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

Members or Alternates

Fred O. Case                  Soil Conservation Service
Jaak G. Koogler               New Mexico State Engineer
Gordin M. Corbin             U. S. Forest Service
Eugene E. Hughes            ARS-Crops Research Division
Glenn H. Lipscomb          Bureau of Land Management
T. W. Robinson            U. S. Geological Survey
Francis V. Olson            Bureau of Sport Fisheries & Wildlife
J. S. Horton                U. S. Forest Service
Lester F. Lawhon            Soil Conservation Service
Wayne D. Criddle          Bureau of Reclamation
Curtis Bowser              State Engineer, Utah
Ed Naphan                  Bureau of Reclamation
Robert H. Rupke             State of Nevada - SCS
John Shannon               Bureau of Indian Affairs
Dean C. Muckel            ARS - Soil and Water

Guests

George Hardman                      Dept. of Cons. & Natural Resources
Robert B. Hickok                    Carson City, Nev.
Kirk Sandals                      ARS - Soil and Water
Elwyn S. Krous                   U.S.D.A. Representative PSIAC
John M. Tromble                 U. S. Bureau of Reclamation
Loyd O. Barnett                  Dept. of Watershed Mgmt. U. of Ariz.
R. B. Rowe                        Tucson, Ariz.
A. S. Dylla                      Dept. of Watershed Mgmt. U. of Ariz.
Frank E. Sylvester              Tucson, Ariz.
Leon Sullivan                   ARS - Soil and Water
Robert I. Candor                 Reno, Nevada
Richard H. Davidson            Bureau of Outdoor Recreation
Roger I. Lanse                   San Francisco, Cal.
Carl E. Lindquist              Bureau of Reclamation
John P. Russo                  Bureau of Reclamation
Steve Gallizioli              Calif. Dept. Fish & Game
David Have                    Calif. Dept. Fish & Game

2. The minutes of the 63-3 meeting were approved as written.
3. OLD BUSINESS
(a) Research and Coordinating Task Force

Chairman T. W. Robinson reported as follows:

Treeholes in willow and cottonwood - In connection with this phenomena reported on at the 63-3 meeting, a field trip was made to Fresno, California on September 20, 1963. Accompanied by Dr. Harold Chapman, entomologist, three areas in which treeholes could be observed were visited. The areas are, Lost Lake a marsh area about one mile below Friant Dam on the south side of the San Joaquin River, on the east side of the Kings River about two miles below Pine Flat Dam, and in Wonder Valley some three miles south of Pine Flat Dam. Treeholes filled with a watery fluid, in which mosquito larvae were living were observed in all three localities. The holes ranged from about four inches to twelve inches in depth and two inches to six inches in diameter. They appear to result from a limb which has died and decayed, the decay extending into the tree trunk, to form a cavity. In all cases stains on the tree trunk indicated the fluid had overflowed from the hole.

The environment at all three sites was wet, either a marsh or spring area. The holes containing the watery fluid were observed only in willow and cottonwood trees, although live oaks and sycamore trees, having holes were associated with them. Ten color photos were taken for future reference. According to Dr. Chapman, the mosquito Orthopodomyia California breeds in the tree holes especially during the summer months.

Inquiry concerning projects listed in USGS Circular 413 "Phreatophyte Research In Western United States" October, 1958 to March, 1959 - A letter from the Bureau of Land Management, Battle Mountain, Nevada, inquired as to the status of the projects listed in this circular and requested any reports that were available. A review of the 24 projects based on the latest information available, indicated that 7 had been completed, 7 were still in progress and for the remaining 10, the status was uncertain. It is estimated that between 12 and 15 reports, either progress or final relating to these projects have been published in some form. For copies of reports, the Bureau was referred to the project leader.

California Division of Water Resources, workshop - On November 13 to 15 the chairman attended and participated in the workshop meetings and field trip at Fresno and Bakersfield, California. He discussed the research in phreatophytes by the U. S. Geological Survey and the results of evapotranspiration studies at Yuma, Arizona, and Winnemucca, Nevada.

