1. The 65-1 meeting of the Phreatophyte Subcommittee was called to order in Apple Valley Inn, Apple Valley, California, at 9 a.m. on March 8, 1965, by Chairman Thomas W. Robinson.

The following members (or alternates) and guests were present:

<table>
<thead>
<tr>
<th>Members or Alternates</th>
<th>Department/Agency</th>
<th>City, State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred O. Case</td>
<td>Soil Conservation Service, USDA</td>
<td>Denver, Colorado</td>
</tr>
<tr>
<td>S. F. Cramer</td>
<td>Corps of Engineers</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td>J. S. Horton</td>
<td>Forest Service, USDA</td>
<td>Tempe, Arizona</td>
</tr>
<tr>
<td>Eugene E. Hughes</td>
<td>Agricultural Research Service, USDA</td>
<td>Los Lunas, New Mexico</td>
</tr>
<tr>
<td>Edgar A. Jeffrey</td>
<td>Public Health Service, HEW</td>
<td>Denver, Colorado</td>
</tr>
<tr>
<td>G. W. Kalstrom</td>
<td>Weather Bureau</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td>Orlan J. Lowry</td>
<td>Bureau of Reclamation, USDI</td>
<td>Amarillo, Texas</td>
</tr>
<tr>
<td>Dean C. Muckel</td>
<td>Agricultural Research Service, USDA</td>
<td>Reno, Nevada</td>
</tr>
<tr>
<td>Thomas W. Robinson</td>
<td>Geological Survey, USDI</td>
<td>Menlo Park, California</td>
</tr>
<tr>
<td>John Shannon</td>
<td>California Department of Water Resources</td>
<td>Sacramento, California</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harry F. Blaney</td>
<td>University of California, Agricultural Science</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td></td>
<td>Department and Water Resources Center</td>
<td>Victorville, California</td>
</tr>
<tr>
<td>Joseph B. Campbell</td>
<td>Mayor, Victorville</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td>Carl Coleman</td>
<td>Manager, Mojave Water Agency</td>
<td>Victorville, California</td>
</tr>
<tr>
<td>L. C. Dutcher</td>
<td>Geological Survey, USDI</td>
<td>Garden Grove, California</td>
</tr>
<tr>
<td>Clifford Farrell</td>
<td>Department of Water Resources</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td>Creede J. George</td>
<td>Bureau of Reclamation, USDI</td>
<td>Phoenix, Arizona</td>
</tr>
<tr>
<td>Robert Hedman</td>
<td>Geological Survey, S.W.</td>
<td>Los Angeles, California</td>
</tr>
<tr>
<td>Robert J. Jasper</td>
<td>Tehachapi-Cummings County Water District</td>
<td>Tehachapi, California</td>
</tr>
<tr>
<td>M. A. MacGillivray</td>
<td>California Department of Water Resources</td>
<td>Bakersfield, California</td>
</tr>
<tr>
<td>John Owens</td>
<td>Director, Soil Conservation District</td>
<td>Helendale, California</td>
</tr>
<tr>
<td>George R. Seals</td>
<td>Mojave Water Agency</td>
<td>Victorville, California</td>
</tr>
<tr>
<td>Lou Shaffer</td>
<td>Bureau of Reclamation, USDI</td>
<td>San Bernardino, California</td>
</tr>
<tr>
<td>W. A. Sidler</td>
<td>San Bernardino County Flood Control District</td>
<td>San Bernardino, California</td>
</tr>
<tr>
<td>Franklin Starbuck</td>
<td>Mojave Water Agency</td>
<td>Victorville, California</td>
</tr>
</tbody>
</table>
2. Introduction of people in attendance. Minutes of 64-4 meeting were approved as written. It was suggested that a copy of the mailing list be mailed to all members of the subcommittee.

3. Report of Task Forces

J. S. Horton gave the following report:

a. Plant succession—Corps of Engineers has submitted a list of photographs covering a portion of the Gila River between San Carlos and Safford. Anyone that has or knows of photos covering river bottoms, where negatives are not filed in photo lab at Salt Lake City, should furnish prints, negatives, or a list of the photographs.

