1. The Subcommittee meeting was called to order by Chairman Victor Myers at 10 a.m. in the Forest Service Headquarters, Glendora, California. The following members and guests were present:

MEMBERS AND/OR ALTERNATES:

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harry F. Blaney</td>
<td>USDA - ARS</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>L. R. Kuiper</td>
<td>State of Colorado</td>
<td>Denver, Colorado</td>
</tr>
<tr>
<td>John W. Shannon</td>
<td>Dept. of Water Resources</td>
<td>Sacramento, Calif.</td>
</tr>
<tr>
<td>Robert H. Rupkey</td>
<td>Bureau of Indian Affairs</td>
<td>Phoenix, Arizona</td>
</tr>
<tr>
<td>Leo A. Sergius</td>
<td>Weather Bureau</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>S. F. Cramer</td>
<td>Corps of Engineers</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>George E. Barclay</td>
<td>Fish and Wildlife Service</td>
<td>Albuquerque, N.M.</td>
</tr>
<tr>
<td>J. S. Horton</td>
<td>USDA - Forest Service</td>
<td>Tempe, Arizona</td>
</tr>
<tr>
<td>Victor I. Myers</td>
<td>State of Nevada - ARS</td>
<td>Reno, Nevada</td>
</tr>
<tr>
<td>Curtis W. Bowser</td>
<td>Bureau of Reclamation</td>
<td>Boulder City, Nev.</td>
</tr>
</tbody>
</table>

GUESTS:

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. D. Sinclair</td>
<td>USDA - Forest Service</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>Gordon M. Corbin</td>
<td>USDA - Forest Service</td>
<td>Albuquerque, N.M.</td>
</tr>
<tr>
<td>George R. Ellis</td>
<td>Weather Bureau</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>Harris R. McDonald</td>
<td>Bureau of Reclamation</td>
<td>Denver, Colorado</td>
</tr>
<tr>
<td>H. C. Fletcher</td>
<td>USDA - ARS</td>
<td>Beltsville, Maryland</td>
</tr>
</tbody>
</table>

2. The minutes of the 59-4 Subcommittee meeting, including Attachments A and B thereto, were discussed and approved subject to the following change. Attachment B titled "Activities, Objectives and Functions", Paragraph 2, Part "d", modified to read "To encourage research in resolving the phreatophyte problem * * *".
3. OLD BUSINESS

a. Report by J. S. Horton, Chairman, Density Survey Task Force

Revision of *A Guide to the Density Survey of Bottom Land and Streambank Vegetation* is not yet completed but considerable progress has been made in incorporating suggestions made by those who reviewed the provisional release.

The Task Force recognizes the need for long-term studies of the change of phreatophyte density and as an initial step it is proposed that information on existing phreatophyte surveys be assembled. The questionnaire that is proposed for submittal to those agencies having completed phreatophyte inventories or surveys is included as Attachment A. It is suggested that each Subcommittee member review this form for discussion at next meeting and it is suggested that individuals not planning to be at Winnemucca forward their comments to Mr. Horton.

b. Coordinating Task Force Report by T. W. Robinson

A Memorandum of Understanding among State of Nevada, Bureau of Reclamation, and Geological Survey for purpose of investigating use of water by phreatophytes along the Humboldt River in Nevada was entered into on March 8, 1960. This agreement is similar in scope and intent to that entered into during Spring 1959 between the Bureau and the Survey for conducting the Buckeye Project. Although the agreement was not formalized until March, the cooperative effort in Nevada had been under way through an informal arrangement since September 1959.

An illustrated report on the installation of the two evapotranspiration tanks for greasewood (*Sarcobatus vermiculatus*) was prepared for inclusion in a progress report on the Humboldt River Research Project by the Nevada State Department of Conservation on January 1, 1960. It is expected that the transplanting of the greasewood plants to the tanks will be done early this spring, probably in April, after the ground has thawed. Three small evapotranspiration tanks, each 10 feet square and 8 feet deep, also are planned for construction as soon as weather permits in the Spring of 1960.

