

Reserve
A-409
B52

REPORT ON 20 YEARS RESEARCH
1913-1933

BUREAU OF BIOLOGICAL SURVEY
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956203

20

Modifications to be made in "Review of Research Projects"
Submitted by Bureau of Biological Survey
in April 1935.

Control Methods	Page 1	Cost of the project	Allotment for fiscal year 1934	\$20,290
Investigation of food resources of migratory bird refuge areas	Page 7	" " " "	" " " "	5,777
Investigations of fur animals	Page 8	" " " "	" " " "	15,006
Fur-Animal Experiment Station	Page 9	" " " "	" " " "	12,850
Rabbit Experiment Station	Page 10	" " " "	" " " "	9,037
Maladies of wild birds and animals	Page 12	" " " "	" " " "	12,075
Investigations of wild animal life	Page 15	" " " "	" " " "	27,312
Investigations of migratory birds	Page 17	" " " "	" " " "	29,327
Research in forest wild life	Page 19	" " " "	" " " "	14,935
Muskox investigations	Page 21	" " " "	" " " "	4,298
Reindeer investigations	Page 23	" " " "	" " " "	9,734



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1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	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1958	1957	1956	1955	1954	1953	1952	1951	1950	1949	1948	1947	1946	1945	1944	1943	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931	1930	1929	1928	1927	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900	1899	1898	1897	1896	1895	1894	1893	1892	1891	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881	1880	1879	1878	1877	1876	1875	1874	1873	1872	1871	1870	1869	1868	1867	1866	1865	1864	1863	1862	1861	1860	1859	1858	1857	1856	1855	1854	1853	1852	1851	1850	1849	1848	1847	1846	1845	1844	1843	1842	1841	1840	1839	1838	1837	1836	1835	1834	1833	1832	1831	1830	1829	1828	1827	1826	1825	1824	1823	1822	1821	1820	1819	1818	1817	1816	1815	1814	1813	1812	1811	1810	1809	1808	1807	1806	1805	1804	1803	1802	1801	1800	1799	1798	1797	1796	1795	1794	1793	1792	1791	1790	1789	1788	1787	1786	1785	1784	1783	1782	1781	1780	1779	1778	1777	1776	1775	1774	1773	1772	1771	1770	1769	1768	1767	1766	1765	1764	1763	1762	1761	1760	1759	1758	1757	1756	1755	1754	1753	1752	1751	1750	1749	1748	1747	1746	1745	1744	1743	1742	1741	1740	1739	1738	1737	1736	1735	1734	1733	1732	1731	1730	1729	1728	1727	1726	1725	1724	1723	1722	1721	1720	1719	1718	1717	1716	1715	1714	1713	1712	1711	1710	1709	1708	1707	1706	1705	1704	1703	1702	1701	1700	1699	1698	1697	1696	1695	1694	1693	1692	1691	1690	1689	1688	1687	1686	1685	1684	1683	1682	1681	1680	1679	1678	1677	1676	1675	1674	1673	1672	1671	1670	1669	1668	1667	1666	1665	1664	1663	1662	1661	1660	1659	1658	1657	1656	1655	1654	1653	1652	1651	1650	1649	1648	1647	1646	1645	1644	1643	1642	1641	1640	1639	1638	1637	1636	1635	1634	1633	1632	1631	1630	1629	1628	1627	1626	1625	1624	1623	1622	1621	1620	1619	1618	1617	1616	1615	1614	1613	1612	1611	1610	1609	1608	1607	1606	1605	1604	1603	1602	1601	1600	1599	1598	1597	1596	1595	1594	1593	1592	1591	1590	1589	1588	1587	1586	1585	1584	1583	1582	1581	1580	1579	1578	1577	1576	1575	1574	1573	1572	1571	1570	1569	1568	1567	1566	1565	1564	1563	1562	1561	1560	1559	1558	1557	1556	1555	1554	1553	1552	1551	1550	1549	1548	1547	1546	1545	1544	1543	1542	1541	1540	1539	1538	1537	1536	1535	1534	1533	1532	1531	1530	1529	1528	1527	1526	1525	1524	1523	1522	1521	1520	1519	1518	1517	1516	1515	1514	1513	1512	1511	1510	1509	1508	1507	1506	1505	1504	1503	1502	1501	1500	1499	1498	1497	1496	1495	1494	1493	1492	1491	1490	1489	1488	1487	1486	1485	1484	1483	1482	1481	1480	1479	1478	1477	1476	1475	1474	1473	1472	1471	1470	1469	1468	1467	1466	1465	1464	1463	1462	1461	1460	1459	1458	1457	1456	1455	1454	1453	1452	1451	1450	1449	1448	1447	1446	1445	1444	1443	1442	1441	1440	1439	1438	1437	1436	1435	1434	1433	1432	1431	1430	1429	1428	1427	1426	1425	1424	1423	1422	1421	1420	1419	1418	1417	1416	1415	1414	1413	1412	1411	1410	1409	1408	1407	1406	1405	1404	1403	1402	1401	1400	1399	1398	1397	1396	1395	1394	1393	1392	1391	1390	1389	1388	1387	1386	1385	1384	1383	1382	1381	1380	1379	1378	1377	1376	1375	1374	1373	1372	1371	1370	1369	1368	1367	1366	1365	1364	1363	1362	1361	1360	1359	1358	1357	1356	1355	1354	1353	1352	1351	1350	1349	1348	1347	1346	1345	1344	1343	1342	1341	1340	1339	1338	1337	1336	1335	1334	1333	1332	1331	1330	1329	1328	1327	1326	1325	1324	1323	1322	1321	1320	1319	1318	1317	1316	1315	1314	1313	1312	1311	1310	1309	1308	1307	1306	1305	1304	1303	1302	1301	1300	1299	1298	1297	1296	1295	1294	1293	1292	1291	1290	1289	1288	1287	1286	1285	1284	1283	1282	1281	1280	1279	1278	1277	1276	1275	1274	1273	1272	1271	1270	1269	1268	1267	1266	1265	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951	950	949	9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BUREAU OF BIOLOGICAL SURVEY