During one session Dr. R. H. Burgy, University of California at Davis, reported on later studies with tritiated water, than that reported in the 63-3 meeting. Considerable improvement in techniques have been made in the use of it as a tracer for plant uptake of water.

The workshop largely planned, and chaired by our subcommittee chairman, Mr. Shannon, was a most stimulating and productive meeting.
(b) Curtis Bowser requested that list of current research projects on phreatophytes be brought up to date. J. S. Horton moved that T. W. Robinson, chairman of Research and Coordinating Task Force, circulate a form letter requesting information regarding phreatophyte research. Motion seconded and passed.

(c) John Shannon reported on a workshop sponsored by the California Department of Water Resources held in Fresno and Bakersfield which dealt primarily in evapotranspiration studies. Federal and state agencies conducting research or engaged in utilizing research in carrying out studies of water utilization and requirement attended and participated in the three day meeting. The meeting clearly demonstrated the great and broad interest in the field of evapotranspiration and at the same time the increasing importance of coordination of activities.

4. AGENCY REPORTS

The following Agency reports were received:

Attachment A - Bureau of Land Management
Attachment B - U. S. Geological Survey
Attachment C - Bureau of Indian Affairs
Attachment D - ARS - Soil and Water Conservation Research Division
Attachment E - ARS - Crops Research Division
Attachment F - U. S. Forest Service
Attachment G - U. S. Bureau of Reclamation

In addition to the Agency report by the U. S. Bureau of Reclamation, Curtis Bowser introduced Professor P. B. Rowe and his two graduate assistants, Loyd Barnett and John Tromble of the University of Arizona who reported on cooperative phreatophyte and plant replacement investigations in Arizona. Professor Rowe's report is included here as Attachment G.

5. NEW BUSINESS

Chairman Shannon welcomed Glenn H. Lipscomb, Conservation Specialist, as a new member representing the Bureau of Land Management. Attachment A under Agency Reports is a statement of responsibilities and activities of the Bureau as regards its interest in phreatophytes.

It was suggested that the chairman mention to the Parent Committee the vacancies occasioned by retirements and other reasons of several state representatives with a suggestion the states appoint replacements. It was also suggested that Health, Education and Welfare be represented on the Subcommittee.

Chairman Shannon turned the meeting over to the 1964 chairman, Fred O. Case who announced the following tentative meeting and places and dates:
64-1 meeting - March 3 and 4, Tempe, Arizona
64-2 meeting - May 26 and 27, Albuquerque, New Mexico
64-3 meeting - September 2 and 3, Alturas, California
64-4 meeting - December, Las Vegas, Nevada

With the exception of the 64-4 meeting, each will include a field trip to areas where there is a phreatophyte problem and/or control measures are being carried on.

6. PROGRAM

The program was devoted to the beneficial aspects of phreatophytes.

Frank E. Sylvester, Acting Regional Director, explained the organization and objectives of the recently formed U. S. Bureau of Outdoor Recreation, and indicated just how the bureau would be interested and concerned insofar as recreation was concerned, with any complete phreatophyte eradication and control programs.

Richard H. Davidson, California Department of Fish and Game spoke briefly on the importance of phreatophytes in certain areas on the fish and game population.

Mr. Steve Gallizioli, Arizona Game and Fish presented a paper (copy attached) on Phreatophytes and Wildlife. The major item was the benefit of Salt Cedar to the white wing dove which had allowed increases in bog limits over the years to now include 25 white wing doves.

* * *

Dean C. Muckel

Dean C. Muckel, Secretary
Phreatophyte Subcommittee, PSIAC
PHREATOPHYTES AND WILDLIFE

by
Steve Gallizioli
Arizona Game and Fish Department

We have been asked to present a statement on the value of phreatophytes to game species of Arizona. We appreciate the opportunity of doing so.

