A PROGRESS REPORT OF THE LIVESTOCK DEMONSTRATION CONDUCTED BY OPERATIONS IN COOPERATION WITH THE NAVAJO EXPERIMENT STATION AT MEXICAN SPRINGS ON THE NAVAJO RESERVATION

WITH

BRIEF REFERENCE TO THE RESEARCH PROGRAM

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THE NAVAJO EXPERIMENT STATION, AT MEXICAN SPRINGS, NEW MEXICO, IN JULY 1939 PASSED THE SIXTH YEAR OF ITS RESEARCH, EXPERIMENTAL AND DEMONSTRATIONAL SOIL CONSERVATION PROGRAM.

A PIONEER TESTING GROUND IN THE EARLIEST DAYS OF THE ORGANIZED SOIL EROSION CONTROL MOVEMENT, THE STATION HAS BEEN THE SCENE OF A WIDE VARIETY OF RESEARCH PROJECTS AS WELL AS OF A SIGNIFICANT LIVESTOCK, RANGE MANAGEMENT AND FARMING DEMONSTRATION PROGRAM.

GRAZING AND LIVESTOCK MANAGEMENT IS EASILY THE DOMINANT INDUSTRY, AND THEREFORE THE DOMINANT LAND USE PROBLEM OF THE NAVAJO RESERVATION AND OF THE SOUTHWEST. THE STATION'S DEMONSTRATION OF THE BENEFICIAL PHYSICAL AND ECONOMIC EFFECTS OF PROPER GRAZING AND MANAGEMENT PRACTICES TOGETHER WITH LIVESTOCK IMPROVEMENT IS, THEREFORE, IMPORTANT TO THE NAVAJO RESERVATION LIVESTOCK PROGRAM AND TO SERVICE PLANNING AND OPERATIONS IN REGION 8.

THE RESEARCH PROGRAM, OF EVEN GREATER SIGNIFICANCE IN THE LONG RUN, IS STILL IN THE MIDST OF STUDIES WHICH WILL REQUIRE MORE TIME FOR COMPLETION.

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BOULDER DAM, IT IS SAID, WAS PARTLY RESPONSIBLE FOR ESTABLISHING THE STATION AT MEXICAN SPRINGS. A LARGE PROPORTION OF THE SILT POURING IN BEHIND THIS COSTLY NEW STRUCTURE WAS TRACED TO THE SAN JUAN DRAINAGE, MUCH OF WHICH LIES WITHIN THE NAVAJO RESERVATION.

WHEN THIS, TOGETHER WITH THE RAPID RATE AT WHICH EROSION WAS DESTROYING NAVAJO RANGES, WAS BROUGHT TO THE ATTENTION OF JOHN COLLIER, COMMISSIONER OF INDIAN AFFAIRS, EARLY IN 1933, HE IMMEDIATELY ASKED THAT SOMEONE INVESTIGATE EROSION CONDITIONS ON THE NAVAJO RESERVATION.

DR. H. H. BENNETT, C. K. COOPERRIDER, C. E. RAMSER, AND OTHERS WERE SELECTED TO MAKE THAT INVESTIGATION. A SITE WAS PICKED WHERE EROSION AND EROSION CONTROL METHODS MIGHT BE STUDIED. WITH PERMISSION OF THE NAVAJO TRIBAL COUNCIL AN AGREEMENT WAS DRAWN UP ON JULY 14, 1933 WHEREBY THE MEXICAN SPRINGS EXPERIMENT STATION WAS ESTABLISHED. A FEW MONTHS LATER, WHEN THE SOIL EROSION SERVICE WAS ESTABLISHED, MEXICAN SPRINGS WAS TRANSFERRED TO THE NEW AGENCY AS ITS FIRST OFFICIAL EXPERIMENT STATION. IT IS NOW CALLED THE NAVAJO EXPERIMENT STATION.

