers, it is suggested that the proper amount be mixed with water in a larger container. Fill sprayer from the tank or container of stock solution.

APPLY IN PROPERLY MAINTAINED AND CALIBRATED EQUIPMENT CAPABLE OF DELIVERING DESIRED RATES OF SOLUTION OR VOLUME.

What is a pesticide?
are listed below.

chemical used to control a pest. The most important kinds of pesticides

INSECTICIDES:

Insecticides control insects and their relatives the spiders, and similar pests.

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A miticide controls mites, a close relative of insects.

FUNGICIDES:

A fungicide is used to prevent or control a plant disease caused by a fungus.

NEMATOCIDES:

This type of pesticide controls nematodes.

FUMIGANT:

This pesticide controls pests by giving off a gas or vapor.

HERBICIDES:

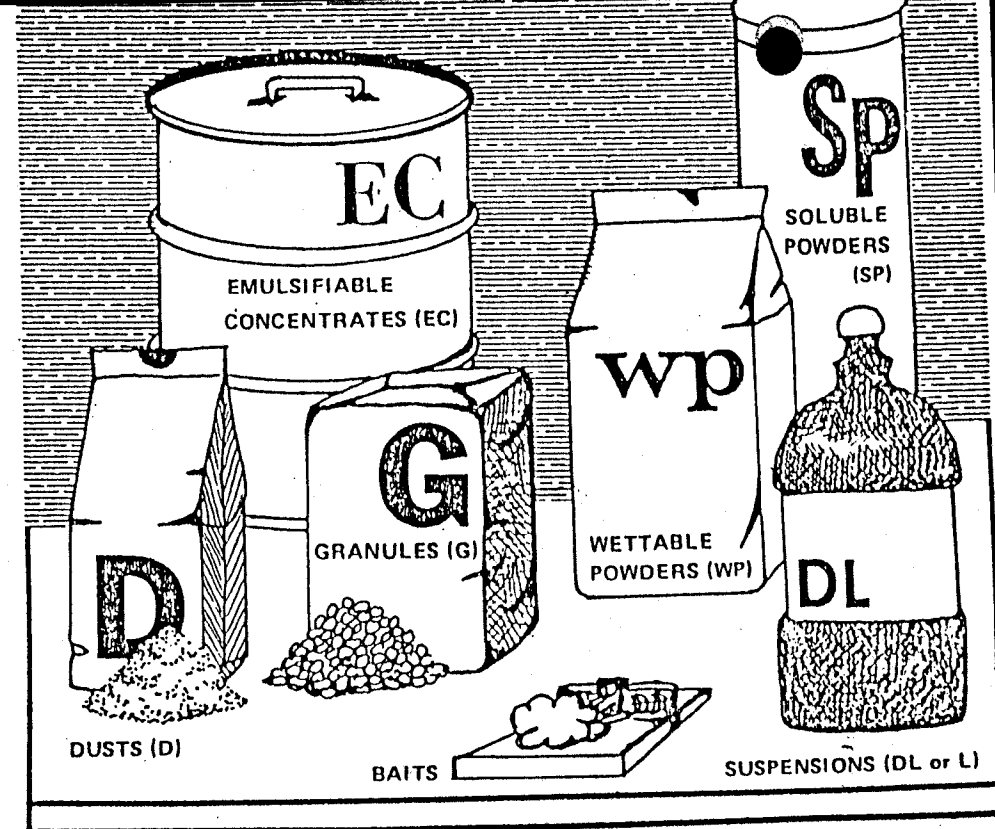
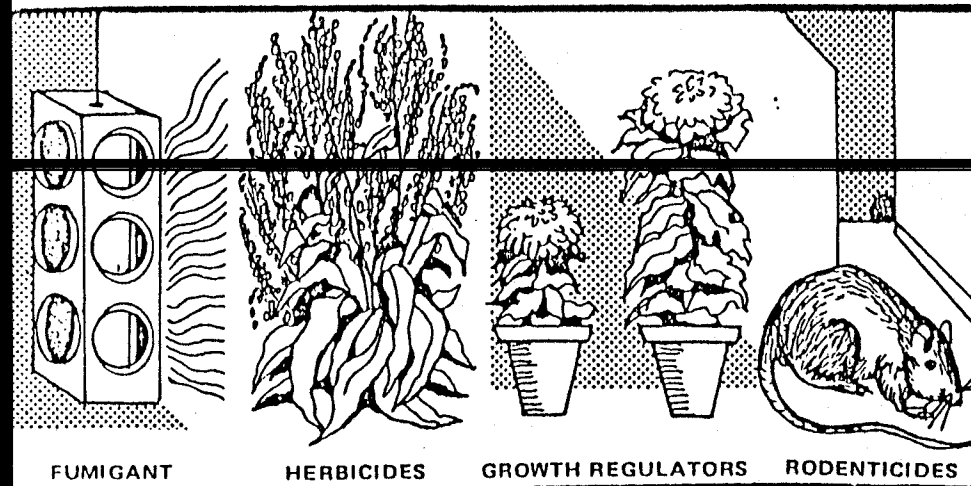
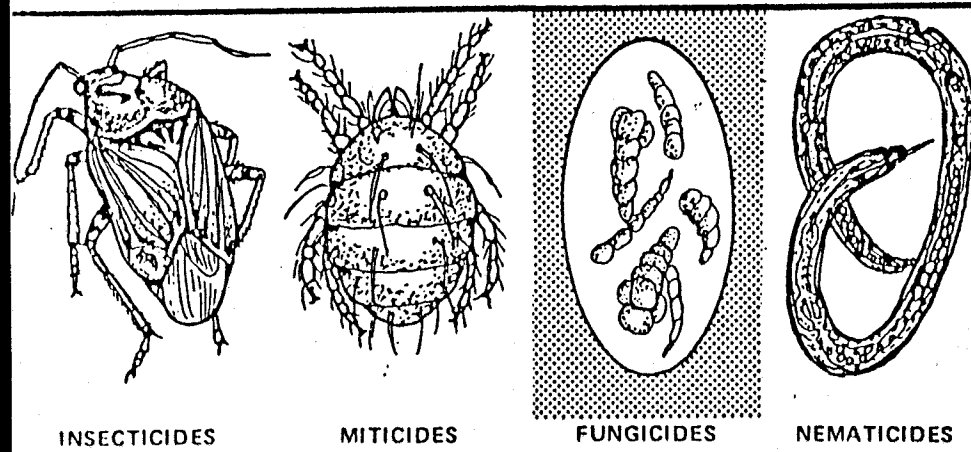
This group of pesticides controls unwanted plants (weeds). Herbicides are often called "weed killers."

GROWTH REGULATORS:

These pesticides change the growing or fruiting habits of a plant.

RODENTICIDES:

Rodenticides control rodents.



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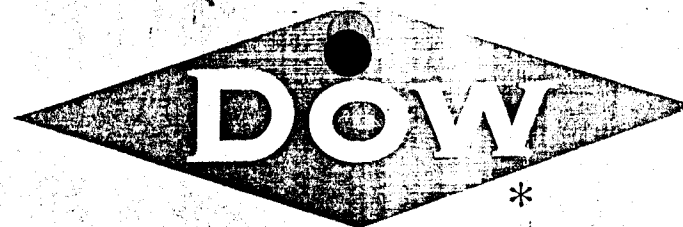
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Formulations
5D
10G
50WP or 50W
6EC or 50E
4DL or 4L
90EC - Fumigant

Meaning
5% Dust
10% Granular
50% Wettable Powder
6 pounds per gallon Emulsifiable Concentrate
4 pounds per gallon Suspension
90% active (turns into gas)

SPECIMEN LABEL
REDUCED TO 88%



GARLON[®] 4

HERBICIDE

*For the control of Woody Plants and Broadleaf Weeds on Rights-of-Way,
Industrial Sites and Non-crop Areas, and for Use in Forest Site Preparation*

ACTIVE INGREDIENT:

Triclopyr (6,6,6-trichloro-2-pyridinyl oxyacetic acid, butoxyethyl ester)

67.6%

INERT INGREDIENTS:

Acid Equivalent triclopyr

38.4%

Contains petroleum distillate

44.3% = 4 lb/gal

EPA Registration No. 464-554

EPA Est. 464-MI-1

PRECAUTIONAL USE: To protect water bodies, do not apply to ponds, streams, or other bodies of water. Do not apply to crops or other plants intended for human consumption. Do not apply to areas where the product will be used in conjunction with other herbicides. Do not use this product until the label has been fully explained to you.

KEEP OUT OF REACH OF CHILDREN

CAUTION

Precautionary Statements
Hazards to Humans and Domestic Animals

HARMFUL IF SWALLOWED
Avoid contact with Skin, Eyes or Clothing
Avoid Contamination of Food
Wash Thoroughly After Handling

Statement of Practical Treatment

In case of contact, flush skin with plenty of water. Get medical attention if irritation persists. Remove and wash contaminated clothing before reuse.

Physical or Chemical Hazards

COMBUSTIBLE

Do Not Use or Store Near Heat or Open Flame
Do Not Cut or Weld Container

Environmental Hazards

This pesticide is toxic to fish. Keep out of lakes, ponds or streams. Do not contaminate water by cleaning of equipment or disposal of wastes. Do not apply where runoff is likely to occur.

If swallowed, do not induce vomiting. Call a physician.

In case of an emergency endangering life or property involving this product, call collect
517-636-4400

AGRICULTURAL CHEMICAL

Do Not Ship or Store with Food, Feeds, Drugs or Clothing

18.93 L/5 gal

86-1471 PRINTED IN U.S.A. IN JANUARY, 1982.
REPLACES SPECIMEN LABEL 86-1471 PRINTED IN SEPTEMBER, 1981.
DISCARD PREVIOUS SPECIMEN LABELS.

REVISIONS INCLUDE: (1) SPRAY BUFFER ZONES DELETED. (2) PESTICIDE AND CONTAINER DISPOSAL INSTRUCTIONS REVISED.

GENERAL INFORMATION

GARLON 4 Herbicide is recommended for the control of unwanted woody plants and annual and perennial broadleaf weeds in forest site preparation and on non-crop areas including industrial manufacturing and storage sites, rights-of-way such as electrical power lines, communication lines, pipelines, roadsides and railroads, fence rows, and around farm buildings.