With water supplies in Arizona becoming increasingly critical, the Arizona Game and Fish Department is fully aware of the urgency of developing more effective water conservation measures. At the same time it is equally and even more directly concerned with maintaining maximum populations of huntable game for an ever increasing hunter population. Water conservation practices and high game population levels are not necessarily mutually exclusive. However, the growing interest in the wholesale elimination of phreatophytes has given rise to concern over the possible effects of various small game populations.

While the term "phreatophyte" embraces a variety of plants I will confine most of my remarks to tamarisk or saltcedar since this appear to be the species receiving most of the attention by agencies interested in phreatophyte control.

Of many species of game birds and mammals in Arizona the mourning and whitewing doves are without doubt the species which will be most affected by removal of phreatophytes. One stretch of Cila River bottomland extending some 35 miles above Gillespie Dam in Maricopa County, has been found to support a late summer population of 750,000 whitewings and 250,000 mourning doves. Here the combination of dense saltcedar nesting cover, adjacent to abundant food and water in nearby agricultural areas, provides optimum habitat for these species. Reports in the files of the Game Department show conclusively that this large nesting colony of doves has developed within the past 30 years. It is significant that the oldest saltcedars in the area have been determined to be approximately 30 years old. Since neither farming practices nor density or composition of native food plants have changed appreciably during this period, there can be little doubt that the growth of this dove population was due to the improved nesting cover provided by saltcedar jungles.

Both species of doves utilize saltcedar bottomlands in other regions of the state but not to the extent observed in this particular area.

During the fall and winter months ducks and geese find excellent resting and escape cover among flooded saltcedars around some of our desert lakes and streams. Picacho Lake in central Arizona would hold few ducks during fall and winter without the saltcedars that have developed throughout this shallow body of water. In like manner tamarisk thickets along many stretches of the Gila and Colorado Rivers furnish desirable cover for waterfowl, especially mallards and other species of seclusion-loving puddle ducks.
It has been suggested that in the event of phreatophyte removal other plants might be substituted which would consume relatively little water while providing food and cover for wildlife. In exploring the merits of this proposal we must consider some fundamentals of game management.

Food, water, and cover are basic requirements of wildlife habitat. A scarcity of any one of these items may seriously reduce the carrying capacity for a particular game species, despite an abundance of the other two. This is a fact which must be kept in mind in considering the advisability of replacing phreatophytes with other vegetation.

In the stretch of river bottom mentioned above nesting cover is clearly the limiting factor. Until these saltcedar thickets developed, this area was comparatively devoid of doves despite an abundance of both food and water. Obviously then, to be beneficial to dove populations, substitute plants would have to be of a type acceptable as nesting cover. Doves, particularly whitewings, require relatively large trees for nesting purposes. It seems unlikely that replacement plants of this type would be acceptable from the standpoint of water consumption. Almost surely any species capable of developing into good nesting cover would have the undesirable attributes of the water-consuming saltcedars themselves. Hence acceptable replacement species would be unlikely to mitigate damage done to game habitat where doves are the primary concern.

Establishment of food plants as replacements for phreatophytes could, however, benefit other game species found in these areas. Quail, cottontail rabbits, and even mule deer occur in varying densities throughout these thickets. And conceivably even doves, in areas where food may be more limiting than nesting cover, may well benefit from the introduction of other plant species.

Actually a comparatively small acreage of river bottom phreatophytic growth is known to be used extensively by nesting doves. Only those areas where the location of food, cover, and water furnishes optimum interspersion of these essential dove habitat features are of immediate concern to the Arizona Game and Fish Department. Much of the acreage currently occupied by saltcedar would probably be improved by judicious clearing with subsequent establishment of plants valuable as wildlife food. Again, however, it should be reiterated that cover is an essential requirement of game habitat. If all phreatophytic growth is removed from large areas and substitute plants fail to provide the type of cover required by these species then game populations will suffer regardless of a possible abundance of food.