On January 12 and 13, the Chairman, who is also a member, attended a meeting of the Advisory Committee of the Humboldt
Research Project at Carson City, Nevada. The meeting was called to report on accomplishments to date and to discuss plans for future work.

A report on phreatophytes, prepared by the Chairman for the Senate Select Committee on National Water Resources, was published by the Department of the Interior as a mimeographed release. Two copies were received in mid-February with the notation that only a limited number were printed. Additional copies have been requested for each member of the Subcommittee.

A Joint Resolution by the Senate of the United States, S. J. Res. 156, was brought to the attention of the Chairman by Mr. Bowser. This resolution proposes a study program and allocation of funds to study control of phreatophytes, and it indicates an awareness in the Congress to the phreatophyte problem. Inquiry for more details concerning the resolution was made to the Washington office of the Survey.

Substantial additions have been made to the map showing occurrence of saltcedar. Data furnished by Mr. Lawhon of Texas, Mr. Kuiper of Colorado, and Mr. Branson of the Survey for areas in Texas, Wyoming, Colorado, and New Mexico have been added to the map. It is estimated that the area infested by saltcedar, as shown on the map, is of the order of one million acres.

In connection with studies of the hydology of Death Valley, additional fieldwork was performed in late February and a hygrothermograph and maximum and minimum thermometers installed on a station at Badwater, very close to the lowest point in the United States. Thermometers were furnished by the Weather Bureau and servicing of the instruments will be by courtesy of the National Park Service. A large area of phreatophytes on the west side of the valley was mapped on aerial photographs.

c. Phreatophyte Library

The collection of reports, photographs and slides pertaining to phreatophytes on file at Arizona State University Library, Tempe, Arizona, is being added to regularly. Your consideration is called to the necessity for each individual to send a copy of reports or publications as they are issued to J. S. Horton for submittal to the library if this collection is to be complete and kept up to date.
d. **Progress on the Webber Creek Project - Arizona**

Mr. Jake West, State of Arizona, reported upon the Webber Creek Project at the 59-4 meeting but unfortunately the map that was prepared to accompany his discussion could not be reduced in time for inclusion with minutes of that meeting. The map is appended hereto as Attachment L and to keep your file of Subcommittee meeting minutes orderly please either place this map with Mr. West's presentation (Attachment J, 59-4 minutes) or footnote accordingly.

4. **NEW BUSINESS**

a. Mr. George Barclay mentioned that recently an incentive award was made to a Fish and Wildlife Service employee for suggesting a poster showing the various herbicide mixing formulas for small quantity applications. A copy of the award is shown as Attachment B.

b. The Subcommittee recognizes that there is sufficient unpublished data pertaining to technique, cost, and effectiveness of mechanical and chemical means that various agencies have employed during past few years to control phreatophytes to warrant consolidation of this information for publication. A report on this subject would be invaluable to action agencies who are planning a phreatophyte clearing operation and would serve as a guide to agencies interested in research to indicate effectiveness and cost of current eradication or control measures being practiced on a field scale. Mr. S.F. Cramer has drafted a questionnaire proposed for use in soliciting information from agencies who have done phreatophyte clearing work. The proposed form, shown as Attachment C, is offered for suggestion and it is requested that members and interested individuals submit their comments to Mr. Cramer or plan to discuss this subject at the next meeting. It is desired that the forms be distributed this summer with plans for consolidating the information to be received for publication under auspices of the Subcommittee.

c. **Agency Reports**

Agency reports were presented to the group and are included as attachments as indicated below:


Attachment E - U. S. Fish and Wildlife Service Report, George E. Barclay
d. **Future Meetings**

The 60-2 meeting will be held June 6 and 7 at Winnemucca, Nevada. A tour of the Humboldt River area is planned to observe the problems and learn about the research program that is being carried on by the various Federal and State agencies in cooperation with Nevada State Department of Conservation and Natural Resources. The 60-3 meeting site was discussed and Riverton, Wyoming, was considered a possibility.

e. Meeting was adjourned at 4:45 p.m.