Among the woody plant species controlled are:

Alder	Choke Cherry	Locust	Sassafras
Arrowwood	Cottonwood	Maples	Sumac
Ash	Crataegus	Mulberry	Sweetbay Magnolia
Aspen	(Hawthorn)	Oaks	Sweetgum
Beech	Dogwood	Persimmon	Sycamore
Birch	Elderberry	Pine	Thimbleberry
Blackberry	Elm	Poison Oak	Tulip Poplar
Blackgum	Hazel	Poplar	Willow
Cascara	Hickory	Salmonberry	Winged Elm
Cherry	Hornbeam		

Among the annual and perennial broadleaf weeds controlled are:

Burdock	Dandelion	Plantain	Vetch
Chicory	Field Bindweed	Ragweed	Wild Lettuce
Curled Dock	Lambsquarters	Smartweed	

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

FOLIAR APPLICATIONS

Use GARLON 4 Herbicide at rates of 1 to 8 quarts per acre to control broadleaf weeds and woody plants. In all cases use the amount specified in enough water to give uniform and complete coverage of the plants to be controlled. The recommended order of addition to the spray tank is water, NALCO-TROL[®] (if used), surfactant (if used), additional Herbicide (if used), GARLON 4 Herbicide. If combined with TORDON[®] 101 Mixture Herbicide², continuous moderate agitation is required. If surfactant is used, add 1 to 2 quarts per acre of a standard agricultural surfactant such as Tronic, Sponto 712 or Ortho X-77. Use continuous mild agitation.

¹ NALCO-TROL — Trademark of Nalco Chemical Co.

² TORDON 101 Mixture is a restricted use pesticide. See label.

Before using any recommended tank mixtures, read the directions and all precautions on both labels.

For best results applications should be made when woody plants and weeds are actively growing. When hard-to-control species such as ash, blackgum, choke cherry, elm, maples (other than vine or big leaf), oaks, pines, or winged elm are prevalent and during applications made during late summer when the plants are mature, or during drought conditions, use the higher rates of GARLON 4 Herbicide alone or in combination with TORDON 101 Mixture.

When using GARLON 4 in combination with ESTERON[®] 99[®] Concentrate Herbicide, generally the higher rates should be used for satisfactory brush control.

Use the higher dosage rates when brush approaches an average of 15 feet in height or when the brush covers more than 60% of the area to be treated. If lower rates are used on hard-to-control species, resprouting may occur the year following treatment.

On sites where easy to control brush species dominate, rates less than those recommended may be effective. Consult State or Local Extension personnel for such information.

HIGH-VOLUME SPRAYS WITH GROUND EQUIPMENT

FOLIAGE TREATMENT: For control of woody plants, use GARLON 4 Herbicide at the rate of 1 to 3 quarts in water to make 100 gallons of spray mixture, or GARLON 4 Herbicide at 1½ to 3 pints may be tank mixed with ¼ to ½ gallon of ESTERON 99 Concentrate or TORDON 101 Mixture Herbicides and diluted to make 100 gallons of spray. Apply at a volume of 100 to 400 gallons of total spray per acre depending on size and density of woody plants. Coverage should be thorough to wet all leaves, stems, and root collars. To minimize spray drift, do not use pressure exceeding 50 psi at the nozzle. Direct the spray away from crops toward the center of rights-of-way.

keeping sprays no higher than brush tops and use NALCO-TROL thickening agent or equivalent to reduce spray drift. (See Use Precautions).

LOW-VOLUME SPRAYS WITH GROUND EQUIPMENT

Make application using equipment that will assure particle breakup and uniform coverage of low spray volumes applied. Do not use pressure exceeding 40 psi at the spray nozzle.

NOTE: Do not apply low volume sprays when conditions exist that may cause spray to drift from the target area, such as high winds or when an air temperature inversion exists in the treatment zone (see Use Precautions).

Woody Plant Control

FOLIAGE TREATMENT: Use 4 to 8 quarts of GARLON 4 Herbicide in enough water to make 20 to 100 gallons of total spray per acre, or GARLON 4 Herbicide at 3 pints to 3 quarts may be combined with 1 to 2 gallons of ESTERON 99 Concentrate or TORDON 101 Mixture in sufficient water to make 20 to 100 gallons of total spray per acre.

NOTE: Do not plant conifer seedlings on treated areas for at least 6 months after applying GARLON 4 Herbicide alone or in tank mixtures.

Broadleaf Weed Control

Use GARLON 4 Herbicide at rates of 1 to 4 quarts in a total volume of 20 to 100 gallons per acre as a water spray mixture. Apply any time during the growing season. GARLON 4 Herbicide at 1 to 3 quarts may be tank mixed with ½ to 1 gallon of ESTERON 99 Concentrate or TORDON 101 Mixture Herbicides to improve the spectrum of activity.

AERIAL APPLICATION (Helicopter Only)

Aerial sprays should be applied with a suitable drift control agent such as NALCO-TROL thickening agent or its equivalent or with the MICROFOIL[®] boom. Use NALCO-TROL at the rate of 1 pint to 2 quarts per 100 gallons of spray solution. Do not apply when conditions exist that may cause spray to drift from the target area, such as high winds or when an air temperature inversion exists in the treatment zone. (see Use Precautions).

³ MICROFOIL — Trademark of Amchem Products, Inc.

FOLIAGE TREATMENT: (Utility and Pipeline Rights-Of-Way) Use 4 to 8 quarts of GARLON 4 Herbicide alone, or 3 to 4 quarts GARLON 4 Herbicide in a tank mix combination with 1 to 2 gallons of ESTERON 99 Concentrate or TORDON 101 Mixture, and apply in a total spray volume of 10 to 30 gallons per acre. Use the higher rates and volumes when plants are dense or under drought conditions.

FOREST SITE PREPARATION (not for conifer release): Use 4 to 8 quarts of GARLON 4 Herbicide and apply in a total spray volume of 10 to 30 gallons per acre, or GARLON 4 Herbicide at 3 to 4 quarts may be used with 1 to 2 gallons of ESTERON 99 Concentrate or TORDON 101 Mixture in a tank mix combination in a total spray volume of 10 to 30 gallons per acre.

NOTE: Do not plant conifer seedlings on treated areas for at least 6 months after applying GARLON 4 Herbicide alone or in tank mixtures.

BASAL BARK AND DORMANT BRUSH TREATMENTS

OIL MIXTURE SPRAYS: Use only diesel oil, No. 1 or No. 2 fuel oil or kerosene. Add GARLON 4 Herbicide to the required amount of oil in the spray tank or mixing tank and mix thoroughly. If this mixture stands over 4 hours, reagitation is required.

OIL-WATER MIXTURE SPRAYS: First, premix the GARLON 4 Herbicide, oil and surfactant in a separate container. Do not allow any water or mixtures containing water to get into the GARLON 4 Herbicide or the premix. Fill the spray tank about half full with water, then slowly add the premix with continuous agitation and complete filling, the tank with water. Continue moderate agitation.

NOTE: If the premix is put in the tank without any water, the first water added may form a thick "invert" (water in oil) emulsion which will be hard to break.

BASAL BARK TREATMENT: In right-of-way, other non-crop areas and forests, use 1 to 2 gallons of GARLON 4 Herbicide in enough diesel oil, No. 1 or No. 2 fuel oil or kerosene to make 100 gallons of spray mixture. Apply with knapsack sprayer or power spraying equipment using low pressures (20-40 psi). Spray the basal parts of brush and tree trunks to a height of 12 to 15 inches from the ground. Thorough wetting of the indicated area is necessary for good control. Spray until run-off at the ground line is noticeable. Old or rough bark requires more spray than smooth young bark. Apply at any time, including the winter months, except when snow or water prevent spraying to the ground line. For oil-water mixture application, mix 2 gallons GARLON 4 Herbicide, 25 gallons of oil and one half gallon of Sponto 712, and add to 72.5 gallons water as indicated under directions for use. Treat as above.

For dormant brush treatment: Use 1 to 2 gallons of GARLON 4 Herbicide, 25 gallons of oil to make 100 gallons of spray. Apply with knapsack or power spraying equipment.

using low pressure (20-40 psi). Treat any time when brush is dormant and most of the foliage has dropped. Thoroughly wet the upper parts of the stems and use the remainder needed to wet the lower 12 to 15 inches above the ground to the point of run-off. For root suckering species such as sumac, persimmon, sassafras and locust, also spray the ground under the plants to cover small root suckers which may not be visible above the soil surface. Brush of average density and 4 to 6 feet high may take up to 150 gallons of spray mixture per acre. For oil-water mixture application mix 6 quarts GARLON 4 Herbicide, 25 gallons of oil and one half gallon of Sponto 712 and 73 gallons water as indicated under directions for use. Treat as above.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

STORAGE: Store above 28°F or agitate before use.

DISPOSAL:

Prohibitions — Open dumping is prohibited.

Pesticide Disposal — Pesticide, spray mixture, or rinse water that cannot be used according to label instructions must be disposed of according to applicable federal, state, or local procedures.

Container Disposal — Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures.

General — Consult federal, state, or local disposal authorities for approved alternative procedures.

Be sure that use of this product conforms to all applicable regulations.

USE PRECAUTIONS

Apply this product only as specified on this label.

Before using any recommended tank mixtures, read the directions and all use precautions on both labels.

Do not apply GARLON 4 Herbicide directly to, or otherwise permit it to come into direct contact with grapes, tobacco, vegetable crops, flowers or other desirable broadleaf plants and do not permit spray mists containing it to drift onto them.

Do not spray when wind is blowing towards susceptible crops or ornamental plants.

AVOID SPRAY DRIFT: Applications should be made only when there is no hazard from spray drift since small quantities of the spray, which may not be visible, may injure susceptible crops. Use coarse sprays to minimize drift since, under adverse weather conditions, fine spray droplets may drift a mile or more.

GROUND EQUIPMENT: With ground equipment, spray drift can be lessened by keeping the spray boom as low as possible, by applying 20 gallons or more of spray per acre, by using no more than 50 pounds of spraying pressure with large droplet producing nozzle tips, by spraying when wind velocity is 10 miles per hour or less and by the use of NALCO-TROL thickening agent or its equivalent. Do not apply with hollow cone-type insecticide or other nozzles that produce a fine-droplet spray.