Plant succession committee revised with following members:

<table>
<thead>
<tr>
<th>Name</th>
<th>Agency</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>J. S. Horton</td>
<td>Forest Service, USDA</td>
<td>Tempe, Arizona</td>
</tr>
<tr>
<td>Fred O. Case</td>
<td>Soil Conservation Service, USDA</td>
<td>Denver, Colorado</td>
</tr>
<tr>
<td>John Shannon</td>
<td>California Department of Water</td>
<td>Sacramento, California</td>
</tr>
<tr>
<td>Dean Muckel</td>
<td>Agricultural Research Service, USDA</td>
<td>Reno, Nevada</td>
</tr>
<tr>
<td>Jack Koogler</td>
<td>State Engineer's Office</td>
<td>Santa Fe, New Mexico</td>
</tr>
</tbody>
</table>

S. F. Cramer gave the following report:

b. Cost of clearing—Corps of Engineers has assigned a technician to review data relative to cost of clearing and control. Skip Cramer will submit a new questionnaire to agencies with regard to clearing and control costs.

Chairman Thomas W. Robinson gave the following report:

c. Research and coordination—Introduction and spread of salt cedar report have been transmitted to GPO to be published as "Studies and Evapotranspiration" before the next meeting.

The report from Texas regarding the Texas Brush Land Problem, Parts I and II, was recently published by the Soil Conservation Service.

For more detail regarding this task force report, see Attachment A.

J. S. Horton gave the following report:

d. Library—A new list of publications or reports available in the phreatophyte library is being prepared. This list should be available within 2 to 3 months for circulation.

4. It was suggested that objectives of the Phreatophyte Subcommittee of the PSIAC be reiterated for information and consideration of members of the subcommittee:
a. The following are objectives of the Phreatophyte Subcommittee as outlined at its first meeting on January 16, 1951:

(1) Keep in touch and see that full values in research and practical application are obtained from all activities concerning phreatophytes.

(2) Obtain a picture of the whole problem in the area covered by PSFIATC. Eventually, inventory areas and types of phreatophytes.

(3) Obtain all available information toward determination of value of various phreatophytes, accenting salt cedar. Compare varieties of salt cedar.

(4) Secondarily, after analysis of work underway and of whole problem, subcommittee should point out information needed and possible methods of obtaining that information.

(5) Subcommittee should see that interested State and Irrigation District offices are kept informed of work underway and planned.

b. The objectives of the Phreatophyte Subcommittee as outlined at its 61-4 meeting in December 1961 are as follows:

(1) To define the phreatophyte problem and its relation to water loss and salvage, sedimentation, flood control, recreation, and other uses both beneficial and nonbeneficial.

(2) To determine the geographic extent of phreatophyte areas, their composition and changes in vegetative cover and economic importance of the various species.

(3) To keep in close contact with all phases of research and control activities on phreatophytes and evaluate the results obtained.

(4) To coordinate research activities and avoid duplication insofar as practicable and to point out and stimulate research on problems where information and data are needed.

(5) To serve as an authoritative source of information on the phreatophyte problem, maintain liaison and a working relationship with other groups, committees, or bodies concerned with the problem, such as the Inter-agency Weed Committee.

(6) To take the lead in resolving the phreatophytic problem either by devising methods of controlling the plants or by developing increased beneficial uses for them.

(7) To keep the Parent Committee and member agencies currently informed of developments and of proposed projects in the field of phreatophytes.
(8) To assemble and maintain at a central point (Arizona State University Library) a library of technical publications dealing with phreatophytes.

(9) To disseminate information on phreatophytes to interested parties upon their request, either through subcommittee publications or by encouraging publications by member agencies.