Respectfully submitted,

![Signature]

Curtis W. Bowser  
Secretary, Phreatophyte Subcommittee  
Bureau of Reclamation  
Region 3  
Boulder City, Nevada

Attachments: A through L
Inventory of Existing Survey Data
Phreatophyte Vegetation
Spread, Composition, or Density

Agency which made survey ____________________________________________

Date of survey ______________________________________________________

Location of area surveyed:
State ___________ County or Counties ________________

River _____________________________________________________________

from _________________ to _________________

Other included streams or areas ______________________________________

Description of surveyed area (such as width of flood plain or channel, relation to reservoir delta, and other distinctive features) ______

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

Principal species of trees and shrubs _________________________________

_________________________________________________________________

Were cover densities determined? _________________________________

Method used: Reconnaissance___ Transect___ Aerial Survey___

Other _______________________________________________________

Describe method used ___________________________________________

_________________________________________________________________

Phreatophyte Subcommittee
Attachment A - p.1
Other data taken (such as soil, herbaceous cover, water table depth, salinity, etc.)

Where are the field data filed?

Were estimates of water loss made?

Was a summary of the data made?

If so, where filed?

Were maps of the vegetation prepared?

Publications and reports including either the data or the summary

Signed __________________ for (agency) ________________

Address ____________________________________________

Return completed form to:

J. S. Horton
282 Agriculture Building
Arizona State University
Tempe, Arizona

Phreatophyte Subcommittee
Attachment A - p.2
REGION 3 INCENTIVE AWARDS FLYER

To: Refuge Managers and Hatchery Managers, Region 3

Subject: Posting of frequently used herbicide formulas (Sugg. No. 3-60-46)

Mr. James R. Rice, Maintenanceman at the Crab Orchard Refuge, recently received an Incentive Award for suggesting the following, which may be of value at your station:

That a rather large poster be printed showing the various herbicide formulas in quantities commonly used at that station, and that such poster be displayed in a conspicuous place by the herbicide storage racks.

Formulas shown on the barrels of the herbicide concentrates are for large quantities only -- not for mixing small quantities commonly used at a particular station, such as in a back-pack sprayer. The posting of such formulas makes it possible for various field employees engaged in plant control work to prepare the correct mixture. It saves time, permits more economical use of the herbicide, and lessens the danger of damage to crops or valuable plants near the area treated.

Sample of the poster suggested by Mr. Rice, showing various formulas, is on the reverse side. Each formula should be checked for its accuracy before being printed and posted.

REGIONAL INCENTIVE AWARDS COMMITTEE
**HERBICIDE FOLIAGE SPRAY MIXTURE OF**

<table>
<thead>
<tr>
<th>2,4-D</th>
<th>2,4,5-T</th>
<th>Diesel Oil or Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/5 Ounces</td>
<td>1 1/5 Ounces</td>
<td>3 Gal.</td>
</tr>
<tr>
<td>1 Pint</td>
<td>1 Pint</td>
<td>40 Gal.</td>
</tr>
<tr>
<td>1 1/4 Pints</td>
<td>1 1/4 Pints</td>
<td>50 Gal.</td>
</tr>
<tr>
<td>1 1/2 Pints</td>
<td>1 1/2 Pints</td>
<td>60 Gal.</td>
</tr>
<tr>
<td>2 1/2 Pints</td>
<td>2 1/2 Pints</td>
<td>100 Gal.</td>
</tr>
</tbody>
</table>

**DILUTIONS BASAL & STUMP SPRAY**

Based on 40% Ester

<table>
<thead>
<tr>
<th>2,4-D</th>
<th>2,4,5-T</th>
<th>Diesel Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Ounces</td>
<td>10 Ounces</td>
<td>3 Gal.</td>
</tr>
<tr>
<td>13 Ounces</td>
<td>13 Ounces</td>
<td>4 Gal.</td>
</tr>
<tr>
<td>1 Quart</td>
<td>1 Quart</td>
<td>10 Gal.</td>
</tr>
<tr>
<td>1 Gallon</td>
<td>1 Gallon</td>
<td>40 Gal.</td>
</tr>
<tr>
<td>2 5/8 Gal.</td>
<td>2 5/8 Gal.</td>
<td>100 Gal.</td>
</tr>
</tbody>
</table>