AERIAL APPLICATION: With aircraft, drift can be lessened by applying a coarse spray, by using no more than 20 pounds spray pressure at the nozzles, by using NALCO-TROL thickening agent or its equivalent or the MICROFOIL boom, and, by spraying only when wind velocity is 5 mph or less.

DO NOT APPLY BY AIRCRAFT OR BY LOW-VOLUME OR HIGH VOLUME GROUND EQUIPMENT WHEN AN AIR TEMPERATURE INVERSION EXISTS. Such a condition is characterized by little or no wind and with air temperature lower near the ground than at higher levels. The use of a continuous smoke column at or near the site of application is suggested to indicate direction and velocity of air movement, and to indicate a temperature inversion by layering of the smoke.

Do not contaminate irrigation ditches or water used for irrigation or domestic purposes.

Do not graze treated areas or feed treated forage.

NOTICE: Seller warrants that the product conforms to its chemical description and is reasonably fit for the purposes stated on the label when used in accordance with directions under normal conditions of use, but neither this warranty nor any other warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, express or implied, extends to the use of this product contrary to label instructions, or under abnormal conditions, or under conditions not reasonably foreseeable to seller, and seller disclaims any such warranty.

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CASUARINA

CASUARINACEAE*

(Australian-pine Family)

This small but distinctive family of about 70 species in 2 genera is native to Australasia although several species of *Casuarina* are naturalized throughout the tropics outside their normal range. The family is distinctive because the leaves are reduced to whorls of scales on slender photosynthetic branches, rather in the manner of horse-tails (*Equisetum*). The flowers are very reduced and specialized in relation to wind pollination. The common names for *Casuarina* stress the superficial similarity to conifers as in "Australian-pine" or "whistling-pine". Other common names are "she-oak", "Australian-oak", with reference to the broad-rayed wood, superficially like oak, while "beefwood" refers to the dense, hard wood.

Casuarina

A genus of 40-50 species, with the distribution of the family. Several species have been introduced into South Florida, but only two are common. The following species is widely naturalized since its seeds are readily distributed by wind and water.

Casuarina equisetifolia L. ex J.R.&G. Forst. Australian-pine
(swamp she-oak in Australia)
(The name *C. littorea* L. has been used for this species)

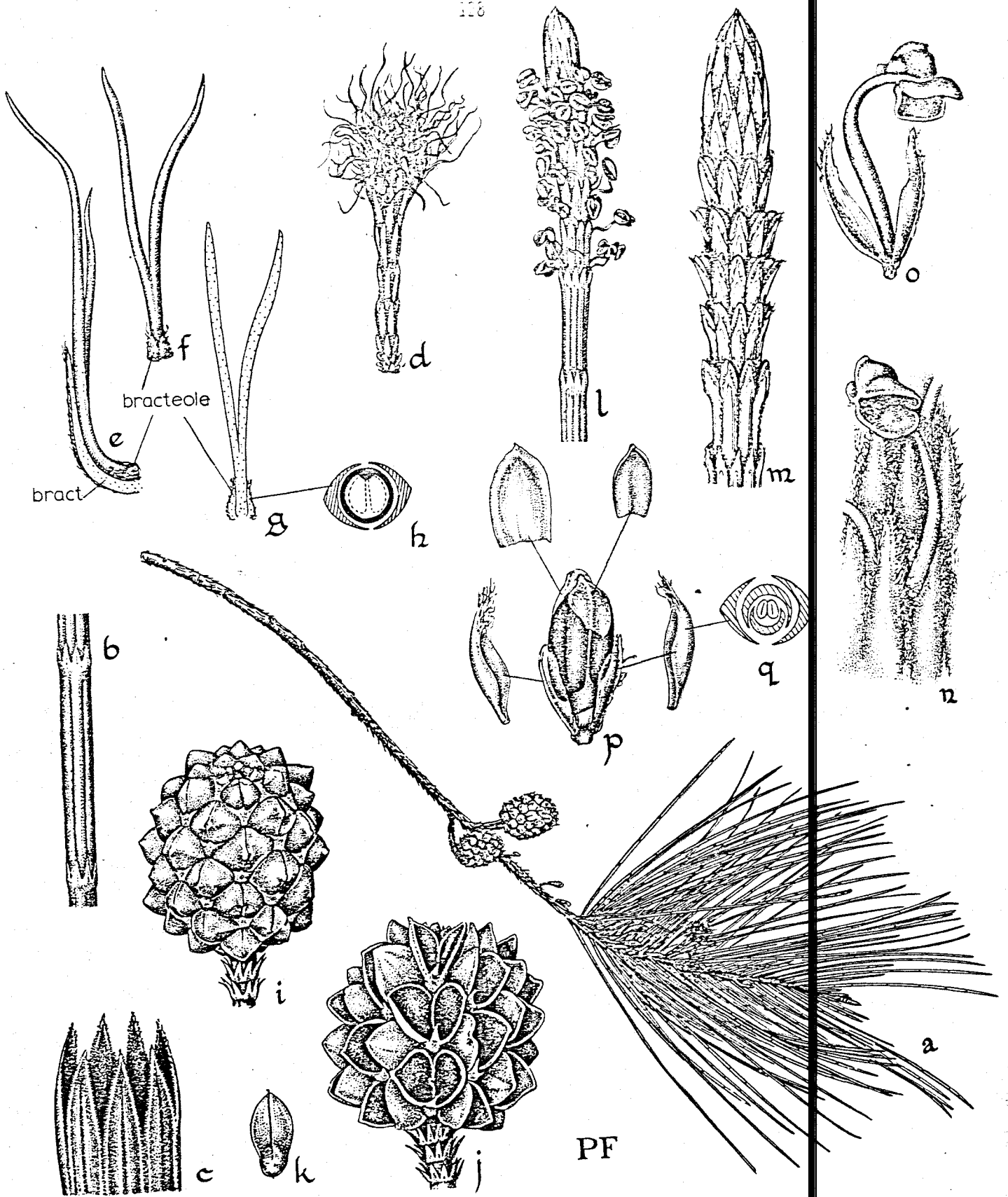
This species sets abundant wind-dispersed seed and seedlings are readily established in disturbed, especially coastal areas. The fine roots of *Casuarina* develop conspicuous nodules which are inhabited by nitrogen-fixing microorganisms (Rodriguez-Barrueco, 1969). This accounts in part for the ability of this tree to flourish in nutrient-deficient soils.

Growth. The larger branches (Fig. 39a) bear a series of slender, green, quill-like twigs (assimilating shoots), which superficially resemble pine-needles. These shoots are jointed (Fig. 39b) with the leaves forming whorls of minute teeth at intervals, the teeth of successive whorls alternating. The green surface stem tissue between whorls is the main site of photosynthesis. The number of teeth per whorl is constant between narrow limits for each species and *C. equisetifolia* usually has seven (Fig. 39c).

There are two types of vegetative shoot, determinate and indeterminate. The former have a limited life span, i.e. their apices abort early and they abscise; they neither branch nor undergo thickening growth. The

* Introduced

Reprinted from: Tomlinson, P.B., 1980. The Biology of Trees Native to Tropical Florida. Allston, Massachusetts, Harvard University Printing Office.



latter have continued apical growth, they undergo secondary thickening, they branch further and usually persist as the permanent shoot system. Both types of shoot originate in the axil of one of the scales of a whorl of leaves; often one whorl may be the site of more than one branch. In the early stages there is no obvious distinction between determinate and indeterminate shoots, the latter become recognizable when they start to branch and thicken.

Flowering and fruiting. The tree is monoecious, with the main flowering period in spring (March-April). Inflorescences are terminal, the male on assimilating switch-shoots of the determinate type, the female on short, inconspicuous non-assimilating lateral shoots, which are clustered in small numbers among the male branches. Male inflorescences develop as yellowish club-shaped regions in the terminal whorls of long assimilating shoots (Fig. 39m). When the anthers expand (Fig. 39l) the flowering stage of the whole tree is conspicuous.

Each male flower consists of a single stamen, with a lateral pair of bracteoles and a "perianth" of two unequal scales which initially form a hood over the stamen (Fig. 39p, q). The stamens of an inflorescence are at first enclosed by the hooded inner scales (Fig. 39p) and become conspicuous only when the filament elongates (Fig. 39l, n) rupturing the perianth, which is usually cast off. Figure 39o shows a male flower dissected from a shoot with the persistent basal bracteoles.

Female branches (Fig. 39d) have a basal series of sterile scale-whorls, with the female flowers in distal whorls. The individual female flowers are represented largely by their pair of scarlet styles (Fig. 39e-g). The female flower has no "perianth" but a pair of lateral bracteoles (Fig. 39h), while the base of the flower is protected by the subtending bract (Fig. 39e). When the styles are receptive the ovary is undeveloped; it enlarges after pollination, as a bicarpellate structure with two ovules, only one of which is functional (Fig. 39h, dotted).

Figure 139. *Casuarina equisetifolia*. a. Habit (x 2/3); b. details of assimilating shoot (x 6); c. whorl of fused scale-like leaves removed from photosynthetic shoot (x 24); d. female inflorescence (x 4); e-h. female flower (x 14), (e) from the side, subtending bract in longitudinal section, (f) front view, (g) in longitudinal section, ovary scarcely developed at this stage (x 14), (h) floral diagram, outermost scales are bracteoles; i. young fruit (x 2); j. fruit after separation of woody bracteoles (x 2); k. seed (x 2); l. male inflorescence at anthesis (x 4); m. young male inflorescence at end of photosynthetic shoot (x 6); n-q. male flower, (n) at anthesis and in situ (x 32), (o) with persistent basal bracteoles (x 32), (p) with remains of enveloping perianth (x 24); parts of envelope are shown in detail; lateral bracteoles to left and right, dorsal and lateral perianth segments above left and right, respectively, (q) floral diagram, outermost scales are bracteoles.

Pollination is evidently by wind. Further development of the female inflorescence is rapid. The lateral bracteoles, previously insignificant (Fig. 39e-g) enlarge to form a pair of woody valves within which the fruit proper develops. The axis thus becomes a cone-like structure (Fig. 39i). Eventually the valves gape (Fig. 39j) to release the winged fruit (Fig. 39k), which is dispersed by wind. The woody cones with fruits can be found throughout most of the year, but they open only in dry weather.

Casuarina species.