Continuing Projects	Duration of work	Annual cost of entire project (F.Y. 1933)	Estimated annual saving	For details see page
Division of Rodent and Predatory Animal Control				
Control methods	1920 -	\$31,950	\$11,000,000	1
Division of Food Habits Research				
Investigation of the relation of birds and animals to agriculture	1885 -	27,600	Cannot be given in dollars.	4
Investigation of food resources of migratory bird refuge areas	1922 -	3,650	do	7
Division of Fur Resources				
Investigations of fur animals	1912 -	14,910	do	8
Fur-Animal Experiment Station	1916 -	13,950	do	9
Rabbit Experiment Station	1927 -	11,700	do	10
Division of Disease Investigations				
Maladies of wild birds and animals	1931 -	21,425	do	12
Division of Biological Investigations				
Investigations of wild animal life	1885 -	48,190	do	15
Investigations of migratory birds	1918 -	32,800	do	17
Research in forest wild life	1929 -	18,900	do	19
Muskox investigations	1930 -	11,320	do	21
Reindeer investigations	1920 -	19,170	do	23
Discontinued Projects	Duration	Cost of on- tire project (For 3 years)	Estimated annual saving	For details see page
Division of Fur Resources				
Commercial Fur Production	1931-1933	34,500	Cannot be given in dollars.	24
Number of continuing projects - 12				
Number of projects discontinued - 1				

100% SATISFACTION GUARANTEE

BUREAU OF BIOLOGICAL SURVEY

Title of project: Control Methods.

Date begun: The project was started in 1930 as a separate project under the title of "Eradication Methods", but similar investigations were previously conducted under other projects.

Date completed: The project as a whole has not been completed. However, several important phases of it have been brought to conclusion and are mentioned below under the heading, "Results." The continuation of this project is essential to determine effective methods for control of injurious rodents and predatory animals because developments in agriculture, horticulture, forestry, livestock production, as well as management of wild game, and protection to the public health are continually bringing us new problems that require constant research for adequate methods to afford protection against injurious animals under changing conditions. Activities under this project are the foundation for all of the Bureau's cooperative operations for the control of injurious rodents and predatory animals.

Authority: Authority for this project is contained in Agricultural Appropriation Acts and most recently under an item for the Bureau of Biological Survey, "Food Habits of Birds and Animals" and also in Congressional Authorizations embodied in the Act of March 2, 1931 (46 Stat. 1468; U. S. Code Supp., Title 7, sec. 426) authorizing a ten-year program of cooperative predatory-animal and rodent control.

Cost of the project: Allotment for fiscal year 1938 \$51,950; allotment for fiscal year 1934 \$34,250.

Results: The following valuable results have been obtained from investigations conducted under this project:

1. The perfection of effective and economical poison baits for the various species of native rodent pests. Research under this project has made it possible to so select, prepare and expose effective poisoned grain baits as not seriously to endanger animals other than those for which the baits are intended.