**BASAL & STUMP SPRAY**

<table>
<thead>
<tr>
<th>2,4,5-T</th>
<th>Diesel Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Pint</td>
<td>3 Gal.</td>
</tr>
<tr>
<td>20 Ounces</td>
<td>4 Gal.</td>
</tr>
<tr>
<td>1 Quart</td>
<td>6 Gal.</td>
</tr>
<tr>
<td>3 1/2 Gal.*</td>
<td>100 Gal.</td>
</tr>
</tbody>
</table>

*You will note formula for this amount is weaker than those above, the reason for which was not given.*

16 Oz. = 1 Pt.
32 Oz. = 1 Qt.
128 Oz. = 1 Gal.

Phreatophyte Subcommittee
Attachment B - p.2
DATA ON PHREATOPHYTE CLEARING

PART I  INITIAL CLEARING
A. Mechanical Methods
B. Chemical Methods
C. Other Methods

PART II  MAINTENANCE OF CLEARED AREAS
A. Mechanical Methods
B. Chemical Methods
C. Replacement Planting
D. Other Methods
DATA FOR EACH MECHANICAL CLEARING METHOD

1. Equipment and materials used and method of employment

2. Acres per hour
   a. 100% density - 100% - 80% density
   b. 75% " - 80% - 60% "
   c. 50% " - or 60% - 40% "
   d. 25% " - 40% - 20% "
   e. Less than 25% density Less than 20% density

3. Size of plants

4. Cost per acre
   a. density -
   b. " -
   c. " -
   d. " -
   e. " -

5. Physical characteristics
   a. Time of year
   b. Growth remaining - missed in clearing

6. Regrowth
   a. 3 months
   b. 6 months
   c. 1 year
DATA FOR EACH CHEMICAL TREATMENT METHOD

1. Equipment and materials used and method of employment

2. Method of application -  
   (Ground spray rig with 50-ft. boom)

3. Rate of application  
   a. 1st application  
   b. 2nd "

4. Meteorological conditions at time of application  
   a. June 1959 - Temperature, humidity, solar radiation, wind, etc.  
   b. December 1959

5. Acres treated per hour

6. Cost per acre

7. Effectiveness - (% kill - defoliation - etc.)

8. Regrowth  
   a. 3 months  
   b. 6 months  
   c. 1 year
DATA FOR EACH OTHER CLEARING METHOD

1. Equipment and materials used and method of employment

2. Acres per hour
   a. density
   b. "
   c. "
   d. "
   e. "

3. Cost per acre
   a. density
   b. "
   c. "
   d. "
   e. "

4. Physical characteristics
   a. Time of year
   b. Growth remaining
   c. Weather conditions
   d. Etc.

5. Regrowth
   a. 3 months
   b. 6 months
   c. 1 year
DATA FOR EACH MAINTENANCE METHOD

1. Equipment and materials used and method of employment

2. Acres per hour

3. Cost per acre

4. Physical characteristics
   a. Size of regrowth
   b. Density of regrowth
   c. Meteorological conditions at time of treatment
   d. Time since original clearing
   e. Etc.

5. Effectiveness

6. Regrowth
   a. 3 months
   b. 6 months
   c. 1 year
Saltcedar Ecological Study

This study has been under way since the Spring of 1956 and involves detailed ecological observations at the beginning of each growing season of 12 different quadrats 1 x 2 rods to 2 x 3 rods in dimensions strategically located along a 12-mile stretch of Fivemile Creek near Shoshoni in central Wyoming. This is a brief summary of observations made from 1956 through 1959.

Saltcedar has produced an abundance of viable seed each year and new seedling infestations have become established each summer on wet sand or silt bars along Fivemile Creek. During the unusual high water level in 1957 saltcedar seedlings became established at the high water mark around Boysen Reservoir especially near the mouth of Fivemile Creek. The established saltcedar plants, especially young plants, have continued to grow rather rapidly on most of the study quadrats and on areas under only general observation. The seedlings have grown 1 to 3 feet tall in the second season after germination and some mature plants have reached heights of 10 to 12 feet.