As control methods are developed that are practical over large areas it seems reasonable to assume that replacement plant species will be found and used. We are hopeful that they will be of value as food and cover for wildlife. The Arizona Game and Fish Department is interested, as funds are available, in aiding in studies directed toward replacement species in the hope that plants of value to wildlife can be found. It would appear desirable to conduct pilot studies to determine what plant or combinations
of plants could be substituted for food and cover or what interspersion of substitute plants and patches of existing phreatophytic growth would best meet the needs of native game populations. Research of this type should precede and not follow wholesale eradication of phreatophytes.

Our department appreciates the necessity for developing control methods for phreatophytic plants, especially tamarisk, in many areas of the southwest. We are hopeful large scale destruction of such native plants as mesquites, cottonwoods, and willows, beneficial as wildlife food and cover, and of aesthetic value as well, will be avoided.

We hope too that the relatively limited acreage of phreatophytes which currently support our largest concentrations of whitewings and mourning doves can be preserved intact. To the Arizona Game Department and the sportsmen of our state the water consumed by phreatophytes in such areas is not wasted and the damage to this fine dove habitat which would result from phreatophyte control would be irreparable.
The Bureau administers approximately 13 million acres of public land in Arizona, all of which are located within the Pacific Southwest Region. Programs carried out on the public lands include land tenure, minerals, recreation, wildlife, range management, soil and moisture conservation, and construction.

Conservation work applied to BLM administered lands include management and land treatment practices such as fencing, brush control, seeding and weed control, and structural projects such as stockwater reservoirs, flood detention dams, waterspreading dikes, diversion dams and other erosion control structures. The brush control program includes control of salt cedar and other phreatophytes which has been carried out on small floodplain invasions where conversion to range grasses was determined to be desirable.

Principal conservation measures being applied to BLM administered lands in Arizona include fencing, brush control, seeding, detention dams, and waterspreading dikes. Total accomplishments to date include approximately 5,500 miles of fencing, 134,000 acres of brush control, 79,000 acres of seeding, 1,200 reservoirs, 71 detention dams and 459,000 lineal feet of dikes.
Humboldt River Research Project - All evapotranspiration activities for the 1963 growing season were suspended on October 20, due to freezing and near freezing temperatures. Measurements of the volume of foliage were made in July for the greasewood tanks and for all tanks in September. Leaf samples of greasewood for boron determination were taken each month, May to September, and in October soil samples inside and outside the tanks were taken for the same purpose. Preliminary data indicate that rabbitbrush uses more water than does greasewood, the averages being 1.68 for greasewood and 2.77 cubic feet of water per cubic foot of foliage.

Yuma, Arizona

The Yuma Project was visited on October 14 and 15. The growth in the tanks planted to saltbush and arrowweed has been remarkable. It will be remembered that when the tank sites were visited in March 1962, the plants had not put on much growth. In October 1963 the saltbush plants ranged from 7 to 9 feet in height and the arrowweed from 6 to 8 feet high. Growth in the tule tanks was representative of that outside the tanks. The only species that failed to make a substantial growth was the carrizo cane.
REPORT ON PHREATOPHYTE ACTIVITIES
BY BUREAU OF INDIAN AFFAIRS

by

Robert H. Rupke

Recent activity of the Bureau of Indian Affairs in phreatophyte matters has been the spraying of canal banks on the various irrigation projects on Indian Reservations -- for the control of willows in Nevada and Utah, and salt cedars and Johnson grass in Arizona.

Leases for the development of about 2,000 acres of additional farm land at the Colorado River Indian Reservation have been entered into. Removal of mesquite and arrow weed will be part of the development.

Plans for leasing an additional 6,400 acres of land now covered with mesquite, arrow weed, and salt cedar, at the Colorado River Reservation, have been developed and prospective bidders are being informed of the leasing proposal by a brochure now being circulated.