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SELECTED BECAUSE IT WAS A SMALL BUT ALMOST COMPLETE WATERSHED, AND PERHAPS AS TYPICAL OF THE NAVAJO COUNTRY AS ANY ONE SITE COULD BE, THE 43,000-ACRE STATION AREA RANGES FROM AN ELEVATION OF 8,120 FEET ON THE HIGH, WESTERN WATERSHED DIVIDE, TO 6,200 FEET IN THE LOWER, EASTERN PORTIONS. AVERAGE ANNUAL RAINFALL IN THE LOWER PORTIONS IS 7.5 INCHES, WHILE IN THE UPPER REACHES 18 INCHES OF PRECIPITATION CAN BE EXPECTED.

DUE TO A HIGH PERCENTAGE OF FOOTHILL AND MOUNTAIN TOPOGRAPHY, SHALLOW RESIDUAL SOILS, AND DEEPLY FILLED ALLUVIAL VALLEYS, THE AREA AS A WHOLE IS RATHER SUSCEPTIBLE TO SEVERE, ACCELERATED WATER EROSION. SINCE THIS IS

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CHARACTERISTIC OF MUCH OF THE SOUTHWEST, EROSION CONTROL METHODS AS WELL AS RUN-OFF DATA SECURED AT MEXICAN SPRINGS HAVE BEEN FOUND APPLICABLE IN MANY OTHER PARTS OF REGION 8.

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WHEN THE STATION WAS ESTABLISHED THERE WAS LITTLE INFORMATION ON THE ACTION OF SILT AND RUN-OFF AND ON SOIL EROSION CONTROL MEASURES IN THE SOUTHWESTERN RANGE COUNTRY. DURING ITS EARLY YEARS, THEREFORE, ALMOST EVERY CONCEIVABLE EROSION CONTROL MEASURE WAS TRIED OUT, AND SILT AND RUN-OFF WERE STUDIED.

IN THE PAST TWO YEARS, HOWEVER, THE STATION HAS NARROWED ITS RESEARCH ACTIVITY TO TWO MAIN GROUPS--RUN-OFF AND DIVERSION FLOODING.

IN THE RUN-OFF STUDIES, NINE REPRESENTATIVE DRAINAGES UNDER CONTROLLED GRAZING, AND THREE OUTSIDE THE AREA, UNDER COMMON USE, ARE SYSTEMATICALLY STUDIED. THE LARGEST DRAINAGE COMPRISES 40,000 ACRES, A[illegible] SMALLEST ONLY 187 ACRES.

RAIN GAGES AND RECORDING STREAM-FLOW GAGES ARE SPOTTED AT STRATEGIC POINTS THROUGHOUT THESE DRAINAGES SO THAT THE AMOUNT AND INTENSITY OF RAINFALL, THE STORM PATTERN AND THE RUN-OFF CAN BE ADEQUATELY RECORDED. DURING ACTUAL FLOWS, SILT SAMPLES ARE TAKEN FROM THE VARIOUS DRAINAGES AND ANALYZED FOR SILT CONTENT. THE DATA ARE CORRELATED WITH THE AMOUNT OF RUN-OFF, DURATION AND PATTERN OF THE STORM, THE VEGETATIVE AND GRAZING FACTORS INVOLVED, TO GET THE WHOLE PICTURE OF HOW MUCH SILT AND WATER CAN BE EXPECTED FROM A CERTAIN TYPE OF COUNTRY WITH A CERTAIN KIND AND AMOUNT OF RAIN.

FROM THESE RUN-OFF STUDIES DATA ARE BEING GATHERED WHICH ARE HELPING TO DETERMINE THE RELATION OF RUN-OFF TO RAINFALL--INFORMATION ESSENTIAL TO THE PROPER DESIGNING OF EROSION AND FLOOD CONTROL STRUCTURES, AND FOR GUIDANCE

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OF WATERSHED TREATMENT.

CLOSELY RELATED, AND POSSIBLY OF MORE IMMEDIATE INTEREST TO NAVAJOS, ARE THE EXPERIMENTS IN THE FIELD OF DIVERSION FLOODING--TAKING FLOOD WATERS OUT OF ARROYOS AND SPREADING THEM ON CROP, PASTURE AND RANGE LAND.