5. The following agency reports are appended:

Attachment B, Agricultural Research Service, Crops Research Division, USDA
Attachment C, Soil Conservation Service, USDA
Attachment D, Bureau of Reclamation, USDI
Attachment E, Geological Survey, USDI
Attachment F, Corps of Engineers, U.S. Army

6. a. Representatives of the Mojave River Ground Water Basin and Geological Survey presented a summary regarding ground and surface water investigation of the Mojave River. The program was arranged by Mr. John Shannon, California Department of Water Resources.

b. Field trip and tour of Mojave River between Big Bear Road (above Victorville) downstream to near Helendale, California, were arranged and guided by Mr. W. A. Sidler, San Bernardino County Flood Control District. The field trip began at 8 a.m., and the group returned to the Apple Valley Inn at 12 noon.


Orlan J. Lowry, Secretary
Phreatophyte Subcommittee, PSIAC
Introduction, Spread, and Areal Extent of Salt Cedar (Tamarix) in the Western States

Page proof for the report was reviewed and proofed and returned to the Publications Division for transmittal to GPO. It will be published as U.S. Geological Survey Professional Paper 491-A in the series "Studies in Evapotranspiration."

California Vegetation Maps

In a paper presented at the 9th International Botanical Congress, Montreal, Canada, 1959, Mr. A. E. Wieslander of the U.S. Forest Service, discussed the mapping of native and naturalized vegetation in the uncultivated mountain and foothill land in California. The pre-World War II mapping on USGS 15 and 30 minute quadrangles covers about 40 million acres. Post-World War II mapping has been done on 15 and 7/2 minute quadrangles. The latter mapping is of two kinds: Soil-Vegetation maps and Timber Stand-Vegetation maps. As of January 1963, 500 7/2 minute blue line maps, covering 18 million acres, are completed and listed for sale at $0.45 per sheet.

The Soil-Vegetation maps show by symbols the species composition of the woody vegetation, kind of soil, and timber site-quality class of timber crop. The Timber Stand-Vegetation maps show by symbols broad kinds of vegetation and density of woody vegetation. From the species symbols and names, it is rather easy to locate areas of phreatophyte growth. In any survey of phreatophyte vegetation, these maps would be invaluable.

Texas Brush Problem

A report entitled "Grassland Restoration - The Texas Brush Problem" by H. N. Smith and C. A. Rechenthin was published by the Soil Conservation Service in June 1964. The report describes the 16 important brush species and gives the acres in the density classes of light medium and thick (more than 20 percent canopy) and also the total for each and total for all woody plants. Sixteen maps show in color the density and distribution of the various species. Two of the 16 species are usually considered phreatophytes, and some of the others may also occur as phreatophytes. Mesquite (Prosopis juliflora) cover a total of 56,245,000 acres of which 15,813,000 acres are listed as thick growth. The report notes that "there has been an increase of 1.25 million acres of mesquite in the last 15 years as well as a thickening of the stand on the land already infested." This rate of increase, 83,000 acres a year, is certainly startling and far exceeds the spread of salt cedar. The report does not state whether or not the mesquite occurs as a phreatophyte, but certainly there must be substantial areas where it does.
Salt cedar shown as Tamarix gallica covers a total of 523,900 acres of which 273,000 acres are listed as thick. Concerning salt cedar, the report states "salt cedar is rapidly spreading."

Request from U.S. Information Agency

A request by telephone was received during January from Miss Shirley Kahn of the U.S. Information Agency for pictures of phreatophytes. The photos were to be of such a nature as to depict (1) the phreatophyte problem and (2) research activities on water use studies and control methods. Ten photos were sent depicting the phreatophyte problem and research activities. For photos on control methods, she was referred to the Amarillo office of the Bureau of Reclamation. According to Miss Kahn, the request was prompted by reading the two following reports sponsored by the subcommittee.

Guide for Surveying Phreatophytes - USFS Agricultural Handbook 266
Phreatophyte Research in the Western States March 1959 to July 1964, USGS Circular 495

Comment on Circular 495, Phreatophyte Research in the Western States

A breakdown of the various facets of research of the active projects listed in this report by Dr. J. Rubin, soil physicist at Menlo Park, is of interest.

On the fundamental aspects of the plants, soil and climate--6 projects. On the measurement of water use--11 projects and on management aspects--17 projects, of which 11 projects deal with eradication problems.