Other activities pertinent to land and water use in the Phoenix area by the Bureau of Indian Affairs was presented in a quarterly report to the parent committee.
Meadow Grass Evapotranspiration and Phreatophyte Replacement Studies

by

A. S. Dylla
Agricultural Research Engineer

A progress report on water used by native meadow grasses growing in evapotranspiration tanks at Winnemucca, Nevada is presently in the process of being prepared for publication release. The report covers data on water used by grasses in ET tanks during the past three seasons. However, only two complete growing seasons of data were obtained.

The water table in the ET tanks was maintained at the 4-foot depth during the entire growing season of 1962. During the 1963 season the water table was fluctuated to simulate wet meadow conditions normal for the Humboldt meadow.

Results showed that grasses grown under a simulated wet meadow environment used more water to produce a ton of hay than when grown with the water table maintained at a 4-foot depth. The ET tanks grasses subjected to wet meadow conditions in 1963 also produced less hay than in 1962 when they were grown with the water table maintained at the 4-foot depth. In 1962, six ET tanks used an average of 19.6 inches of water to produce an average hay yield of 1.65 tons per acre. In the following growing season of 1963, the same six ET tanks used an average 22.6 inches water to produce an average 1.30 tons per acre hay.

Phreatophyte replacement vegetation studies conducted in Paradise Valley, Nevada in cooperation with the Crops Research Division of the Agricultural Research Service, the Bureau of Land Management, the Soil Conservation Service, and the University of Nevada Agricultural Experiment Station, are progressing. Present observations of replacement species plot trials indicate that seedbed preparation in the form of shallow pitting and furrowing did not improve seedling establishment. Tall wheatgrass (Agropyron elongatum) and basin wildrye (Elymus cinerous) appear to be the best species for replacement on the greasewood and rabbitbrush sites. Two irrigations weekly appeared slightly better than one. The vigor and density of seedling establishment appeared directly related to the degrees of soil salinity and alkalinity. Further investigations are being conducted to determine the degree of alkalinity of salinity limiting seedling establishment. Additional experimental plot seedings of tall wheatgrass and basin wildrye are planned for 1964.
Final evaluation of field spray treatments put out in 1962 was completed in September. Results show that benzoic and s-triazine herbicides are ineffective as foliage sprays at the rates used. A comparison of ester, emulsifiable acid and amine formulation of silvex, 2-(2, 4-DP), and a brushkiller mixture of 2, 4-D and 2, 4, 5-T showed that a silvex ester and the silvex emulsifiable acid at 4 lb/A were the most promising. The ester formulation of 2-(2, 4-DP) at 4 lb/A was also effective but less so than the two silvex formulations. Rates of herbicides are expressed as acid equivalent.

A study designed to evaluate the effect of specific ions and varying levels of salinity on germination of saltcedar seeds showed that at 100, 500, 1000, and 5000 ppm of the ion, sodium reduced germination some 18 percent but this was just barely significant at the .05 level.

When it became apparent that the lower levels of salinity did not have much effect on germination, the levels were raised to 5000, 10,000, 20,000 and 40,000 ppm. Even at these levels, saltcedar seed germination and the lowest percentage was 25 at 40,000 ppm of magnesium ion. Generally, magnesium, sodium, and potassium at 40,000 ppm had the most effect on germination, with calcium having a lesser effect at that level. The averages for all treatments were 86 percent for distilled water, 41 percent for sodium, 41 percent for magnesium, 47 percent for potassium, and 48 percent for calcium. All chemicals were in the chloride form.

Since high salinity did not greatly inhibit germination, greenhouse studies are planned to study effect of salinity on establishment and subsequent growth of saltcedar seedlings.

Rooting of cuttings and establishment of vigorous new plants for experimental use ranged in the 90 percent level throughout the spring and summer. It appears that rooting in October will decrease to about 25 percent. Continued study is under way.

Vegetative photoperiodic responses obtained in cuttings planted in February-April were not consistent with those responses obtained from cuttings planted in September. This study will be continued throughout the year.