The two common species growing in our area may be distinguished easily by habit as follows:

- 1A. Trees monoecious (with fruiting "cones") reproducing from seed and lacking root suckers. Shoot clusters relatively open; branches spreading, not plumose; scale teeth about 7 per whorl
 *C. equisetifolia*
- 1B. Trees dioecious, male plants only (without fruiting "cones"), not reproducing from seed; root suckers abundant. Shoot clusters dense; branches erect, plumose; scale-teeth about 12 per whorl
 *C. cristata* Miq.
 (also known as *C. glauca* Sieber and as *C. lepidophloia* F. Muell.)

The latter species is commonly planted along canal banks in South Florida, where it is useful in stabilizing the soil, but proliferation by root suckers is a nuisance. Attempts have been made to combine the desirable properties of these two by grafting, to produce a non-suckering, non-seedling tree. Nomenclature for *Casuarina* species in Florida remains uncertain and confusing.

References for Casuarinaceae

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CASUARINAS IN FLORIDA (USA) AND
SOME CARIBBEAN ISLANDS

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Paper presented to International Casuarina Workshop
17-21 August 1981, CSIRO Division of Forest Research
Canberra, ACT, Australia.

CASUARINAS IN FLORIDA (USA) AND
SOME CARIBBEAN ISLANDS

by T. F. Geary

Casuarinas are ubiquitous in the Florida peninsula from its southern tip at 24°30'N latitude to about 29°N. Elevations are rarely more than 30 m and most are less than 15 m above sea level. Australian pines, as the casuarinas are known locally, are very common on the coast, along roads and property lines, on ditch and canal banks, and around buildings. Despite their conspicuousness, casuarinas occupy a very small percentage of the total land in the region.

The casuarinas have not been studied in detail in Florida. Identification of the species that occur is uncertain, but it appears that almost all, if not all trees, are C. equisetifolia, C. glauca, C. cunninghamiana, or their hybrids. Trees are found that seem to have characteristics of all three species. C. cristata (syn C. lepidophloia) is reported as widely planted in Florida (Little, 1979), but this may be a misidentification of C. glauca.

Casuarinas were once highly regarded for landscaping, wind breaks, and shade, because they grow well on acid and alkaline soils, sand dunes, calcareous rocky soils, muck and many other soils (Conover and McElwee, 1971). Now plantings are regarded as a mixed blessing.

C. equisetifolia is the only species that is truly naturalized. It regenerates and spreads by seed. It is common along the coast where it is appreciated for its shade and the pleasant sensation produced by the wind "whispering" through the foliage. However, on fore-shore dunes C. equisetifolia roots can prevent sea turtles from digging nests for their eggs, and sometimes turtles are trapped by the roots.^{1/} On coastal areas subject to wave erosion, toppled casuarinas act as groins, increasing loss of sand.^{1/}

A key concern of those who discourage planting in coastal areas is public safety. C. equisetifolia is the largest coastal tree, with heights to 30 m. Trees of this size if toppled by hurricanes, to which Florida is prone, can cause substantial property damage. The major fear, though, is that C. equisetifolia planted along roads and on causeways may fall and block evacuation routes from low-lying coastal areas during hurricanes. This species has a bad reputation in some cities in the northern part of its range, because large trees killed by a record freeze became a public nuisance due to falling limbs and tops. Removal of dead trees and debris was costly. C. equisetifolia is not common inland, as it cannot survive the harder inland freezes. Its tolerance of fire also limits its ability to spread uninhibited in the fire-dominated environment of southern Florida.

^{1/} Personal communication from Richard W. Workman, Thomas M. Missimer & Assoc., Inc., Cape Coral, Florida.

C. glauca is found in coastal areas, usually around brackish waters, but it is more prominent inland as an ornamental, windbreak, and grove for cattle shade. The species is propagated by transplanting root suckers of male trees, and it is uncertain if there are any females of genetically pure C. glauca in Florida. Prolific root suckering characterizes stands of this species. This property has caused C. glauca to be considered a pest, and some counties legislated against planting it and other members of the genus (Conover and McElwee, 1971). Because of the desirable ornamental value of the dense, dark green crown of C. glauca, it is sometimes grafted onto rootstocks of C. equisetifolia, which does not have root suckers, and sold for landscaping (Conover and McElwee, 1971).

Planting of C. glauca as an agricultural windbreak has fallen into disrepute, because reductions in crop yields at field margins due to shading and root feeding exceed benefits of the windbreak. Windbreaks have been felled because of this. Old plantings along roads, so common in southern Florida, are slowly disappearing as roads are widened. Planting of trees near road edges is now discouraged to prevent collision of cars with trees.

C. cunninghamiana is the least common of the three species in Florida, even though it is the most cold hardy and is the least objectionable to environmentalists. The species' lack of popularity may be caused by its relatively low visual appeal as an ornamental, its intolerance of coastal sites, and relatively slow growth.

Casuarina stands, particularly those of C. glauca, appear impressive in standing volume compared to native forest. But the timber is not used commercially. Interest has developed in growing casuarinas in Florida as a source of fuelwood for industrial boilers, but experimental plantings have been disappointing. The growth rate of casuarinas has been substantially less than that of eucalypts. Lack of nodulation of the experimental plants may have caused the unexpectedly slow growth. If commercial plantations of casuarina are established, Clitocybe root rot could be a serious problem (Rhoads, 1952).

The Dominican Republic is on the island of Hispaniola at about 18°N latitude. Trees of C. equisetifolia were very common in the coastal city of Santo Domingo until hurricanes in 1979 blew them down. Trees 20 to 25 cm diameter at breast height snapped off from 3 to 5 m above ground, while larger trees were uprooted.^{1/} Streets were clogged with debris from these downed trees, and cleanup was costly. C. equisetifolia is being replanted in some sections of the city, but whether the tree again becomes a common ornamental remains to be seen.

Casuarinas are rare outside of Santo Domingo. But trial plantings by a private company, Falconbridge Dominicana, of C. equisetifolia on strip-mined land in a humid climate zone have grown faster than eucalypts of unknown species and Pinus caribaea var. hondurensis. In the dry zones of the island, on alkaline soils, there are a few trees of casuarina of unknown species that have grown to a large size. Because the Dominican Republic is heavily dependent on charcoal and wood for home cooking, and the existing forests have been heavily exploited, casuarina plantations could become important to the fuelwood industry of the island.

In Puerto Rico, an island just east of the Dominican Republic, C. equisetifolia is the only casuarina commonly planted. It is found along the coast, and less commonly in the lower mountain regions (Little and Wadsworth, 1964). It is recommended as an outstanding species for beaches and windbreaks (Schubert, 1979). Planting close to buildings is not recommended because a disease, probably Clitocybe root rot, sometimes kills old trees, and there is danger of the trees being blown over by hurricanes. Natural regeneration is rare in Puerto Rico because ants eat nearly all the seeds (Little and Wadsworth, 1964).

In screening trials of trees for commercial timber production on granitic uplands in Puerto Rico, C. equisetifolia grew faster in height than Pinus caribaea var. hondurensis and a variety of other gymnosperms and angiosperms (Geary and Briscoe, 1972). Only Eucalyptus tereticornis grew faster. As in Florida, the trees' timber is rarely utilized, if at all. Utilization of the wood of casuarina in Puerto Rico is not anticipated; in contrast to the Dominican Republic, fuelwood and charcoal use of any species in Puerto Rico is negligible.

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COLUBRINA

Family : 215
Genus : Colubrina
Species: Asiatica

RHAMNACEAE
BUCKTHORN FAMILY

COLUBRINA ASIATICA (L.) Brongn.
ASIATIC or SHRUBBY COLUBRINA

Ceanothus asiaticus L. Sp. Pl. 196. 1753.
Colubrina asiatica Brongn. in Ann. Sp. Nat. 1, 10:369. 1827.

Rambling shrub, 15-30 dm. high, with ultimate branches green and usually about 5 dm. long. Leaves alternate, shiny, glabrate, ovate, dentate, acuminate, 4-8 cm. long and 2-4 cm. wide, on 1 cm. long petioles. Flowers perfect, rotate, greenish, 4 mm. in diameter, on 3 mm. pedicels subtended by minute bracts, in small axillary clusters on common peduncle about 2 mm. long. Sepals 3-nerved, acute. Petals hooded, equal to sepals in length, before anthesis folded inward to enclose stamens, later explanate. Stamens less than 1 mm. long; anthers minute. Ovary topped by circular, 3 mm. wide, yellow, nectar-secreting intrastaminal disk; style short, 3-lobed. Fruit a brown, trilocular, 3-grooved, about 8 mm. high, depressed-globose capsule immersed in the prominent ridged disk for one-third of height. Seeds dark brown, almost 5 mm. long, subglobose with 1 hemispheric and 2 plane sides; embryo large, yellow, surrounded by small amount of white endosperm.

Type Locality: "Habitat in Zeylona."