FOR STUDYING THE EFFECTS OF FLOOD WATERS ON SOIL AND VEGETATION, FIELD AND PLOT STUDIES ARE UNDER WAY. WHILE THERE IS NO CONTROL EXERCISED ON THE WATERS RECEIVED BY THE FIELD STUDIES, THAT RECEIVED BY THE PLOT STUDIES IS CONTROLLED AS TO AMOUNT OR KIND OR BOTH.

THUS, ONE SET OF PLOTS, PLANTED TO NATIVE GRASSES, IS SUBDIVIDED INTO SEVERAL SERIES, WHICH RECEIVE RIGIDLY CONTROLLED MIXTURES OF WATERS AND SILT. THE AMOUNT AND KIND OF SILT VARIES WITH THE SERIES. ANOTHER SET OF PLOTS, PLANTED TO THE SAME NATIVE GRASSES, RECEIVE SIX-INCH APPLICATIONS FROM EVERY FLOW WHICH COMES DOWN MEXICAN SPRINGS WASH. A COMPARABLE SERIES RECEIVES CLEAR WELL WATERS; AND ANOTHER, NOTHING BUT RAINFALL. A THIRD SET, UPON WHICH CROP PLANTS ARE GROWN, IS DIVIDED INTO SERIES TO TEST THE EFFECTS OF APPLYING PORTIONS OF EACH FLOW COMING DOWN THE WASH AND OF FLOWS SELECTED FOR TIMELINESS AND FOR SILT CONTENT.

MEASUREMENTS ARE MADE OF CROP YIELDS, CHANGES IN GRASS COVER, CHANGES IN SOIL, AND OF SOIL MOISTURE, TO DETERMINE THE EFFECTS OF THE VARIOUS TREATMENTS.

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AS AN IMPORTANT PHASE OF THE BROAD PROGRAM DESIGNED TO PREVENT EXCESSIVE SOIL AND WATER LOSSES THROUGH ACCELERATED EROSION, A LIVESTOCK AND RANGE MANAGEMENT DEMONSTRATION WAS UNDERTAKEN ON THE 43,000-ACRE AREA. THIS DEMONSTRATION SOUGHT NOT ONLY TO ASSIST IN REHABILITATING RANGE LAND BUT ALSO TO FIND WHETHER REDUCING THE NUMBERS OF LIVESTOCK TO PROPER CARRYING CAPACITY WOULD GIVE THE NAVAJOS USING THE RANGE WITHIN THE EXPERIMENT STATION BOUNDARIES AS MUCH INCOME AS THEY WERE GETTING TO START WITH.

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BECAUSE THE AREA HAD BEEN HEAVILY OVER-GRAZED PRIOR TO THE ESTABLISHMENT OF THE STATION, THE FIRST STEP WAS TO REDUCE TO PROPER NUMBERS, THE NAVAJO SHEEP, CATTLE, AND OTHER STOCK GRAZING WITHIN THE STATION BOUNDARIES. AFTER THE AREA WAS FENCED, ALL LIVESTOCK WERE REMOVED. SURVEYS SHOWED THE ESTIMATED CARRYING CAPACITY TO BE 1,854 SHEEP UNITS. THIS AMOUNT OF STOCK WAS RETURNED TO THE AREA FOR STUDY AND DEMONSTRATION OF PROPER LIVESTOCK AND RANGE MANAGEMENT.

OF THE 1,854 SHEEP UNITS, 500 ARE NOW PUREBRED RAMBOUILLETS, AND 500 ARE MIXEDBRED NAVAJO SHEEP. PUREBRED HEREFORD COWS MAKE UP 320 SHEEP UNITS, AND 534 SHEEP UNITS ARE IN MISCELLANEOUS STOCK SUCH AS HORSES, RAMS, STALLIONS, AND BULLS.

IN ADDITION TO RECORDS ON THE LIVESTOCK WITHIN THE AREA, THE STATION STAFF HAS ALSO KEPT RECORDS ON YIELDS AND RETURNS FROM TYPICAL LIVESTOCK OUTSIDE THE EXPERIMENTAL AREA.