Germination tests of saltcedar seed produced in two different years show that the seed loses its viability within a few months and apparently must germinate in the same season that it matures. This may mean that the extremely small seedlings one-half to one inch tall observed in late summer of each year and early the following spring have developed from seed matured in July or August and germinated immediately upon falling to the ground.

Despite its apparent adaptability and aggressiveness along Fivemile Creek, saltcedar has not become a serious weed pest in that situation. However, the plant does appear to be a potential threat in the future around Boysen Reservoir and perhaps other situations not only in the Wind River and Bighorn Basins but also in the entire Missouri River system.

The most important change observed in 1959 was the winter killing during the Winter of 1958-1959 of numerous small basal sprouts.
on most of the 33 saltcedar plants which are given detailed individual study each year. No entire plants were winter killed nor any mature trunks or large sprouts. The killing of small sprouts may have been due to a combination of severe drought in the late Summer and Winter of 1958 and the low temperatures in the Winter of 1958-1959.

Chemical Control of Saltcedar

Broadcast applications of fenuron pellets at 10, 20 and 40 pounds per acre active ingredient and of monuron pellets at 20 pounds per acre (a.i.) in May 1958 killed 99 to 100 percent of saltcedar plants averaging 6 feet tall. Unusually heavy rainfall of 4.16 inches in May and June 1958 probably leached the chemicals into the root zone of saltcedar soon after treatment.

The results of this experiment indicate that the optimum rate of fenuron would be 10 pounds per acre active ingredient (40 pounds per acre commercial formulation) under the favorable rainfall conditions that prevailed. About 75 percent of the saltcedar plants in untreated check plots were killed by border effect from adjacent plots treated with fenuron or monuron. Apparently lateral roots of plants in untreated plots extended into the treated plots and absorbed enough chemical to kill many of the plants.

Basal spray applications of a brushkiller mixture of butoxyethanol esters of 2,4-D and 2,4,5-T to the lower 15 inches of the trunks of saltcedar plants 3 to 9 feet tall at concentrations of 0.5, 1, and 2 percent in diesel oil killed 70, 88, and 94 percent, respectively, of the saltcedar plants.

Results in this experiment begun in May 1958 indicate that the optimum concentration of the brushkiller mixture of 2,4-D and 2,4,5-T is 1.0 percent. Followup retreatment probably would always be necessary to kill the small percent of plants that survived the original treatment. Judging from results in an earlier experiment conducted in 1956-1957, basal applications of the brushkiller mixture applied at the full-leaf stage in early summer usually would be more effective than treatments applied in the spring before "leaf out" as in this experiment. However, basal applications are much more difficult after full foliage has developed, especially in dense thickets of saltcedar.
Amino triazole was used on 26 acres of phragmites (P. communis) on plots estimated at from 1 to 4.5 acres in size, all located in the bottom lands of the Bosque del Apache National Wildlife Refuge. Wherever possible all areas infested with phragmites were treated though some of the larger plots could not be reached with the ground rig used for applying the herbicide. For the most part, areas treated were dense stands located on dikes or adjacent to dikes on dry land.

Equipment used was a Case 411 tractor with two connected 50-gallon oil drums mounted to the front end of the vehicle. A Continental PT-2 pump, 50 feet of 5/8 inch garden hose leading from pump, and a common garden hose adjustable nozzle was used to apply the chemical to the plants. The nozzle was set to deliver a fine spray. Good coverage was obtained by using this type of equipment. It was necessary to utilize the services of two people, one to drive the tractor and operate the power takeoff pump and the other to do the actual spraying. The spray was applied at approximately 30 pounds pressure at a rate of 4 pounds per acre. The chemical was mixed with water at a rate of 4 pounds to 100 gallons of water. A commercial spreader as well as detergent soap was used, and both appeared to help considerably in wetting the plants being treated. Extreme care was taken to wet all parts of plants, but in some of the dense heavy stands it was not possible to get 100 percent coverage. However, better coverage was possible using the above equipment than by using conventional spraying heads.

Spraying began on August 17 and was stopped on August 28, 1959. All plants had fully developed heads and seeds were forming or had formed.