Hydrology Subcommittee Handbook, Limitations in Hydrologic Data

The section on evapotranspiration for the handbook is complete. First draft is being reviewed in Menlo Park. Following this review and needed revision, it will be sent to five members of the subcommittee for their review and criticism before transmittal to the Hydrology Subcommittee.
In view of the good control of salt cedar from dormant applications using the PGBE ester of silvex in oil last winter, the dormant application research was expanded this year. Work has been initiated to evaluate high-volume treatments, utilizing an orchard gun and spray-boom applications at relatively high volumes (50-100 g.p.a.), using straight diesel oil and oil:water emulsions down to a 1:1 ratio. In addition to silvex ester, the true invert (water in oil) emulsion of silvex will be used.

Another exploratory study involving dormant treatments, planned for this winter, involves a combination of mowing and spraying the cut stumps. The mowing and spraying are accomplished in one operation.

Expansion of the dormant work was prompted not only by good results but by the need for this type control in areas adjacent to susceptible crops such as in the Pecos River Basin.

In addition to the dormant salt cedar work, a study was initiated in January on dormant cane treatments for control of willows growing on ditchbanks near susceptible crops. As in the salt cedar treatments, the amount of oil and water was varied: 100 percent oil carrier, 75:25 oil:water, and 50:50 oil:water. The PGBE ester of 2,4-D was used at 2 and 4 lb aehg. All applications were made from one side, using an orchard gun nozzle and 100 p.s.i. pressure.

On February 1, 1965, Dr. R. E. Wilkinson resigned to accept a position with the Georgia Agricultural Experiment Station at Experiment, Georgia. Since that time, the author has temporarily taken over the greenhouse chemical screening study. Tests of compounds of unknown herbicidal activity were initiated on salt cedar cuttings in February using rates of ½ and 2 pound/acre, with six plants used in each treatment. In addition to the above compounds, we have 16 more on hand to be tested as soon as the plants become available.

It is anticipated a plant physiologist to succeed Dr. Wilkinson will be employed by June 1965 or sooner.
Expanding and speeding up the work relating to replacement vegetation in the phreatophyte area at Winnemucca area.
PHREATOPHYTE SUBCOMMITTEE
65-1 MEETING
BUREAU OF RECLAMATION

By O. J. Lowry

Summary Report, Bureau of Reclamation, Region 7

Negotiations are underway to make arrangements with the Fort Hays Kansas State College to survey and analyze the phreatophyte infestation on Federal land of the Cedar Bluff Reservoir, Kansas. USDA Handbook No. 266, "A Guide for Surveying Phreatophyte Vegetation," will be used as a guideline for the work.

The Office of the Chief Engineer, Denver, reports that phreatophyte work commenced during 1964 is continuing particularly as it relates to culture of salt cedar plants in the greenhouse for use in evaluating the effectiveness of herbicides. A laboratory report on 1964 phreatophyte activities at Denver will be completed soon.

Summary Report, Bureau of Reclamation, Region 3

Cooperative work between the Geological Survey at Buckeye and Yuma will be continued. Vegetative density survey of the Colorado River flood plain from Davis Dam to the International Boundary is being planned.

Summary Phreatophyte Activities for Region 2 in 1964

1. Spraying and mowing of salt cedar in the Rye Patch Reservoir area of the Humboldt Project between Lovelock and Winnemucca, Nevada.

2. A survey of phreatophytes on withdrawn and acquired lands outside district boundaries of the Newlands Project.

3. Experimental spraying of salt cedar using various materials and conditions of plants when applied, conducted by the University of Nevada.

4. Continued a three-way cooperative study on evapotranspiration of greasewood, rabbitbrush, willows, and wildrose.

5. Conducted a survey of native vegetation along Putah Creek in Yolo County, California.

Summary Report, Bureau of Reclamation, Region 5

Program will be continued to accomplish control of phreatophyte regrowth on the Caballo Reservoir and the Bernardo prototype study area. Much of this work is in cooperation with the New Mexico State Engineer's Office.