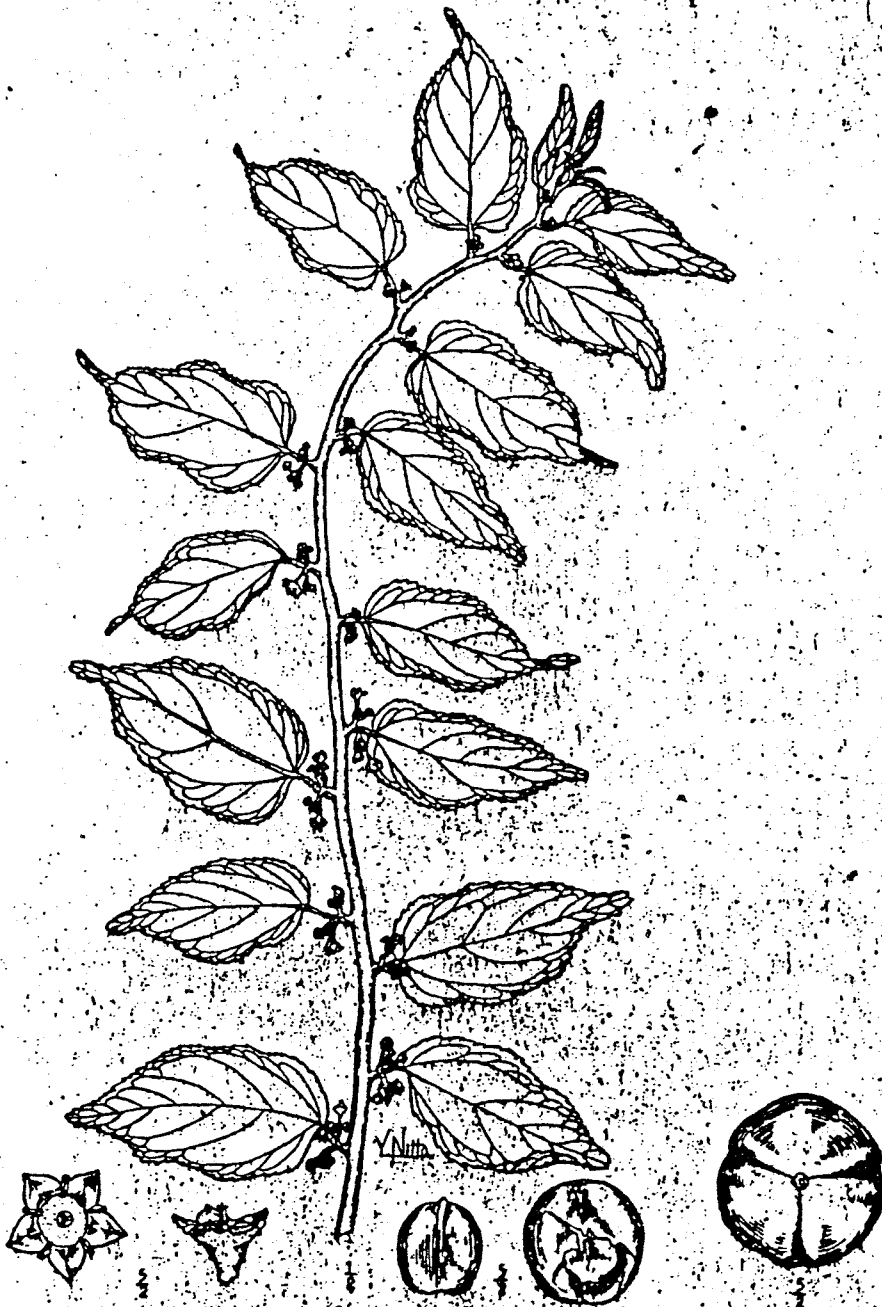
Local Range: Found possibly on all the islands in arid places near the coast. On Oahu it is quite common along the road between Waiāluā and Laie, where it was collected in 1927. In 1930 it grew in Kamanele Park, Honolulu. On Molokai it was collected along the road east of Ualapue in October 1927. At that time it was in full flower. The plant is very poisonous and was, therefore, frequently employed by the ancient Hawaiians to narcotize fish to facilitate their capture.

Extra Range: A plant of wide distribution, probably due to the ability of its seeds to float. It is found in India, Africa, Malaya, Australia and Polynesia; doubtfully reported from Bermuda.

(Illustrated on following page)

Family : 215
Genus : Colubrina
Species : Asiatica

RHAMNACEAE
BUCKTHORN FAMILY



COLUBRINA ASIATICA (L.) Brongn.
(Original)
(Described on preceding page)

© Otto Degener, 6/30/12

(Waimea, Oahu)

ly double or long-spurred. The fruit is a long, woolly ch bursts open when ripe, the five valves coiling and the seeds.

BUCKTHORN FAMILY (Rhamnaceae)

thorn family includes about 50 genera and 600 species of and a few herbs, some spiny, some woody climbers, buted in more or less dry localities of temperate and ns. Few species are useful to man: a few ornamentals; g small, edible fruits; some with bark yielding medicine, green dyes and paint colors, or soap substitutes. The ranges from light and soft to heavy and hard, yellow to k, is not used commercially, as trees of sufficient size

ernate or opposite, simple; stipules commonly present. *Flowers:* road, flat-topped clusters (cymes), small, perfect or not; calyx r five-lobed; petals four or five or absent, small; stamens four or oposite petals and encircled by them or not; ovary superior or dded in the disk, two- to four-celled, ovules solitary (or paired). / a drupe, or a capsule.

ORN. *Paliurus spina-christi* Mill. An ornamental shrub or tive from southern Europe to China, has alternate ovate anches long, their edges finely toothed. Each petiole has vo spines, one straight, the other curved. Flowers are -parted. Fruits are dry, circular, to one inch in diameter, wide, flat bordering wing.

UBE. *Zizyphus mauritiana* Lam.; synonym, *Z. jujuba* l. An evergreen tree or shrub, 10 to 40 feet high, native metimes grown ornamentally. The branches are droop- hlets, woolly. Single or paired thorns are usually present ie alternate, broad-ovate, toothed, blunt-tipped leaves, 3 inches long, three-veined at the base, white or tawny- th, short-stemmed. Small, greenish-white, five-parted me in short clusters at leaf axils. The fruit is a globose

ng to brown drupe, 0.5 to 1 inch long, with edible, ce pulp surrounding a two-celled, knobby stone. The red of little value as food. In India the tree is a host ect and is a source of shellac. Leaves and bark yield dicine, and leaves are fed to cattle. The Chinese jujube l.), a deciduous tree or shrub, with smooth branchlets oth, narrow leaves, green on both sides, is grown in ntries. It is also known to be growing in Hawaii.

being one of the five principal fruits of China, where more than 300 varieties are known.

BUCKTHORN. *Rhamnus alaternus* L. A small tree from the Mediter- ranean region is grown ornamentally in the southern United States and has been planted in Hawaii. Leaves are alternate, ovate, toothed, about 2 inches long; small green flowers develop at leaf axils, followed by blackish, berrylike fruits. A variety has white-edged leaves.

RAISIN TREE. *Hovenia dulcis* Thunb. A small tree from China is cultivated in China and Japan for the pear-flavored swollen red stems of the fruit, which are used as food and medicine. Leaves are alter- nate, ovate, toothed, to 7 inches long; flowers are small, in small clusters; fruits are globose, whitish, 0.25 inch in diameter, three- seeded.

'ANAPANAPA KUKUKU. *Colubrina asiatica* (L.) Brongn. A smooth shrub with twining stems, sometimes reaching a height of nearly 20 feet, is distributed from Africa, India, and Australia to Polynesia. It has alternate, shiny, ovate to heart-shaped, pointed leaves, 2 to 3 inches long, three-veined at the base, edges toothed or scalloped. Short, broad clusters, about 0.33 inch long, of tiny, yellow-green flowers develop at leaf axils. The fruit is a globose, three-grooved, brown capsule about 0.33 inch in diameter, which finally opens and frees three black, angular seeds. In Hawaii, the 'anapanapa (meaning glistening) is found mainly near the coast. In Fiji, Samoa, Hawaii, and elsewhere, the leaves, which form a lather in water, have long been used as soap. In Guam and elsewhere, the plant is used medic- inally. Statements that it is poisonous have been disproved by feeding its leaves and stems to guinea pigs, with no bad effects.

The kauila (*C. oppositifolia* Brongn.) is a rare native Hawaiian tree found only on Hawaii and Oahu. It has opposite, thin, ovate or oblong leaves to 7 inches long, on stems to 2 inches long. The hard, dark red, heavy wood sinks in water, and was formerly valued by Hawaiians for spears and tapa beaters. The wood is even harder than the red and black streaked wood of the closely related, larger, native Hawaiian kauila tree (*Alphitonia ponderosa* Hbd.), which also sinks

in water and which has alternate, thin, oblong to narrow leaves to 6 inches long, grayish or rusty-woolly below, on stems to 1 inch long. This species is found on the six largest Hawaiian Islands. It also has flowers with stamens half as long as the petals, and fruits more than 0.5 inch in diameter, marked with a ring around the middle. Very similar is the toi [*A. zizyphoides* (Spreng.) A. Gray], an introduced tree, native from Polynesia westward to Malaysia and the Philippines, which has leaves perhaps more densely white-downy below. the

LEUCAENA

Fabaceae - Pea Family

Subfamily: Mimosoideae

5. LEUCAENA Benth. LEAD TREE

Tree; leaves bipinnate, petiolar gland between the lowest pinnae or near the middle of the petiole. Flowers white or pinkish in globose heads; solitary or in racemes; calyx campanulate, dentate; corolla of free petals; stamens ten, free. Legume stipitate, linear, compressed, two-valved; embryo embedded in horny endosperm. About 50 species, trop-

ical America, one pantropical, one Polynesian, warm regions of New World and Old World.

1. *L. leucocephala* (Lam.) de Wit—Shrub or small unarmed tree, 5-8 m tall. Leaves glaucous with four to eight pairs of pinnae, 8-15 cm long; leaflets falcate, inequilateral. Flower spikes axillary or in small terminal racemes; calyx 3 mm long, dentate, corolla 4-6 mm long; stamens 10-12 mm long. Legumes 10-15 cm long, pulpless, many-seeded. Seeds 6 mm long, stalked. $2n = 104$. Hammocks, coastal strand, Fla. Keys, Everglades, south Fla., W.I., South America. Summer. *Mimosa glauca* L., *Leucaena glauca* (L.) Benth.