FOR COMPARING RESULTS UNDER PROPER MANAGEMENT WITHIN THE AREA WITH RESULTS UNDER ORDINARY NAVAJO MANAGEMENT OUTSIDE THE AREA, THE FORMER NUMBER OF SHEEP UNITS GRAZING THE AREA WAS ESTIMATED TO BE 3,700. THIS IS BASED ON THE FACT THAT THE STATION WAS LOCATED WITHIN, AND WAS TYPICAL OF, DISTRICT 14 OF THE NAVAJO RESERVATION WHERE RANGE SURVEYS AND LIVESTOCK COUNTS HAD SHOWN THAT THE ESTIMATED CARRYING CAPACITY WAS 50 PERCENT OF THE TOTAL NUMBER OF STOCK GRAZING WITHIN THE DISTRICT.

THE LIVESTOCK AND RANGE MANAGEMENT PROGRAM INCLUDES BOTH CATTLE AND SHEEP BECAUSE 1) THE NAVAJOS AROUND MEXICAN SPRINGS ORIGINALLY HAD A FEW BEEF CATTLE IN ADDITION TO THEIR SHEEP AND WANTED TO CONTINUE SOME DUAL USAGE, AND 2) THE FLOOD IRRIGATION TESTS AND EROSION CONTROL TREATMENT AFFORDED SOME RANGE THAT CATTLE WOULD MAKE MORE EFFICIENT USE OF THAN SHEEP.

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THE LIVESTOCK BREEDING PROGRAM TO IMPROVE NAVAJO SHEEP IS A FACTOR IN THE DEMONSTRATION. THE PUREBRED SHEEP HAVE BEEN GRAZED IN THE AREA FOR THE FIVE-YEAR PERIOD, 1935-1939. HOWEVER, THE MIXEDBRED SHEEP OF THE NAVAJOS WERE INTRODUCED TO THE STATION RANGE A LITTLE OVER TWO YEARS AGO. THE PERIOD 1937-1939 HAS, THEREFORE, NOT BEEN LONG ENOUGH FOR THE BREEDING IMPROVEMENT PROGRAM TO BRING RESULTS IN INCREASED PRODUCTION. THE MIXEDBRED SHEEP INSIDE THE AREA ARE, AT THE TIME THIS REPORT IS ISSUED, OF ABOUT THE SAME QUALITY AS THE MIXEDBRED SHEEP OUTSIDE.

THE TABLES OF RESULTS THAT FOLLOW, THEREFORE, REFLECT FOR THE MIXEDBRED SHEEP INSIDE THE AREA, PRODUCTION INCREASES DUE ONLY TO REDUCED STOCKING AND PROPER MANAGEMENT.

PRODUCTION RECORDS OF THE RAMBOUILLETS SHOW THAT THE NAVAJOS CAN RUN PUREBRED SHEEP AND, WITH PROPER MANAGEMENT AND CURTAILED NUMBERS, BOOST THEIR INCOME AS MUCH AS 37 PERCENT PER ACRE.

THE STATION DOES NOT EXPECT ALL NAVAJOS TO HAVE PUREBRED SHEEP. IT DOES, HOWEVER, EXPECT THAT THE ORDINARY NAVAJO SHEEP WILL BE VASTLY IMPROVED OVER THEIR PRESENT TYPE.

DATA ARE NOT YET AVAILABLE WHICH WILL SHOW HOW LONG IT MAY TAKE FOR THE INCOME OF THE PROPERLY MANAGED NAVAJO HERD, THROUGH CAREFUL BREEDING, TO APPROACH THE PUREBRED HERD INCOME. HOWEVER, WITH CAREFUL TEACHING OF BREEDING AND CULLING PRACTICES, IT IS THOUGHT THAT THIS POINT MAY BE REACHED IN TEN YEARS.

IN THE DEMONSTRATION, THE INDIANS HAVE BEEN HANDLING THE NATIVE MIXEDBRED STOCK THEMSELVES, PAYING ALL BILLS AND BUYING SALT.