Work authorized on the Pecos last year by Congress will get underway as soon as funds are made available, perhaps Fiscal Year 1966.
Fluorescent Dye Experiments

Experiments with fluorescent dyes were continued during the quarter using Pontacyl Brilliant Pink and Rhodamine WT. This latter dye is relatively new and purported to be better in many respects. Two oleander plants were dosed with the two dyes in the amounts of 250 m.g. for the Pontacyl Pink and 200 m.g. for the Rhodamine WT. Absorption in the plant and identification in the leaves for the Rhodamine WT were about seven times faster than for the Pontacyl Pink. Rhodamine WT took only 24 hours whereas the Pontacyl Pink required 7 days. There was a slow but steady increase of dye in the leaves with time for both dyes.

Winnemucca Evapotranspiration Tanks

Results for the 1964 growing season were described in a report to be published by the Department of Conservation and Natural Resources, State of Nevada. The use of water by all four species under study was less in 1964 than in 1963. Use by greasewood in acre-feet per acre decreased from 1.75 to 1.35, for rabbitbrush from 2.16 to 1.64, for willow from 3.70 to 2.41, and wildrose from 1.42 to 1.38. Evaporation was nearly the same for both years, amounting to 52.32 inches in 1963 and 52.85 inches in 1964.

The lesser use of water in 1964 is believed due in large part to the cooler growing season. A comparison was made using degree days, that is the number of degrees of average temperature of the day above a base of 32° F. Temperature during the period April 1 to October 31 was 355 degree day less in 1964 than in 1963. This is equivalent to an average daily temperature of 1.66° F. less. The duration of the growing season in 1963 was 135 days but only 102 days in 1964. Growing season was taken as the number of days between the latest and earliest dates the temperature dropped to or below 32° F. Although June and July were warmer in 1964, they did not compensate for the cooler April, May, August, September, and October.

Volumes of foliage for the greasewood, rabbitbrush, and wildrose tanks increased in 1964. For the greasewood, the increase was 8.5 percent, for the rabbitbrush tanks, 25 percent, and for the wildrose tanks, 35 percent. Foliage volume in the willow tanks decreased about 5.5 percent. The decrease due in large part to damage to the willow plants by rabbits gnawing the bark and killing some of the stems.
Middle Gila River Project

The authorized Middle Gila River phreatophyte-clearing project, from the head of Safford Valley downstream about 94 miles to Kelvin, is presently being considered for construction in three separate incrementally justified segments.

For the segment downstream from Coolidge Dam, between Winkleman and Kelvin, acquisition of rights-of-way is in progress.

In the upstream segment, from the head of Safford Valley downstream to the San Carlos Indian Reservation boundary, delineation and acquisition of rights-of-way are getting underway.

Because a major portion of the segment which is wholly within the San Carlos Indian Reservation lies within the research area of the USGS, consideration is being given to its clearing the entire reservation segment at the time it clears its research area. Subsequent maintenance of this entire segment would be by the San Carlos Tribe under the same agreement being formulated for maintenance of the research area.

Salt and Gila Rivers Project

This authorized phreatophyte-control project extends from Granite Reef Dam on the Salt River downstream to Gillespie Dam on the Gila River, a distance of about 77 miles.

This project is being considered in two segments—one from Gillespie Dam upstream to the mouth of the Salt River and the other along the Salt River from its mouth to Granite Reef Dam.

Rapid drawdown of the water table in the Salt River Valley killed most of the phreatophytic growth along the Salt River and that segment is presently in a deferred status. A review report has been authorized and funded to determine the feasibility of channelizing the Salt River in combination with flood-control storage to be provided in the Bureau of Reclamation's Orme Reservoir (previously designated as McDowell and Maxwell).

The Gila River segment has bogged down because of objections raised by the Arizona Game and Fish Department. It objects to salt cedar clearing through its lands, a discontinuous distance of about 14 miles, because it would eliminate what is reputed to be the finest white-wing habitat in the world. A meeting will be held in the near future to discuss with
local interests their desires of having flood control and water conservation or a reduced population of white-wing doves.

Phreatophyte Studies on the Arkansas River in Colorado and Kansas

The Albuquerque District is initiating studies of the phreatophyte problems on the Arkansas River in Colorado and Kansas.