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

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2. Ascertaining the fact that birds of the gallinaceous group such as quail, pheasant, grouse, and domestic chickens are relatively immune to strychnine poison. From this information grain baits were developed so that birds of the foregoing group are not endangered when the strychnine-poisoned grain recommended by the Bureau is used in rodent control.
3. The development of a method of using thallium sulphate for the control of highly resistant species of rodents of which the California ground squirrel is one. This has solved the problem of controlling these animals on many of the agricultural areas where other forms of poison had failed.
4. The determination that the danger of secondary poisoning to man is practically nil should he eat any game birds that had been poisoned with thallium sulphate exposed in ground squirrel control.
5. The development of mechanical means of preparing a uniformly standard rodent bait of high quality at a low cost which supercedes the old time method of hand-mixing.
6. The development of a raticide (powdered red squill) which is practically specific for the brown rat and which has the advantage over other raticides of being relatively harmless to cats, dogs, rabbits, chickens, pigeons, pigs, and human beings.
7. The development of a method which made possible the cooperative production of ready-prepared red squill baits in sealed tin cans for use in county and state-wide campaigns for rat control.
8. The determination of lethal doses of strychnine for coyotes and other predatory animals.
9. The development of a method whereby the use of strychnine in predatory animal control is made efficient by mechanically processing the strychnine to materially delay the bitter taste of this chemical.
10. The development of a strychnine tablet containing the correct amount of poison and which is acceptable in the poisoning of coyotes.
11. The development of an effective bait for use in poisoning predators and which at the same time reduces to a minimum the loss of other animals including fur bearers.

12. The development of improved trapping methods for the control of coyotes, wolves, and other predators in the United States as well as in Alaska.
13. The development of oil of catnip for use in trapping of mountain lions and bobcats.
14. The perfection of a safety spring attachment for animal traps whereby smaller and valuable species of fur-bearing animals and birds are safeguarded during predatory animal trapping operations.
15. Development of repellents for bats to be used when they establish obnoxious roosts in dwellings.

Economic importance: All of the activities under this project are of direct benefit to farmers and livestock growers, enabling them to efficiently and economically control injurious rodents which cause enormous losses in farm crops, forestry and fruit trees, range forage and stored products, and to efficiently and economically control predatory animals which commit serious depredations on sheep, lambs, goats, cattle, pigs, and poultry. Rodents and predatory animals are at times responsible for the spread of diseases such as bubonic plague, spotted fever, tularemia and rabies, and their control for the protection of public health is important. This project is necessary in the Bureau's operations for the control of animal pests, for under it effective methods of control are developed and special poisons are prepared for use in the field in connection with cooperative control operations. In many instances, the portion of farm products, range forage and livestock destroyed by these animal pests represents the difference between profit and loss of a year's enterprise. The cooperative control of injurious rodents and predatory animals under the leadership of the Bureau has materially decreased their depredations and where conducted has been one of the most tangible means of increasing profits from agricultural pursuits.

Estimated annual saving: Field operations conducted under projects for the control of rodents and predatory animals employing methods developed under the Control Methods project have effected an average annual saving estimated at \$11,000,000.

Similar work at State Experiment Stations: No work of similar nature is being conducted by State Experiment Stations.

BUREAU OF BIOLOGICAL SURVEY

Title of project: Relation of birds and animals to agriculture.

Date begun: 1885.

Date completed: Specific portions of the general project and local investigations have been completed up to a certain date, but the project as a whole is a continuing one, and due to the facts that we are dealing with living organisms, some of them highly migratory, in a constantly changing environment, new problems are constantly arising or old ones appearing in a new guise, so that it is as difficult to say in this as it is in most research work that any line of investigation is definitely completed.

Authority: Annual appropriation acts for the Department of Agriculture, the first in 1885. In recent acts the specific clause reads: "For investigating the food habits of North American birds and animals in relation to agriculture, horticulture, and forestry."

Cost of the work: Allotment for the fiscal year 1933 \$67,860; allotment for fiscal year 1974 \$50,750.

Results:

The economic value of birds. Publication in more than 250 bulletins and other papers of information on the economic status of about 500 species of birds. This data is utilized in determining bird protective legislation and regulation in the United States. Several special reports have been issued on the relation of birds to various insect pests. Problems in economic ornithology have received attention through all the years varying from brief correspondence to intensive field and laboratory investigations. In carrying on the latter work, about 100,000 stomachs of birds have been examined, the results fully indexed, and extensive reference collections assembled, including probably the best collection of the seeds of native plants in the country. A comprehensive indexed pamphlet file has been accumulated, which embraces 10,000 or more items relating to all phases of the work.