From: Long, Robert W. and Olga Lakela. 1976

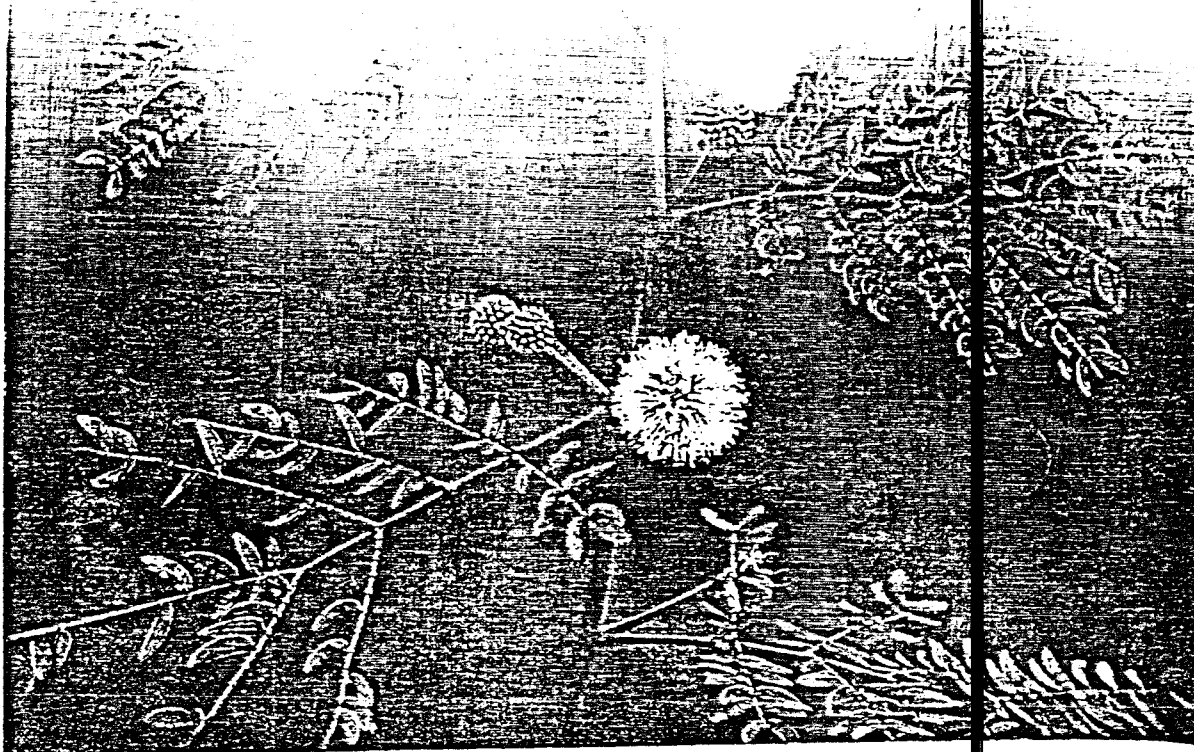
A Flora of Tropical Florida. Miami, Florida

Banyon Books.

Leucaena is closely related to Lysiloma and looks a lot like it. During early leaf expansion, Lysiloma has conspicuous stipules at the base of the petiole - Leucaena does not. [Stipules look like small bumps].

Lysiloma fruits are up to 20cm long

Leucaena's are 10-15cm.



Leucaena leucocephala (Lam.) de Wit

LEGUMINOSAE

"GUAJE" "XAXIM" "HUATSIM" "UAXIM"

DESCRIPCION: Arbusto o árbol de 1-10 m. de altura, con el tronco recto, la copa redondeada; con la corteza lisa a ligeramente fisurada, gris-parda, con lenticelas, con olor de ajo; la madera de color crema; hojas medianas con numerosos folíolos pequeños, esta especie tira el follaje en la época de sequía; tiene pequeñas flores blancas, agrupadas en vistosas cabezuelas globosas, perfumadas; los frutos son vainas de 10-20 cm. de largo, moreno brillantes, y en nuestro caso velutinoso, con numerosas semillas; florece durante todo el año.

DISTRIBUCION: Especie ampliamente cultivada en México y en ciertos casos escapada; desde Tamaulipas hasta la Península de Yucatán por el Golfo de México y de Sinaloa a Chiapas por el Océano Pacífico; formando parte de la vegetación secundaria de las selvas mediana subperennifolia y subcaducifolia.

En la Península de Yucatán y en particular en Quintana Roo, se distribuye aparentemente en forma natural, en todas las asociaciones secundarias derivadas de las diversas selvas del estado, aunque también ha sido objeto de intensa propagación por el hombre.

USOS: A esta se le ha considerado como una de las especies del trópico americano con mayor diversidad de usos; su importancia radica principalmente en que las semillas tienen gran cantidad de aminoácidos y éstas son muy consumidas por el hombre; la madera se usa localmente para construcciones ligeras y como combustible. También se le utiliza como forraje de corte o en ramoneo, en el control de la erosión y en general como mejorador del suelo, por la fijación de nitrógeno.

Gina -

On Dec. 5, 1979, I read an article in The Miami Herald about a miracle tree that may provide a cure for the world's dwindling forests. The tree is called *Leucaena leucocephala*. I live in the Republic of Panama and I would like to plant some of those trees on my ranch here. My problem? I don't know where to get the seeds. — Cynthia Stahl

They're on the way to you now. Mike Bengé of the U.S. State Department's Agency for International Development in Washington, D.C., is sending you a package of seeds and information on the tree. Defoliation is a major problem in underdeveloped countries where trees have been chopped down for fuel and to clear the land for agriculture, Bengé says. *Leucaena leucocephala*, also called *Leucaena glauca*, is one of the world's most rapid-growing trees and the agency is promoting it to help solve the defoliation problem. Under proper conditions, the tree can grow 13 feet tall in six months, 30 feet in two years and 55 feet in six years. That kind of growth can cause problems. The tree is considered a pest in Florida, says Dr. Julia Morton, Florida's famed expert on trees and plants. Once you plant one tree, seedlings shoot up all over the place. There's also evidence that horses, cattle and pigs can fall ill from eating too many of the leaves. However, Morton says, the tree has the ability to extract nitrogen from the air and release it into the soil as fertilizer.

Thought you might be interested in this item from Action Line. An exotic here might not be an exotic there?

Gina Conroy

MELALEUCA

Family Myrtaceae

Subfamily Leptospermoideae

Melaleuca (paper-bark tree) (Fig. 102 on P. 285)

A genus native to Australasia but represented in our area by one introduced and widely naturalized species. *Eucalyptus* species are only occasionally cultivated in Florida and several species of *Callistemon* (bottle-brushes) are grown as ornamentals.

Melaleuca quinquenervia (Cav.) S.T. Blake

paper-bark tree

This tree is widely referred to as *M. leucadendron* (L.) L. but it has been shown recently that this was based on a misidentification of Florida trees. The tree has a wide ecological tolerance with preference for wet sites and this allows it to compete successfully against the natural vegetation. It is recognized by its white, spongy flaking bark, lanceolate longitudinally parallel-veined leaves and the clusters of woody fruits.

Growth. Leaves are spirally arranged and monopodial growth is pronounced. Saplings of this tree are strongly excurrent with a dominant leader which is readily substituted if the terminal bud is damaged but older trees be-

From: Tomlinson, P.B. 1980. The Biology of Trees Native to Tropical Florida.
Allston, Massachusetts, Harvard University Printing Office.

come several-stemmed. Erect branches are borne at irregular intervals and there is some tendency for them to be tiered. Distal shoots have distinct alternation of vegetative and reproductive increments along the same axis separated by very conspicuous "scale-zones" made up of the closely overlapping scars of numerous bud-scales (Fig. 102f). Scale-zones may be over 2 cm long and represent the position of resting terminal buds. Lengths of shoot with foliage leaves separated by long internodes are produced during more vigorous cycles of growth.

The reproductive phase involves an increment of the axis which bears flowers. Former sites of inflorescences are indicated by the zones of persistent capsules on old wood and are usually separated from leafy increments by a longer or shorter scale-zone. Since all these changes in patterns of growth are reflected in distinct twig features, the previous history of a shoot can be assessed (Fig. 102a). However, different trees and even different shoots on the same tree are non-synchronous in their flowering.

Buds are borne singly in the axils of the foliage leaves but are largely absent from the scale-zones (except for occasional ones in association with the lower scales). Branching is somewhat irregular, but is most common at or just below the scale-zone i.e., from the upper nodes of the previous increment. The morphology of branch bases shows that a branch may grow out early or late i.e., after a brief or lengthy period of "rest". If brief there is but a single pair of prophyllar scales, if lengthy there may be a well-developed scale-zone. In this sense, although there is no sharp distinction, a relative difference between proleptic and sylleptic shoots is maintained.

Flowering and fruiting. Reproduction involves the direct conversion of an axis into a flowering spike. This seems always to be preceded and succeeded by a "resting" phase represented by a scale-zone. Two main periods of flowering are evident, one in the fall and the other in early summer, but individual trees vary very much and isolated shoots may flower in almost any month. The fruiting "period" is even less easy to define because it is difficult to establish a precise time when capsules are ripe. It is possible that seeds are available throughout much of the year.

The apparent spikes (Fig. 102a) in fact include clusters of flowers in 3's, each triad subtended by a bract which falls early. The triads may be interpreted as dichasial units with the stalks to individual flowers suppressed. Each flower has a trilocular ovary enclosed by the calyx tube (Fig. 102e) and covered by ten prominent, hairy glands in five pairs which seem to be outgrowths of the calyx tube (cross-hatched in Fig. 102h). The nectar produced by these glands accumulates internally in the cavities evident in Figure 102c. There are five glandular sepals and five white petals, each petal with prominent elongated glands (Fig. 102b). Opposite each petal is a stamen group with 6-10 stamens in each group (Fig. 102d). The style is a little longer than the stamens (Fig. 102c).

The fruits ripen as persistent woody capsules, clustered on the axis

(Fig. 102f). They dehisce when dry (Fig. 102g) and the numerous light seeds are exposed and scattered by wind.

SCHINUS

Schinus

Schinus terebinthifolius Raddi is 1 of about 28 species (Tomlinson 1980) in the Central and South American genus Schinus of the family Apocynaceae. It is an extremely variable taxon, and Barkley (1944) discussed 4 varieties: acutifolius, Pohlianus, Raddianus, and rhoifolius, in addition to the "typical" form, Schinus terebinthifolius. However, field separation of the varieties is difficult (Barkley 1944, Campbell et al. 1980), and the South Florida populations have not been classified to the variety level. In the U.S. several common names are used for this species: Brazil peppertree (or Brazilian pepper or peppertree), Florida holly, and Christmas-berry. It is not a "pepper", it is not a "holly", and its fruit is not a "berry" (it is a drupe). In this report the generic name is decapitalized and used as a common name, as this is how the taxon is normally referred to by researchers and resource managers in South Florida. It is most commonly pronounced "shynus", but perhaps more correctly "skynus".