Plants reproduced from cuttings were treated with silvex oil-soluble amine at concentrations required to apply 1/16, 1/8, 1/4, and 1/2 lb/A in 20 gpa of water. Regrowth occurred at all rates. There were no differences in average response between greenhouse plants that were between 3 and 9 months of age.
Richard Lee has replaced John Decker in charge of the evapotranspiration studies for the Forest Service phreatophyte project. Richard has been carefully searching the literature and analyzing the basic problems involved in measurement of evapotranspiration from living plants growing under natural situations. While he has not specifically developed a research program, his immediate effort will be a study of the enclosure effect caused by the plastic tent. It is planned now to carry on various studies in cooperation with the Watershed Management Division of the University of Arizona, when they start work on the Gila River. Cooperative studies may also be done with Dr. Harold C. Fritts, Laboratory of Tree-Ring Research at Tucson.

The reconnaissance study reported upon at the Salt Lake meeting is continuing satisfactorily. The vegetation data on the reaches already sampled have been partially analyzed. Satisfactory contacts have been made to accomplish the second stage of the survey.

The study carried on in cooperation with the Bureau of Reclamation to determine submergence effects of tamarisk growing on the Tonto Creek Delta of Roosevelt Lake suffered somewhat of a setback during the summer due to flood flows of Tonto Creek which destroyed quite a number of the permanently-marked elevation points. However, the stations established by the Bureau away from Tonto Creek were untouched and we have gone ahead and set out a large number of permanently-marked quadrats in addition to the previously established transects. We are now confident that we have a base of information which will yield excellent data both on effects of past submergence, and on future events; and because of this reason, we do not think it necessary to ask the Bureau to survey additional points.

The two-year clipping study has now come to a close and we feel that additional data will not be needed. In general, we have found that periodic clipping of tamarisk, if severe enough, will kill a large percentage of the plants and will greatly reduce the carbohydrate storage in the roots of the survivals.

Probably our greatest effort for the last quarter has been in the preparation of manuscripts, principally for technical journals. Two manuscripts have been published since the last report, "Root distribution of five-stamen tamarisk, seepwillow, and arrowweed" by Howard L. Gary, and Decker's "An analysis and simplification of the Blaney-Criddle method for estimating".
The Bureau of Reclamation report consolidates information on the phreatophyte activities being conducted by several regional offices working in this field and by personnel in our laboratory in Denver. In the laboratory, carbohydrate analyses were completed recently on 44 samples of saltcedar for the Rocky Mountain Forest and Range Experiment Station, Tempe. This work is in connection with a plant clipping study which has been reported upon previously by Mr. Jerry Horton. Also, 200 samples of saltcedar submitted by the Agricultural Research Service, Los Lunas, New Mexico, have been analyzed to determine carbohydrate level in relation to season of growth in connection with a study on timing of herbicide application. Further tests will foliar-applied herbicides have been made on greenhouse-grown saltcedar plants in the last several weeks and an evaluation of this work now is underway. The outdoor nursery used to grow phreatophytes is being expanded with plans for a more active investigational program in 1964.

Region 5 in Amarillo has issued specifications and awarded a contract for clearing the prototype study area. The nine bids received for clearing the 6,700-acre study area ranged from $288,990 to over $550,000. Mr. O. J. Lowry has compiled a report on floodway clearing and maintenance. This report contains information on cost of operations and has excellent information on types of equipment in general use.

Our Sacramento office has reported that a saltcedar-infested area in the Rye Patch Reservoir area on the Humboldt Project between Lovelock and Winnemucca was sprayed in May, 1963. There were 1,050 acres sprayed of which 662 were treated for the first time. Approximately 218 acres were sprayed in 1962 and 170 acres sprayed in 1961. The herbicide applied in 1963 was a low volatile ester of Silvex (2, 4, 5 - TP) using four pounds acid in four gallons of diesel oil. Application was by helicopter at a contract price of $12.35 per acre. In early October the sprayed area was inspected. Indications are that a good kill was obtained in the upper portion of the reservoir where the saltcedar have been sprayed two years in succession.