Improving food resources for wild fowl. Results of this work have been published on the food habits of the birds, including accounts of all of the shoal water species of wild ducks, and upon the important wild duck food plants and methods of propagating them. These publications have been widely distributed and the methods recommended used to improve a great many places as feeding resorts for wild fowl. This has not only been of considerable value to the birds but in some cases has greatly increased value of the property planted. Lists of dealers in duck food plants are kept available for correspondents. Surveys of feeding conditions for wild fowl have been made in numerous localities and reports on the food resources for wild fowl of certain areas of which those of the Sandhill region of Nebraska, the Bear River marshes of Utah, and the State of North Dakota have been published and others on Missouri, Minnesota, and Wisconsin are in press or preparation.

Methods of attracting birds. From the complete index to items of bird food available, the preferences of birds among fruits and seeds were ascertained. A list of genera of favorite fruit-bearing shrubs and trees was prepared and data on the fruiting season of their species obtained by personal visits to, or by purchase from, most of the leading herbaria of the United States, as well as from a variety of other sources. This information has served as the basis of a series of bulletins on attracting birds in various sections of the United States. These bulletins have dealt also with nest boxes and with methods of protecting birds from common enemies. A bibliography of books on attracting birds and lists of dealers in devices have been kept available for correspondents.

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Introduction of game birds: A publication issued suggesting improvements in methods of introducing game birds and pointing out what species are undesirable and what desirable with indication of where the latter can be successfully introduced.

Propagation of game birds: A series of bulletins has been published summarizing the methods in use by the most successful American and European game breeders. Lists of dealers in, and of points where game birds have been kept available for correspondents.

Care of ornamental birds. Publications issued on the care of peafowl, fancy pheasants, and waterfowl. Bibliographies of related works and lists of dealers in the birds and in supplies kept available for correspondents. Similar output on cage birds has been done incidentally as an accommodation to the public.

Welfare of upland game birds. Two reports of progress on a 5-year cooperative quail investigation were published and the final report prepared in manuscript (this later published by cooperator in book form). Cooperative work under a fellowship system carried on in the following states with the object of research mentioned in connection with each: Michigan, Hungarian partridge; Wisconsin, ruffed grouse; Wisconsin, bobwhite; Arizona, Gambel's quail; and now with 9 experimental quail management demonstration projects in 6 states. A list of dealers in quail food plants is available and a report on quail food plants is in manuscript.

Control of injurious birds. Reports have been published on all of the principal injurious species together with suggestions for their control. Investigations of local bird nuisances and demonstrations are made with special recommendations in all cases; this work now engages much of the time of personnel at three western field stations. Leaflets on bird control are kept constantly available for correspondents. Aid in bird control has been a much appreciated service and has elicited important local cooperation.

The economic value of mammals. The work on the food habits of mammals was largely of an incidental nature until recently. Publications have been issued, however, containing information on the food habits of several groups of mammals, and others have been prepared on bulb pests and pocket gophers. Investigations are now in progress of the economic status of predatory mammals in general, of animals classed as vermin, of seals and sea lions in relation to the fishing industry on the northwest coast, and of the food of prairie dogs and pocket gophers in relation to methods of controlling these animals. It is probable that in time studies of the food of mammals, especially the predatory species will yield information that will have the same relation to policies concerning protection of these animals, as the bird food-habit studies have in the avian field.

The economic value of reptiles and amphibians. The principal results of this project so far are publication of a bulletin on the economic importance of alligators, preparation of a pamphlet on the food habits of American toads, and of one leaflet relating to toads, one on the classification and two relating to snakes, especially poisonous species with directions for treatment of snake bites and for reducing the numbers of snakes.

Economic importance: It was scientific research in Economic Ornithology that led to the universal enactment of bird protective legislation in the United States and to the widespread movement for the preservation and increase in the number of birds. Maintenance and increase of the numbers of beneficial birds means increased destruction of insect pests and prevention of increase in losses due to them. A limited number of birds are destructive, and research has resulted in effective methods of control. County agents have estimated that destruction of English sparrows in Utah by methods recommended

Economic importance (con't.)