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THE FOLLOWING TWO TABLES ILLUSTRATE THE EFFECT ON YIELD AND RETURN OF PROPER LIVESTOCK MANAGEMENT:

TABLE 1. COMPARISON OF AVERAGE YIELDS FROM NAVAJO MIXEDBRED SHEEP AND PUREBRED RAMBOUILLETS.
A. AVERAGE OF RECORDS FOR 193 -1939
B. AVERAGE OF RECORDS FOR 1935-1939

	No. of Ewes	% Lamb Crop	Av. Fleece Weight	Av. Lamb Weight	Av. % Death Loss
A. MIXEDBRED SHEEP INSIDE AREA	500	75	5 LBS.	55 LBS.	6
MIXEDBRED SHEEP OUTSIDE AREA	500	55	4 LBS.	50 LBS.	15
B. PUREBRED SHEEP INSIDE AREA	500	92	11 LBS.	64 LBS.	6

TABLE 2. AVERAGE RETURNS FROM NAVAJO MIXEDBRED SHEEP AND PUREBRED RAMBOUILLETS.
A. AVERAGE OF RECORDS FOR 1937-1939
B. AVERAGE OF RECORDS FOR 1935-1939

	Av. Price Wool per Pound	Av. Price Lambs per Pound	Av. Gross Return per Ewe
A. MIXEDBRED SHEEP INSIDE AREA	$ .174	$ .0615	$ 3.40
MIXEDBRED SHEEP OUTSIDE AREA	.174	.060	2.33
B. PUREBRED SHEEP INSIDE AREA	.190	.073	6.39

IN 1935, NAVAJOS IN THE MEXICAN SPRINGS AREA PURCHASED A HERD OF PUREBRED HEREFORD CATTLE FROM THE DROUGHT AREA OF WEST RN TEXAS. IN 1939 THE COWS WERE POOLED INTO AN OWNERS' ASSOCATION, WITH EACH OWNER ISSUED SHARES IN THE TOTAL HERD. THE NAVAJOS PAID FOR THESE CATTLE OUT OF THE HERD'S INCREASE, AND SINCE THE FORMATION OF THIS ASSOCIATION, RECORDS ON CATTLE YIELD AND RETURN HAVE BEEN KEPT. IMPROVED RANGE AND LIVESTOCK MANAGEMENT SHOWS INCREASED

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RETURNS IN BEEF PRODUCTION AS WELL AS IN LAMB AND WOOL PRODUCTION, AS IS EVIDENCED IN THE FOLLOWING TABLE:

TABLE 3. COMPARISON OF AVERAGE YIELDS AND RETURNS FROM NAVAJO CATTLE OF FAIR GRADE AND PUREBRED CATTLE, 1939.

	No. of Mature Cows	% Calf Crop	% Death Loss	Av. Calf Weight	Av. Price per Pound	Gross Return per Cow
Purebred cows inside area	50	94	2	462	$ .09	$ 38.25
Grade cows outside area	40	60	0	350	.06	12.60

IN VIEW OF THE FACT THAT PART OF THE STATION AREA HAS DUAL USAGE (CATTLE AND SHEEP) THE GROSS RETURNS MAY WELL BE FIGURED ON THAT BASIS. THE AVERAGE GROSS RETURN FOR ALL LIVESTOCK, CONVERTED INTO SHEEP UNITS, IS $6.45 PER SHEEP UNIT, WHEREAS THE GROSS RETURNS FOR SHEEP AND CATTLE ON THE NAVAJO RANGE OUTSIDE THE AREA IS $2.74 PER SHEEP UNIT FOR 1,854 UNITS. HOWEVER, BECAUSE OF THE 50 PERCENT REDUCTION FROM 3,700 UNITS TO 1,854 UNITS, THE UNIT GROSS INCOME INSIDE SHOULD BE COMPARED TO THE GROSS INCOME FROM TWO UNITS OUTSIDE. THIS WILL MAKE GROSS RETURNS PER UNIT INSIDE THE AREA $6.45 COMPARED TO A FIGURE OF $5.48 HAD NO REDUCTION BEEN MADE.