Phragmites treated showed discoloration within 7 to 10 days and by 14 to 20 days after spraying the plants were brown in color and dry showing the same symptoms as if hit by a hard freeze. No regrowth was noted on any of the treated areas, whereas phragmites not treated continued to have a green color until frost. Examination approximately 50 days after treatment showed that 50 percent of the
root stalks and runners of the treated plants were discolored. It appears that the kill of phragmites was from 95 to 100 percent, but a true evaluation of the treatment cannot be made until spring or early summer. It is anticipated that some regrowth, particularly at the outer edges of the treated areas, will appear and these will require retreatment as soon as the new growth is sufficiently advanced.

The cost of spraying the 26 acres of phragmites totaled $455.16, or $17.65 per acre. The cost of application was $1.23 per acre.

**Brush Control on the Bosque Refuge Using 2,4-D**

The purpose of spraying was to control saltcedar (Tamarix) and willow (Salix). Previous experimental use of 2,4-D on the Refuge showed that some control was possible. However, the use of 2,4-D was on an experimental basis and consisted of one treatment with no followup. It was believed that complete control could be obtained by using this herbicide on saltcedar at least twice a year by making an early application to effect a kill of the top growth and a late application to kill any regrowth. This double treatment each year is scheduled to run for a three-year period.

A start on this program was made in the Spring and Summer of 1958, but we were not able to get full or complete coverage due to inadequate spray equipment. An all-out attempt was made during the Spring and Summer of 1959. Equipment used was a power takeoff Continental PT-2 pump and a Hanson Model BJT pump. The spray heads were Boom Jet Type No. 5430 using the OC 10 and OC 40 tips which gave 10-gallon per acre delivery at 4 mph at a pressure of 30 pounds and 30 gallons per acre at 4 mph at a pressure of 30 pounds, respectively. The equipment was mounted on a Case 411 tractor and a UB Minneapolis-Moline tractor. Also used was a Peerless Model 55105 pump mounted on a 2-wheel trailer carrying a 100-gallon tank, the pump powered with a Kohler 1 hp gasoline motor; the spray heads were the Boom Jet type with OC 10 nozzles. This trailer was pulled with a TD-6 tractor and was used only where the conventional wheeled tractors could not be operated. Spray pressure was regulated at 35 pounds at a tractor speed of 3 miles per hour which delivered 14 gallons per acre.

The herbicide used was 40 percent Butyl ester 2,4-D with 2.64 pounds acid equivalent per gallon. This chemical was mixed with water at a rate of 1 gallon to 100 gallons of water and sprayed at a rate of 2 pounds per acre or mixed at rate of 2 gallons herbicide to 100 gallons of water but also sprayed at the rate of 2 pounds per acre. No spreader was used.

Phreatophyte Subcommittee
Attachment E - p.2
Spraying operations began May 17 and were terminated on September 23. No spraying was attempted when winds were strong enough to cause drift. There were sprayed 1442.5 acres of dikes, roadides, and field borders primarily for the control of saltcedar and willow; 320.93 acres of field crops were sprayed for the control of saltcedar, willow, cocklebur, sunflower, spiny aster, muletail, and alkali weed.

All areas sprayed had received previous control work, either mechanical (mowing or pulled up with a dragline in connection with ditch rehabilitation work) or burning during the previous winter. Therefore, most of the top growth of saltcedar and willow was killed or destroyed. Attempts were made, but not always successful, to apply the chemical to the regrowth when regrowth was 10 to 16 inches in height.

The results of the 1959 spraying were not what was anticipated. In all cases where adequate coverage was obtained the top kill on the initial spraying was 80 to 85 percent, the young sprouts seemingly being very susceptible to the 2,4-D. Resprouting from the roots and basal areas appeared within 30 to 40 days. The second application was made in August and September. In some instances the regrowth at that time was 24 to 30 inches in height. This second application gave practically the same results as the initial spraying, i.e., 80 to 85 percent top kill of the regrowth. The saltcedar sprayed early in August showed some regrowth from the basal areas prior to the first killing frost. However, it appeared that this second regrowth was not as vigorous nor as dense as the initial regrowth. Examination of the sprayed areas in the spring and early Summer of 1960 will provide more definite conclusions.