the Biological Survey resulted in a saving of \$337,000 in three years. These methods have been used with great success also at the North Dakota Experiment Station and at certain Army posts. Aid has been rendered also in the control of rice - and other grain - and fruit-destroying birds with results which have been highly praised by the beneficiaries but which are difficult to estimate in money terms; persons using methods devised by our workers in California have been able to reduce damage to a tenth of what it was before. Research on the feeding habits of game wild fowl and in methods of propagating the plants most important as food for them has assisted to build up a business in the sale of these plants that amounts to many thousands of dollars annually. Recommendations by the Biological Survey for improvement of wild fowl feeding grounds have resulted, it is acknowledged, in doubling the value of certain estates, and in one case the gain was set at tenfold. Studies in improvement in the environment of upland game birds have set new standards for game bird management and embodied in the final report upon one of them, the most comprehensive account of an American game bird that has ever been published. Quail production on extensive southern holdings was doubled as a result of the findings of this Cooperative Quail Investigation. Considering the high value set on quail hunting, the financial gains would be estimated at a large figure.

Estimated annual saving: By prevention of increase in the amount of damage done by injurious insects, through fostering the maintenance and increase of the nation's stock of useful birds, and by reduction in damage by injurious birds through use of methods devised or recommended by the Bureau millions of dollars have undoubtedly been saved. The value of upland game birds and of wild fowl produced or conserved annually by methods devised or recommended by the Bureau has amounted to hundreds of thousands of dollars, and profits from the wild duck food industry have amounted to a vast sum.

Similar work at State Experiment Stations: In New York "Extension service in ornithology deals with birds in their relation to agriculture and rural life" (45th Ann. Rep., N. Y., Cornell Sta., 1932, p. 56); this as noted is extension, not research work.

In Arizona there are two projects which deal with food habits of mammals in which the Biological Survey cooperates. These are: "Study of the life history of range rodents (Jack Rabbits)" No. 24 Adams Fund, and "Food requirements of certain game animals in the Southwest with especial reference to the influence on the livestock industry" (recent, no number, Purnell Fund).

Arizona also is making "A study of the life history and ecology of the wild turkey" (recent, no number, Purnell Fund).

Oklahoma has a project "Game Bird Propagation and Distribution" (Rep. Okla. Agr. Exp. Sta. 1930-31, pp. 143-144).

In California it is said that "The work of the Station has to do with studying the historic records and present economic status of the various species of animal life in California with emphasis on problems of economic concern" (Rep. Calif. Agr. Exp. Sta., 1931-1932, p.65); this work appears to be almost exclusively bibliographic.

To sum up, States can pursue in a limited way restricted problems in the economics of wild life, but as the latter in the case of almost every species, spreads far and wide regardless of State boundaries, it is only the federal government that can make the general studies necessary as a basis for enlightened public policy toward wild life.

BUREAU OF BIOLOGICAL SURVEY

Title of project: Food resources of migratory bird refuge areas.

Date begun: 1929.

Date completed: The first great campaign of surveys of proposed refuge sites to determine their biological characteristics and desirability as sanctuaries and breeding, feeding and resting places for migratory birds was completed in a single field season; supplementary work occurs from time to time and investigations looking toward the improvement of existing refuges is continuing in nature.

Authority: Annual appropriation acts of the Department of Agriculture; wording in this year's act, "For carrying into effect the provisions of the Act entitled 'An Act to more effectively meet the obligations of the U. S. under the migratory-bird treaty with Great Britain (39 Stat. p. 2, p. 1702) by lessening the dangers threatening migratory game birds * * * to furnish in perpetuity reservations for the adequate protection of such birds; and authorizing appropriations for * * * their maintenance and improvement."

Cost of the work: Allotment for fiscal year 1933 \$5,650; allotment for fiscal year 1934 \$5,650.

Results: In the three fiscal years subsequent to authorization of the work, about 220 areas totalling over 4,250,000 acres were examined and reported upon. About a sixth of them were recommended for acquisition.

Economic importance: The saving of the lives of waterfowl is of economic as well as of esthetic importance, but to put the value in figures would be a difficult task.

Estimated annual saving: To be measured in improvement of refuge facilities and quality, and in accommodation of increased numbers of migratory waterfowl; but not readily in money terms.

Similar work at State Experiment Stations: The selection and management of migratory bird refuges are exclusively federal functions, so there is no State work concerned.

GENERAL INFORMATION

1. Name of the project: ...

2. Description of the project: ...

3. Objectives of the project: ...

4. Justification of the project: ...

BUREAU OF BIOLOGICAL SURVEY

Title of project: Investigations of Fur Animals

Date begun: 1912.

Date completed: This project is a continuing one and like other research problems of its nature the work is being constantly developed.

Authority: Agricultural Appropriation Act under item in the appropriation for the Bureau of Biological Survey "For investigations, experiments, demonstrations, and cooperation in connection with the production and utilization of fur-bearing animals raised for meat and fur, in the United States and Alaska."