Carbohydrate susceptibility experimental plots located at the Humboldt Sink site were evaluated. In this test, saltcedar have been sprayed at frequent intervals with four p/a Silvex in diesel oil. Samples for carbohydrate determinations were taken at each spray date. The results of the two-year study (7/60 to 6/62) showed that the kills from Silvex were not markedly related to the low carbohydrate content of the root samples. Eighty-two percent kills were obtained in early April and mid-May of 1961 with a carbohydrate percentage of 21 and 18 respectively. Reverse results were obtained during the same period in 1962 with a 60 percent kill and 20 percent carbohydrate in mid-April, and 39 percent kill and 18 percent carbohydrate for the first week in May. The poor kills during the spring of 1962 after April were no
doubt due to extreme drought conditions during that period. The carbohydrate trend was fairly consistent with a high level in the fall and winter (21-30 percent). A rapid decline with the start of growth in the spring results in a yearly low in May (18 percent) or June (16 percent) depending on the season. Apparently, other factors may be of greater importance in controlling saltcedar than carbohydrate level.

Wild rose investigations have been continued cooperatively at Battle Mountain. Wild rose was sprayed at frequent intervals with one p/a 2-, 4-, 5-T in diesel oil. Samples for carbohydrate trend was similar to that for saltcedar except that the low point appears to be later, i.e., mid-July. The best kills were obtained by spraying in September with another favorable period in April, May, or early June depending on the season. A correlation of kill with carbohydrate level has not been apparent.

There is a cooperative evapotranspiration study between the State of Nevada and the U.S. Geological Survey. Reclamation furnished the funds for the materials used in the tanks and water system, the installation expenses and part of the operation costs. The following tanks are in operation under this agreement: 2 greasewood, 3 willows, 3 wild rose, 3 rabbit brush and 1 bare soil tank.

Two studies are being conducted on consumptive use of riparian vegetation in California, one on the Santa Ynez River and one on Putah Creek. These studies are made periodically (Santa Ynez River 1959 and 1962; and Putah Creek 1958, 1960 and 1962) in connection with the Cachuma and Solano Project operations. The Santa Ynez River study covers about 49 miles of the channel area downstream from Cachuma Dam to the Pacific Ocean, and the Putah Creek study extends about 29 miles downstream from Monticello Dam to Yolo Bypass. The technique involves mapping riparian vegetation or phreatophytes, according to density of cover, and assigning a unit consumptive use value for each density category for a specific location. The study on Putah Creek was made by Bureau personnel, whereas the mapping of vegetation densities on the Santa Ynez River was made by the Lompoc office of the Agricultural Research Service.

Region 3 contracted early in 1963 with the University of Arizona to study the effect of phreatophyte removal from floodways in Arizona including water use of plants and a determination of replacement plants most desirable to discourage reinvasion of undesirable species and be of economic value for grazing. Today, we have with us Professor P. B. Rowe, who directs this program for the University. Many of you will recall this subcommittee met with Mr. Rowe at San Dimas several years ago and had an opportunity to see some very fine watershed investigations being conducted under his direction. Professor Rowe has with him two able graduate assistants, Loyd Barnett and John Tromble, who will present details of the cooperative phreatophyte and plant replacement investigations in Arizona.
We are happy to have the opportunity to meet with this group and discuss the phreatophyte study being carried on by the University of Arizona under the sponsorship of the U. S. Bureau of Reclamation.

As previously reported, the experimental site is situated on the lower reach of Salt Creek, a tributary to the Gila River near Coolidge Dam on the San Carlos Indian Reservation. This reach of canyon bottom is typical of many of the phreatophyte zones found along the smaller and intermittent streams of the state.