It is believed that our approach has merit and it is recommended that the work be continued in 1960 with the same operation as carried on in 1959. If similar results are noted at end of the 1960 season then the treating of phreatophytes should be continued for an additional year. The saltcedar at least has been held in check and at a cost of less than for mechanical control.

The following recommendations are made for the 1960 control year. Spray operations should not commence prior to May 1 though weather conditions may affect the starting date.

Increase the pounds per acre from 2 to 4 pounds and strive for better spray coverage. This probably will result in a slower traveling speed of the spray rig and consequently the cost of application will be greater.

Phreatophyte Subcommittee
Attachment E - p.3
Willows, with the exception of peach leaf willow, were successfully controlled with an estimated 75 percent kill. Peach leaf willow, unless drenched with spray, appears very resistant. Cottonwood also was very resistant to the chemical. Our difficulty is that in this area the soils have been well impregnated with willow and saltcedar seeds or cuttings and with a variety of weed seeds which may lie dormant before sprouting. It can be anticipated that it will be a number of years before weed free fields can be expected. Also, reinfestation with weed as well as willow and saltcedar seeds that are carried in with the irrigation waters is anticipated.

Costs of spraying during the 1959 season, which includes expenses such as labor, parts and repairs, fuel, cleaning, administration, materials and equipment, but does not include depreciation, total $2,768.58 for the 1763.43 acres treated (this includes 320.93 acres of agricultural crops sprayed for weed control). Cost per acre was $1.60.
The paper "The Problem of Phreatophytes" presented in September 1959 at the Hannoversch-Munden Symposium of the International Association of Scientific Hydrology is now available for distribution. A manuscript on utilization of tamarisk by cattle has been written by H. L. Gary and is in process of Tempe Unit review. John Decker has prepared a paper summarizing the results of the studies on evapotranspiration of tamarisk and Bermuda grass for presentation at the May AAAS meeting in Alpine, Texas. Progress has been made toward publication of several of the manuscripts mentioned in earlier reports.

In connection with our studies on taxonomy of tamarisk, we have been gathering information on the spread of saltcedar in the Southwest. A determination of the age of the old trees in the Rio Grande Valley would give some clue as to date of introduction into New Mexico. Several trees in Albuquerque are reported to be about 100 years old. A study of these trees was supposed to have been made by Rufus Carter but no reference to them has been found in his reports. One of his reports covers the growth rate of saltcedar in relation to consumptive use but does not include data on any of these old trees.
Negotiations are in progress to establish two new tripartite contracts among the Corps of Engineers, the Bureau of Reclamation, and the University of Arizona to study certain aspects of the phreatophyte problem.

One contract would extend the existing contract for an additional two-year period and modify the existing contract to include consideration of the effect of clearing on groundwater conditions. Mr. Kenneth Frost, the graduate student working under the existing contract, has written his thesis for a master's degree and is preparing a final report on the basis of the first two years' work.

The second contract would be for the purpose of investigating the feasibility of using replacement vegetation in cleared floodways as a means of maintenance and suppression of saltcedar regrowth.

It is expected that these new contracts will be consummated prior to June 30, 1960, the expiration date of the present contract.
Colorado has completed a reconnaissance survey of phreatophyte infestation in the state.

The survey was conducted on a drainage basin basis utilizing the facilities and personnel of the Extension Service of Colorado State University. Each County Agent in the state was furnished with a complete drainage map of his county on which he sketched the location of phreatophyte growth. Accompanying the maps were tabular forms on which the County Agents estimated the acreages sketched on the maps.

From the information thus obtained water use is being computed and the amount of potential salvage estimated.

The problem areas are in the process of being determined. When problem areas are fully ascertained, priorities for further, more extensive, field studies such as density surveys, means of corrections, etc., will be established and carried out.
Lysimeter Installations

The Agricultural Research Service, Soil and Water Conservation Research Division, recently completed the installation of nine lysimeters at Winnemucca, Nevada. The Nevada State Department of Conservation and Natural Resources is financing the installation and will provide a technician for taking data. Several meadow vegetative tules, common to the Humboldt, will be planted in the lysimeters. Consumptive use will be measured under high water table conditions. The meadow vegetation will include saltgrass, bluestem, and sedges. Each treatment will be replicated three times.