Cost of work: Allotment for fiscal year 1933 \$14,910; allotment for fiscal year 1934 \$14,110.

Results: Numerous bulletins, leaflets, and circulars have been published on all phases of fur animal production. This information serves as a guide to fur farmers and those contemplating entering the business. Foreign countries also depend upon the Bureau for much of this information. Cooperative relations have been established with the Carnegie Institution of Washington, University of Maryland, Conservation Department of Maryland, Bureau of Animal Industry, University of California, and the Montana Fur Company.

Economic Importance: Fur is an important commercial commodity of high cash value. The United States consumes more fur than any other country and more than it produces. Imports are received from 80 countries. Yearly fur trade values are as follows: Raw-fur catch, \$15,000,000; furs dressed and dyed, \$20,000,000; furs manufactured, \$250,000,000; exports of furs and fur manufactures \$50,000,000, 80% of which are raw furs. Fur-farming equipment, including the animals amounts to about \$40,000,000 and the estimated personal tax paid is approximately \$900,000. The work performed by the Division of Fur Resources, while of special interest to the trappers, fur farmers, legislators and conservationists, is of benefit also to fur tradesmen. These industries and interests consider this unit the source of technical information and the means to assist in solving their problems.

Estimated annual saving: This cannot be given in dollars and cents. These investigations benefit the entire fur trade and allied industries, the trapper, fur farmer, fur tradesman, and consumer.

Similar work at State Experiment Stations: No similar work is conducted at State Experiment Stations.

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7. This document contains information that is classified as CONFIDENTIAL - SECURITY INFORMATION.

Title of project: Fur-Animal Experiment Station (New York)

Date begun: 1916

Date completed: This project is a continuing one and like other research problems of its nature the work is being constantly developed.

Authority: Agricultural Appropriation Act under item in the appropriation for the Bureau of Biological Survey "For investigations, experiments, demonstrations, and cooperation in connection with the production and utilization of fur-bearing animals raised for meat and fur, in the United States and Alaska.

Cost of work: Allotment for fiscal year 1933 \$13,950; allotment for fiscal year 1934 \$13,550.

Results: Investigations conducted at the Fur-Animal Experiment Station have developed more practical and economical methods for the production and distribution of furs. Suitable rations have been devised for fur animals in captivity. Feed costs have been reduced by utilizing meat substitutes and disregarding feeds not adaptable for fur animals. The addition of suitable vitamin concentrates to the ration has been studied. Improvements made in pens, dens, and feeding troughs, together with a practical system of feeding and management, have eliminated wasteful practices. New developments, such as varied wire-bottom pen floors, improved feeding and water troughs, have prevented parasitic infestation. Progress has been made in determining the effect of sunlight on the quality of fur. Detailed anatomical data on various fur animals has been recorded. A genetic basis for control of color phases in foxes has been established and the breeding and gestation period of martens have been definitely established.

Economic importance: The Fur-Animal Experiment Station is the only one of its kind on the North American continent where various species of fur animals are studied to determine the best methods of breeding, feeding, and managing for the economic production of fur.

Estimated annual saving: There are no statistics available to show the losses occurring from faulty investments, improper feeding, breeding, and handling of fur animals and the lack of applying proper methods of sanitation. Experience indicates that the losses in these respects have been tremendous. Pioneering in a field of research naturally revolutionizes practices and the effect is progressive and accumulative.

Similar work at State Experiment Stations: No similar work is conducted at State Experiment Stations.

BUREAU OF BIOLOGICAL SURVEY

19

Title of project: Rabbit Experiment Station (California)

Date begun: 1927

Date completed: This project is a continuing one and like other research problems of its nature the work is being constantly developed.

Authority: Agricultural Appropriation Act under item in the appropriation for the Bureau of Biological Survey "For investigations, experiments, demonstrations, and cooperation in connection with the production and utilization of fur-bearing animals raised for meat and fur, in the United States and Alaska."

Cost of work: Cooperative project. Biological Survey allotment for fiscal year 1933 \$11,700; allotment for fiscal year 1934 \$11,660. (Cooperators' investment, \$34,000.00)

Results: Practical information has been obtained as to the amount of feed necessary and the rate of growth to raise rabbits to a marketable age. Oats and barley have equal feeding value. Best results are obtained when 80% of the ration is composed of alfalfa hay. Feed given in the form of pellets has no advantage over a moist, crumbly mash. Cod-liver oil and yeast added to an otherwise satisfactory ration has little value. A nutritive ratio of about 1:3.8 is not satisfactory for does suckling young. The most practical and efficient protein supplements for rabbits have been determined. Market grades and classes of dressed rabbit carcasses have been established. Experiments demonstrate that cross-breeding develops meat and fur qualities in rabbits. By actual count, the relative proportion of guard hairs to underfur has been determined and measurements of the guard hairs and underfur length and texture have been made. The quality of fur from rabbits of different ages has been studied. Nineteen feeding and breeding experiments have been planned and put into operation since March, 1928, and thus far 15 have been completed.