FROM THESE FIGURES, IT IS FOUND THAT THE MEXICAN SPRINGS NAVAJOS EARNED 15 PERCENT MORE PER ACRE WHERE LIVESTOCK WERE PROPERLY MANAGED AND UNDER DUAL USAGE THAN DID THOSE OUTSIDE. THE GROSS RETURNS SHOW THAT THE MEXICAN SPRINGS AREA PRODUCED 16 CENTS PER ACRE AS COMPARED WITH 14 CENTS PER ACRE OUTSIDE, ON THE SAME NUMBER OF ACRES WITH TWICE THE STOCK.

IN OTHER WORDS, THE NAVAJO EXPERIMENT STATION IS BEGINNING TO SHOW THE NAVAJO STOCKMEN THAT THEIR LIVESTOCK INCOME CAN BE MAINTAINED AND POSSIBLY

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INCREASED--EVEN WHILE PROTECTING AND IMPROVING THEIR SINGLE, MOST SIGNIFICANT RESOURCE--RANGE LAND."

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EQUALLY AS SIGNIFICANT AS THE YIELD AND RETURN STATISTICS IS THE RECOVERY PICTURE WITHIN THE BOUNDARIES OF THE STATION. IF IT HAD DONE NOTHING ELSE, THE PROJECT HAS BEEN WORTHWHILE ALONE FOR ITS DEMONSTRATION OF THE VALUE OF PROPER GRAZING PRACTICES IN EROSION CONTROL. GULLIES, WITH LITTLE OR NO OTHER TREATMENT HAVE HEALED OVER MUCH OF THE AREA, THEIR BOTTOMS AND SIDES WELL STABILIZED BY GRASS.

THERE IS A STRIKING FENCE LINE PICTURE AT THE TOP OF THE DIVIDE WHERE A FENCE MARKS THE WESTERN BOUNDARY. WELL-SODDED WESTERN WHEATGRASS AND BLUE GRAMA SLOPES INSIDE CONTRAST SHARPLY WITH BARE, ERODING SOIL OUTSIDE, WHOSE CHIEF PERENNIAL VEGETATION IS SCATTERED CLUMPS OF SNAKEWEED AND PINGUE. THERE IS EVIDENCE THAT THE CARRYING CAPACITY OF THE AREA HAS INCREASED--POSSIBLY DOUBLED IN PORTIONS OF THE HIGHER RAINFALL BELT AND IN FLOOD IRRIGATED AREAS.

THE STATION, HOWEVER, APPROACHES HEAVIER STOCKING WITH CAUTION, AND SO FAR ONLY ABOUT 200 HEAD HAVE BEEN ADDED TO THE RANGE LOAD AGREED UPON WHEN THE AREA WAS ESTABLISHED.

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TABLE X

GENERAL INFORMATION BY LAND MANAGEMENT UNITS

Unit No.	Unit Name	Acreage	Estimated Population	Acres Per Sheep Unit
1.	Echo Cliffs	1,318,922	1,350	31
2.	Navajo Mountain	968,271	1,100	57
3.	Tuba	1,374,180	2,075	42
4.	Black Mesa	1,102,670	2,139	35
5.	Tolani Lakes	659,437	1,186	27
6.	Hopi	553,145	3,037	27
7.	Castle Butte	1,131,600	2,335	20
8.	Monument	1,403,626	1,600	48
9.	Carrizo	1,010,463	2,475	32
10.	Chin Lee	827,761	3,220	24
11.	Tsailee	433,661	1,970	26
12.	Shiprock	1,320,220	3,575	46
13.	Cottonwood	428,114	2,730	25
14.	Five Chapters	626,905	2,180	25
15.	Crown Point	738,943	3,600	29
16.	Wingate	462,695	2,850	—
17.	Pueblo	1,142,654	3,950	15
18.	Defiance	1,041,731	5,380	19
	TOTALS	16,546,598	46,752	29 Av.

TABLE X

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