Broadly stated the study is aimed at: (1) Evaluating effects of phreatophytes (particularly saltcedar and mesquite) on streamflow, evapotranspiration and water yields (2) Determining effects of phreatophyte removal or other potential management practices on water yields, channel erosion, flood flows, and water quality and the development of methods of predicting these effects (3) Selecting and testing replacement vegetation (principally grasses) and developing methods of establishing and maintaining an effective and desirable vegetation following removal of the phreatophytes (4) Advanced training of future technicians.

There are several aspects of this study that may be of interest to your committee. The study will be carried out with the cooperative assistance of several groups, including the: U. S. Bureau of Indian Affairs and the San Carlos Apache Tribe; U. S. Geologic Survey: U. S. Forest Service; and various departments of the University of Arizona. Every effort will be made to utilize existing information and to avoid unnecessary duplication of past and current research efforts. In other words, the study will be directed toward supplementing results of allied research and at filling in some of the gaps in existing information. Data collected and results obtained will be kept current and available to the cooperating agencies at all times.

Methods of both basic and applied research will be used, but the project will be concerned primarily with studies of the basic processes influencing evaporative losses and water yield, and of the effects of the physical conditions of the environment upon these processes. It is believed that such information will have wide application to other areas where adequate inventories of pertinent climatic, soil, vegetative and water conditions are available.
Three canyon bottom cross sections, each approximately 250 feet wide, will be used in the study. The middle section is in a stand of saltcedar and will be maintained undisturbed as a check or control area. The lower section will be kept cleared of saltcedar and other woody vegetation and maintained as a treatment or test area. The upper section is situated in a mesquite stand and after 1-2 years of measurements will be partially cleared and converted to a test area similar to the lower cross section.

A climatic station has been installed and is equipped to measure precipitation, air temperature and humidity, evaporation, wind speeds at 2, 10, and 18 feet above ground level, wind direction, net radiation, and soil temperatures at 3, 6, and 12-inch depths.

Evapotranspiration rates of phreatophytes, bare soil, and replacement vegetation will be sampled, using a modification of the Decker transpiration tent method. To date, one tent has been constructed and a few sample field runs completed. The tent is approximately 12 in diameter by 10' in height and is constructed of polyvinyl plastic film. Humidity differences are obtained with wet- and dry-bulb thermometers.

Several problems in the use of the transpiration tent have become apparent. Foremost among these are the heat-trapping characteristics of the polyvinyl tent material and the reduction in wind velocity inside the tent as compared to natural conditions outside. Opaqueness of the tent to outgoing long-wave radiation caused an increase in temperature inside the tent during warm days. Methods being investigated to overcome these difficulties include calibration of the tent to account for differences between inside and outside conditions, and the possibility of fabricating the tent from other materials that will reduce the greenhouse or heat-trapping effects.

In addition to aerial measurements of evapotranspiration, further evaluation of water use will be made with the neutron soil moisture meter. Installation of access tubes for these measurements is planned for early 1964.

The initial studies concerned with the selecting, testing, and developing of methods of replacing the phreatophytes with vegetation more compatible with increased water yields, forage production, and soil stabilization will be done on carefully selected field plots. One series of plots (each plot 1/40-acre in size) will be situated in 2 of the 3 canyon bottom study sites described above. A third series of plots will be located in saltcedar stands occupying areas of high water table at the confluence of Salt Creek and Gila River.

An initial inventory of the vegetation in the three Salt Creek study sites, was completed in September. The density of the overstory vegetation, in the lower study site, was about 40 percent, principally saltcedar, in the upper study site about 48 percent, principally

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mesquite. In the center or control cross section the density of the overstory was about 40 percent of which about 62 percent was saltcedar and 38 percent mesquite.

A soils inventory delineating the hydrologic characteristics and site productivities of the experimental area will be completed prior to the final selection of the treatments and installation of the vegetation-soil-water plots.

The University of Arizona, Department of Watershed Management wishes to express appreciation for the support of this project by the U. S. Bureau of Reclamation, and for the assistance of our cooperators that have made this project possible. We also wish to acknowledge the interest, enthusiasm and leadership extended the project by our sponsor's representative, Mr. Curtis Bowser.