Economic importance: The production of rabbits for food and fur has an estimated economic value of \$50,000,000. It is an agricultural business that has assumed large proportions in every state in the Union. During the past ten years it has developed ten-fold. Domestic rabbit meat has become a staple article of food in many markets of our large cities. Rabbit fur is used more extensively than any other kind by the fur trade.

Estimated annual saving: There was no authentic information on rabbit production available to the breeders from any source prior to the establishment of the United States Rabbit Experiment Station. In the six years since this project was commenced much valuable data on the raising of rabbits for food and fur and the management of rabbitries has been made available to the public. Through these findings and the dissemination of accurate information on the rabbit industry many have been prevented from becoming the victims of unscrupulous promoters, and thus saved from losses which otherwise would have amounted to thousands of dollars.

TYPE OF SUBJECT: Rabbit by animal husbandry

DATE: 1937

CLASSIFICATION: This report is a continuation of the work reported in the preceding report.

ABSTRACT: The purpose of this investigation was to determine the effect of the various factors on the growth and development of the rabbit. The results of the investigation are as follows:

1. The growth of the rabbit is affected by the various factors mentioned above.

2. The development of the rabbit is affected by the various factors mentioned above.

3. The reproduction of the rabbit is affected by the various factors mentioned above.

4. The health of the rabbit is affected by the various factors mentioned above.

Similar work at State Experiment Stations: No similar experimental work is being conducted by any state experiment station.

The Poultry Husbandry Department of the University of Michigan has conducted some feeding experiments with rabbits. They are not very extensive in scope and include from 4 to 8 rabbits.

The Extension Service in the State of California publishes a bulletin on rabbit raising and revises this publication annually. The information it contains is not based on any research work but on information that can be obtained from the U. S. Rabbit Experiment Station and persons raising rabbits. It should be remembered that Secretary Jardine obtained the approval of the University of California before the Rabbit Experiment Station was established in Fontana.

Submitted April, 1933.

Similar work as State Department Station: No further experiments were conducted in the
Department Station.

The Public Health Department of the University of London has conducted some research work with rabbits. They are not very extensive in scope and include from 1 to 5 rabbits.

The extension service in the State of California publishes a bulletin on rabbit raising and breeding. This publication annually. The information is not based on any research work but on the
information that can be obtained from the U. S. Rabbit Raising and Breeding Manual.
It should be remembered that Secretary Harding advised the control of the University of California
before the Rabbit Raising Station was established in 1920.

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BUREAU OF BIOLOGICAL SURVEY

Title of project: Maladies of Wild Birds and Animals.

Date begun: Established as a separate project in 1931. Prior to this date disease investigations were conducted in connection with various wild bird and animal projects. At this time for efficiency and economy all disease investigations in the Bureau were consolidated under one project.

Date completed: Continuing. While several specific diseases of fur animals, upland game birds and migratory waterfowl have been diagnosed and successful means for treating them developed or methods discovered for protecting them from loss, a number of obscure ailments continue to take a large toll of the valuable species raised in captivity as well as those maintained in the wild.

Cost of work: Allotment for the fiscal year 1933 \$21,425; allotment for the fiscal year 1934 \$20,370.

Authority: Items in Agricultural Appropriation Act. "Production of fur-bearing animals: For investigations, experiments, demonstrations, and cooperation in connection with the production of fur-bearing animals *****in the United States and Alaska *****." ---- "*****investigations of the relations of wild animal life to forests." ---- "For investigation, experiments, and demonstrations in the establishment, improvement, and increase of the reindeer industry and muskoxen in Alaska *****." ---- "Protection of migratory birds; for all necessary expenses for enforcing the Migratory Bird Treaty Act of July 3, 1918 ***** and for necessary investigations connected therewith." ---- "Migratory-Bird Conservation Act. ****An act to more effectively meet the obligations of the United States under the migratory-bird treaty act with Great Britain by lessening the dangers threatening migratory birds ****. ---- "Control of predatory animals and injurious rodents; for demonstrations **** and protection of stock ***** through the suppression of rabies and other diseases of predatory wild animals *****."