The anatomy and morphology of schinus were described by Oliveira and Souza Grotta (1965), and general botanical descriptions are in Barkley (1944), Little et al. (1974), Morton (1978), and Tomlinson (1980). Schinus is a compound-leaved, evergreen tree that reaches heights of about 13 m. It has a multiple-stemmed trunk, and its branches do not readily self-prune, but stay attached to the trunk and form a nearly impenetrable tangle that surrounds the tree to ground level. It sprouts vigorously from trunk and roots, even if undamaged (Woodall 1979a). Schinus is dioecious (i.e. it has male and female flowers on different individuals); male trees bear more flowers than do female trees. Campbell et al. (1980) examined 31 herbarium specimens (most identified to variety) in Brazil, and determined that collections of flowering Schinus had been made in every month except May, June, and September. More flowering specimens (7) were collected in March than in any other month. Seven flowering specimens had been collected in October, the month when schinus flowering peaks in South Florida. In São Paulo,

From: Ewel, John J., Dennis S. Ojima, Dorie A. Karl, William F. DeBusk. 1982.
Schinus in Successional Ecosystems of Everglades National Park.
South Florida Research Center Report T-676., 141 pp.

Brazil, schinus blooms in March and April (Oliveira and Souza Grotta 1965), months when we seldom observed flowering in Everglades National Park. However, Morton (1978) reported that, in South Florida, there is no month when specimens cannot be found in bloom. Its fruit is a drupe, about 0.5 cm in diameter, and bright red when ripe.

Schinus may be allelopathic (i.e. it may release chemicals into its surroundings that inhibit the growth of competing vegetation) (Gogue et al. 1974), and it, in turn, is subject to allelopathy from Myrica cerifera (wax-myrtle), a common native shrub (Dunevitz and Ewel 1980). The foliage and fruits have a pungent turpentine odor, and Campbell et al. (1980) report that the odor is restricted to female trees. (We were unable to confirm this, but did not design a statistically valid test.) The plant has a long history of use in folk medicine in Brazil (see Morton 1978, plus references cited by Oliveira and Souza Grotta 1965). Morton (1977, 1978) called attention to the skin and respiratory irritation that schinus causes some people. Its recent use as a spice ("pink peppercorn") in gourmet restaurants is cause for concern (Salamon 1981).

The species is a native of Argentina, Paraguay, and Brazil, where it occurs in the states of Minas Gerais, São Paulo, Pará, Rio de Janeiro, Rio Grande do Sul, and possibly others. It is found in a variety of habitats, ranging from sea level to >700 m. In its native range it is a sparse species, and never attains the dominance that it acquires in some of the places where it is a naturalized exotic. Schinus has been introduced, and become successfully naturalized, in >20 countries, and its range now forms 2 circum-global belts, 1 in the northern hemisphere and the other in the southern hemisphere, both concentrated at latitudes 15 to 30°. In Panama and Singapore its naturalized range approaches to within 10° of the equator, but schinus seems to be primarily a subtropical species.

In the U.S. schinus is found in southern Florida, southern Arizona, southern California, Hawaii; and in the Commonwealth of Puerto Rico as well as St. John, Virgin Islands (Little et al. 1974). Although it is an aggressive colonizer in South Florida and Hawaii, it has never become widely naturalized in southern California, where it is widely planted as an ornamental. Its lack of success in southern California was attributed to the short period of ample soil moisture, which is not long enough for germination and root establishment (Nilsen and Muller 1980). It was intentionally introduced into South Florida for use as an ornamental, and the date of first introduction is reported as 1888 (Morton 1978) or 1891 (Workman 1979). However, Barkley (1944) examined a Missouri Botanical Garden herbarium specimen collected from a cultivated plant in Florida by Rugel in 1842-1849, so the species was in Florida about 50 yr before it was "officially" introduced.

Even though schinus has been in South Florida since the last century, it did not become a conspicuous dominant in the area until after 1950. For example, Davis (1943) did not mention it, even though he was an especially keen observer. It successfully colonizes several native plant communities, especially the pinelands that occupy non-urbanized remnants of the Miami Rock Ridge (Loope and Dunevitz 1981a). It also invades

hammocks, and forms extensive stands in the mangrove forests of Everglades National Park, especially in areas severely disrupted by hurricanes (I. Olmsted, Everglades National Park, pers. comm.). However, it most aggressively invades areas disturbed by human activities (Alexander and Crook 1973, Koepp 1979). It is common along roadsides, on powerline rights-of-way, and on canal banks. Its most common South Florida habitat, and the one studied as part of the research reported here, is fallow farmland.

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Family: Anacardiaceae

Schinus (Pepper-tree)

A genus of about 28 species native to Central and South America. The following is widely established as an escape in Florida. The tree was introduced for its attractive drupes ("berries") and is often called "Florida-holly".

Schinus terebinthifolius Raddi

Brazilian pepper

This species is a weed occupying drier places where the natural vegetation has been cleared or disturbed and it can form a dense overgrowth of long, arching smooth-barked stems. Field characters are the odd-pinnate leaves with a narrowly winged rachis (Fig. 25a) and rounded, often toothed leaflets, which give off a strong smell of turpentine when crushed.

Growth. The trees are evergreen but undergo an extended period of dormancy in winter, although shoots are not articulate. Extension growth in the summer produces long, mainly unbranched drooping shoots. Branches form infrequently on the upper surface of the arch so that a dense interlacing network of woody stems results. Eventually a low tree without a distinct trunk may develop. Leaves persist for more than a season and it is not uncommon to find them still attached to woody stems more than 2 inches in diameter. Each leaf subtends either a single vegetative bud, which remains dormant, or two buds, one above the other (Fig. 24d) of which the uppermost is a potential flowering shoot.

Flowering and fruiting. Flowering is prolific from lateral branches in the axils of leaves towards the end of the shoots (Fig. 24b). Outgrowth of inflorescences seems to bear little relation to the extension of the main shoot. When flowering is especially abundant, the whole stem may be determinate and show no further vegetative growth. Flowering and fruiting plants may be found at any season. Plants are dioecious and this is obvious in late fall when female plants fruit heavily (Fig. 24c), while male plants remain barren.

Inflorescences are quite conspicuous although individual flowers are

From: Tomlinson, P.P. 1980. The Biology of Trees Native to Tropical Florida.
Allston, Massachusetts, Harvard University Printing Office.



Figure 24. *Schinus terebinthifolius*, shoot morphology. a. Habit with fruit ($\times 2/3$); b. habit with flower ($\times 2/3$); c. fruiting branch ($\times 2/3$); d. node with 2 serial axillary buds ($\times 2$).

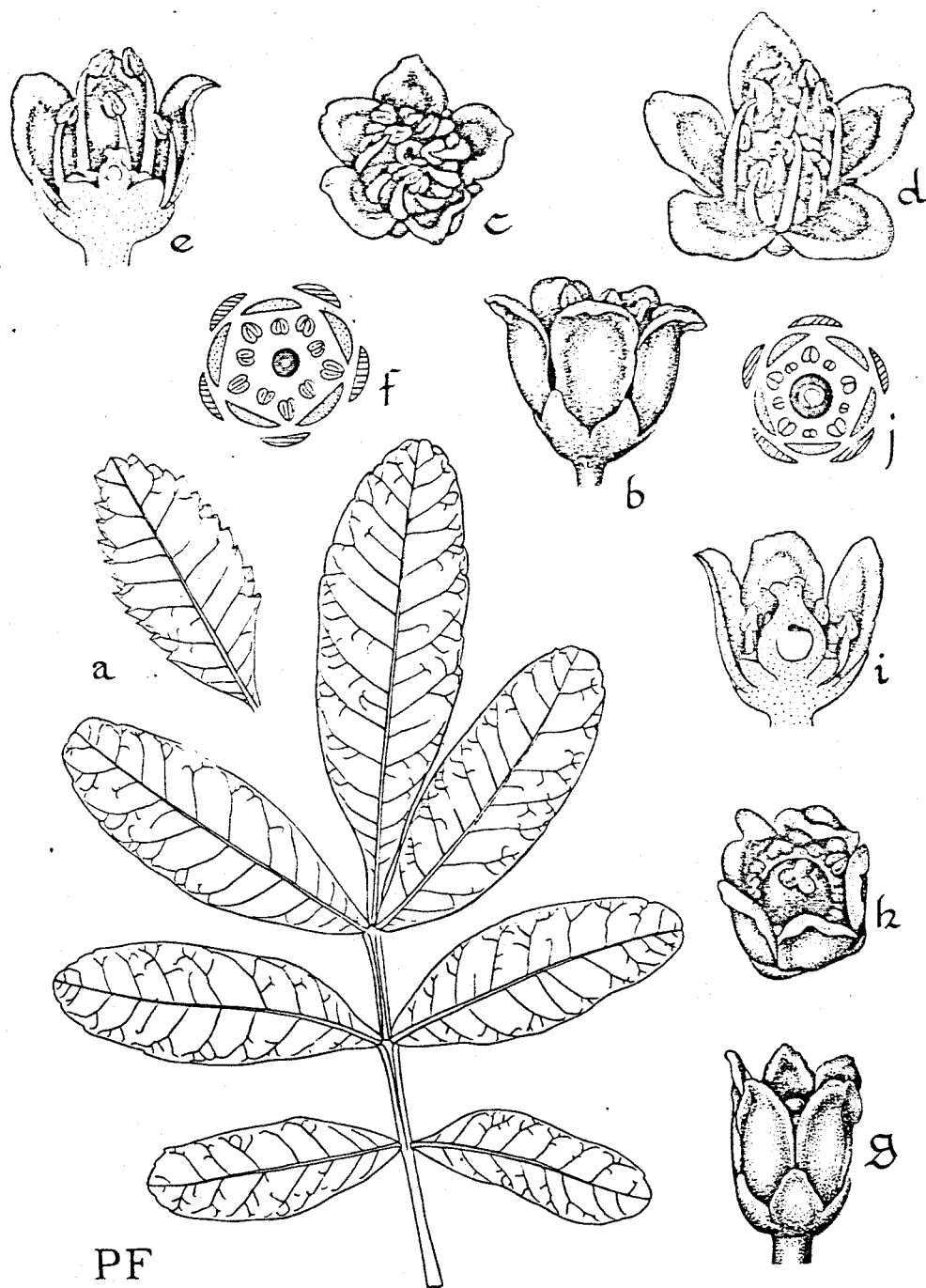


Figure 25. *Schinus terebinthifolius*, leaf and flowers. a. Leaf outline ($\times 2/3$); toothed leaflet above; b-f. male flower ($\times 10$), (b) from the side, (c) from above, early stage, (d) from above, late stage, (e) in longitudinal section, (f) floral diagram; g-i. female flower ($\times 10$), (g) from the side, (h) from above ($\times 10$), (i) in longitudinal section ($\times 10$); j. floral diagram.

small. Male and female flowers (Fig. 25b-f; g-i) are similar and have the parts in fives, with 10 stamens in 2 series of 5, the inner series of stamens always smaller. The male flower has functional stamens and a small pistillode (Fig. 25e); the female flower has staminodes and a well-developed unilocular ovary with 3 short styles and a single ovule attached near the top of the locule (Fig. 25i). A conspicuous feature of both flowers is the lobed disc within the stamens. Flowers are insect visited and seed set is always abundant (Fig. 24c). The individual fruits (drupes), each contain a single seed, scattered readily by birds, judging from the ease with which seedlings appear in waste ground.