Phreatophyte Replacement Vegetation Study

A reconnaissance study was undertaken in the Fall of 1959 to determine the feasibility of establishing beneficial grass vegetation, such as tall wheatgrass, in areas where greasewood and rabbitbrush are presently growing. There are millions of acres of greasewood and rabbitbrush growing in the Great Basin area of the West under high water table conditions. To be able to utilize the water presently being wasted by these phreatophytes for growing grass for beneficial use promises to be one method of eliminating part of that waste.

Tall wheatgrass, giant wild rye, and other grasses are phreatophytes. Natural rainfall is not sufficient in most areas for establishing grasses. The reconnaissance study was concerned with determining the feasibility of concentrating natural fall or pumping shallow groundwater for a period long enough to establish the vegetation. After roots are established it is most likely that the plants will obtain moisture from the water table.

In the investigations, holes were augered or drilled at random locations to explore soil and groundwater conditions. Samples and detailed data were taken at some of the sites. The detailed field and laboratory investigations are listed as follows:

a. Soil log

b. Moisture in soil throughout the profile

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c. Salts in soil throughout the profile

d. Quality of groundwater

e. Depth to groundwater

f. Hydraulic conductivity of water-bearing aquifer

g. Type and density of vegetation

h. Greenhouse studies attempting to germinate tall wheatgrass and other beneficial plants in soil samples. (These studies are conducted by R. E. Eckert and R. A. Evans, ARS, Field Crops Division.)
The Bureau, in cooperation with the Corps of Engineers, has drafted two contracts with the University of Arizona to further the study on special phreatophyte problems. Under the arrangements proposed the Corps and the Bureau jointly will finance research that is conducted by the University through its establishment of a fellowship. Supervision of work is a direct responsibility of the University within the broad limits of the study outline proposed by the cooperators. Studies and investigations are proposed on revegetation of floodways following clearing and evaluation of effectiveness of mechanical operations to clear saltcedar, coupled with a determination of change in water quality following floodway clearing. Primarily, the first-mentioned study will be directed to the floodway that has been cleared in the Gila River by the Wellton-Mohawk Irrigation and Drainage District and specifically to a reach of that tributary identified as Snyder Ranch Floodway that is being leased by the Government to a private party for planting to irrigated pasture in an effort to reduce annual maintenance expenses and keep out weedy plants. The second investigation will be a continuation of work that has been cooperative between the Corps and the Bureau during the past two years in studying effectiveness of mechanical control of phreatophytes in floodways. Emphasis will be placed upon the proposed clearing by the Corps in that reach of Gila River between Granite Reef and Gillespie Dam. Initially the work will involve collection of data pertaining to condition of plant density and water quality prior to clearing.

A third investigation is planned, but has not been finalized, to study incidence of phreatophytes in stream channels at lower elevations. An objective of this work will be to record spread of phreatophytes by periodically inventorying the plant communities.

Operation responsibility of the Buckeye Water Use Project was assumed by Geological Survey last spring following installation of the evapotranspiration tanks by the Bureau. The first of proposed annual meetings among the groups interested in operation of this station is scheduled for March 15 to discuss the program and to plan additional investigations in this field.
The Bureau of Indian Affairs has not pursued an active program of phreatophyte control during the last few months, except for routine cleaning of growth in irrigation canals and drains.

Precipitation on the watershed of the Gila River has been above normal and the river flow has been good. Snow pack as of March 1 was 281 percent of normal for the upper Gila River watershed and the forecasted stream flow for the period March through May is 246 percent of normal. San Carlos Reservoir contained 206,000 acre-feet on March 1 and the forecast indicates that 130,000 acre-feet additional runoff will occur before May 31. Much of this will pass through the reservoir without creating additional storage. Since the reservoir level now is higher than it has been for several years a considerable area of phreatophyte growth will be flooded.