References for Anacardiaceae

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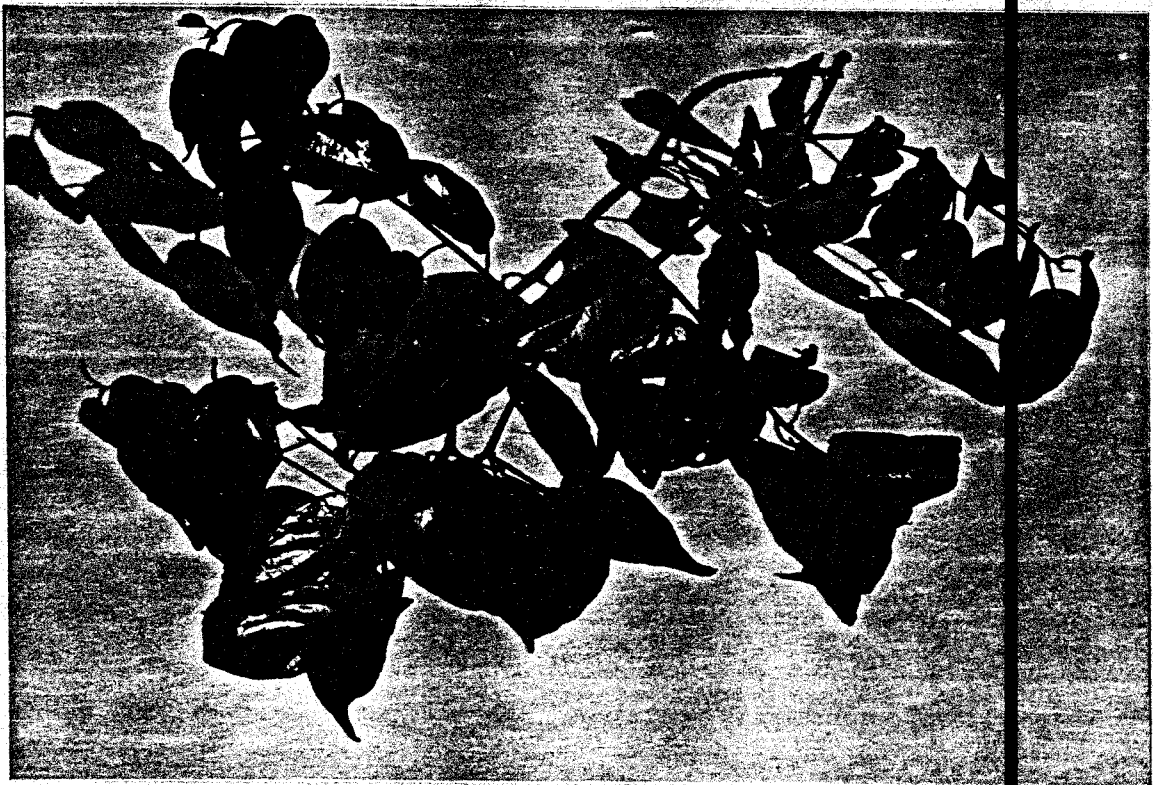
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PHOTOS OF EXOTICS

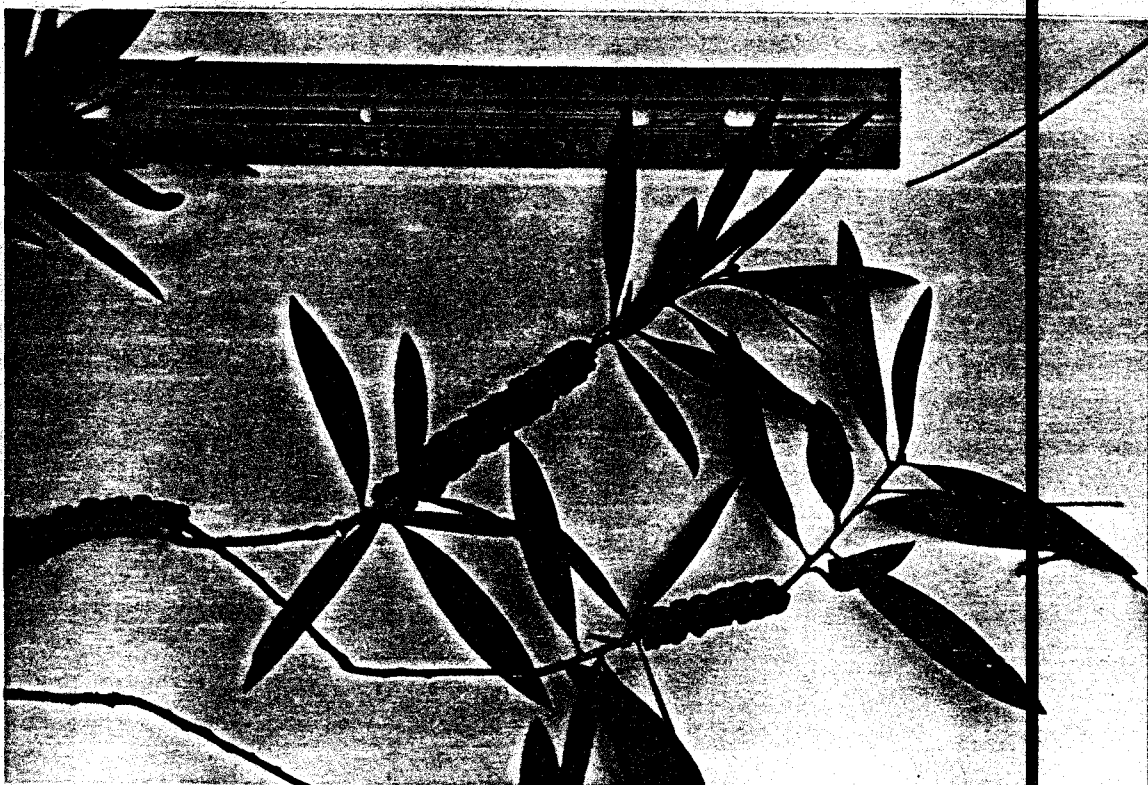


COLUBRINA ASIATICA





MELALEUCA QUINQUENERVIA - CAJEPUT

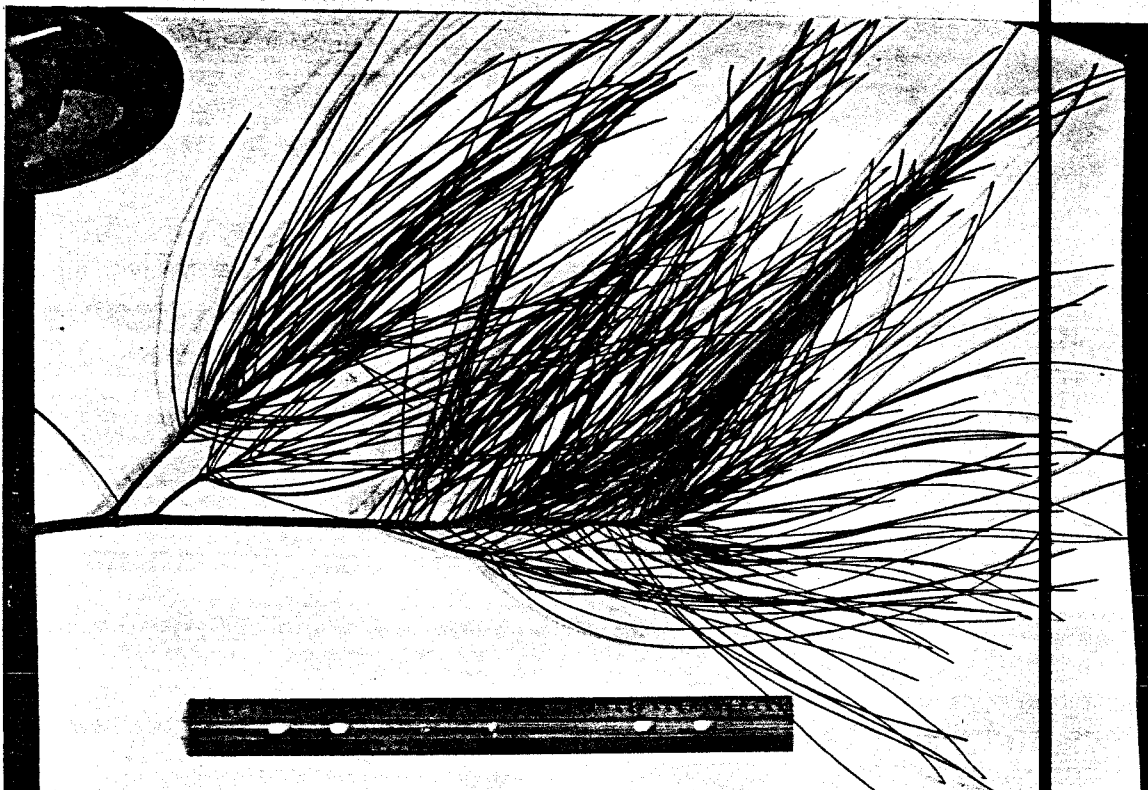




CASUARINA GLAUCA - AUSTRALIAN PINE



CASUARINA EQUISETIFOLIA - AUSTRALIAN PINE



CASUARINA GLAUCA - AUSTRALIAN PINE



SCHINUS TEREBINTHIFOLIUS - BRAZILIAN PEPPER



SCHINUS TEREBINTHIFOLIUS - BRAZILIAN PEPPER



SCHINUS TEREBINTHIFOLIUS - 4 WEEKS POST-TREATMENT.
NOTICE THAT SOME GREEN LEAVES STILL REMAIN ON THE TREE BUT
RETREATMENT IS PROBABLY UNNECESSARY.