Results: A number of epizootics have been stamped out on fur farms and game farms as a result of research in this project. Abnormal conditions usually attacking wild life are of such severity that a large portion of the exposed populations are wiped out and as a consequence of investigations conducted under the project "Maladies of Wild Birds and Animals" many of these activities have been saved from bankruptcy.

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Economic importance: Since disease is the limiting factor to the successful operation of fur farms and game farms information furnished many of those enterprises has been the means of reducing the losses and enabling the operators to continue on a profitable basis. Individuals and organizations connected with the \$65,000,000 fur production industry in this country as well as the upland game bird producers demonstrate their appreciation of the actual help being furnished in the control of disease in that they annually contribute more than twice the amount appropriated by the Government. Those officials in charge of wild-life preserves frequently have recourse to call on this project for aid in control of losses of birds and animals on protected reservations. The periodic or cyclic disappearance of game over wide areas is a highly important feature in wild-life administration. Since these conditions are of interstate extent the various State officials look to this project for authoritative information and advice in controlling wild-life losses.

Estimated annual savings: This project has been established so recently that savings as a result of investigations cannot be stated in dollars and cents. It is conceded by the officials of fur farming organizations and State conservation officials that this work is of incalculable value to raisers of fur animals and game birds and in the conservation of wild life and the preservation of valuable species from complete extinction.

Similar work at State Experiment Stations:

In Minnesota (Adams Act) Dr. W. A. Riley, Deot. of Entomology and Economic Zoology, is engaged with a project entitled "The Animal Parasites of Fur-bearing Animals with Special Reference to Those of Mink and Foxes". The Bureau of Biological Survey in conducting studies on the losses of fur animals has a cooperative working agreement with the University of Minnesota and the leader in this project located at that place utilizes the findings of Dr. Riley in a collaborating manner with no duplication of effort whatever.

In Wyoming (Purnell Act) Dr. J. W. Scott and R. F. Honess are engaged with a project entitled "The Investigation of the Lungworms of Mammals, Wild and Domestic, in Wyoming - I, The Lungworms of Rabbits, Sheep and Other Ungulates in Wyoming". The Bureau of Biological Survey in conducting studies on the losses of game concerns itself essentially with the forms of destructive agents responsible for deaths in widespread or epizootic form. Local conditions of parasitism in game species as occur in Wyoming are reported to the Bureau by published records and direct correspondence and are used as an adjunct to the Bureau's activities in the control of loss in wild life. There is no overlapping or duplication of effort.

Since disease is the leading cause of death in the United States, it is important to have accurate information on the status of the disease. The National Center for Health Statistics is the principal source of information on the status of the disease. The Center collects and analyzes data on the status of the disease from a variety of sources, including hospital discharge data, death certificates, and surveillance systems. The Center also conducts research on the causes and consequences of the disease, and provides information to the public on the status of the disease.

[illegible]

In Arizona (Purnell Act) Dr. A. A. Nichol in a project entitled "A Study of the Life Histories of Certain Game Animals" is engaged in a study of the parasites and diseases of these animals; and at the same institution Dr. C. T. Vorhies in a project entitled "A Study of the Life History and Ecology of the Wild Turkey" is engaged in a study of the parasites and diseases of these birds. The Bureau of Biological Survey through its employee Dr. W. P. Taylor located at the University of Arizona is cooperating with these workers in the execution of these investigations and no overlapping of endeavor occurs. The work being done by Dr. Taylor, Dr. Nichol, and Dr. Vorhies is all part of a coordinated program.

Submitted April, 1933.

BUREAU OF BIOLOGICAL SURVEY

Title of project: Investigations of wild animal life (distribution, migration, and habits of birds and animals).

Date begun: 1885.

Date completed: The project is a continuing one since needed work is far from completion, and ranges and habits of many species are changing under conditions of agricultural occupation and use of the land. Some species have multiplied greatly, some have extended their ranges hundreds of miles within the past 40 years, and others have been reduced or even exterminated. Changes in abundance and range result in changed relations to agriculture and forestry. Some lines of work, such as biological surveys and life zone maps for certain States, have been completed and the results published. The field and laboratory investigations supply information that is constantly required by institutions and individuals throughout the country, by the administrative office, and other divisions of the Biological Survey, and the Department of Agriculture, and by other State and Federal Departments.

Authority: Agricultural appropriation acts "for biological investigations, including the relations, habits, geographic distribution, and migration of animals and plants, and the preparation of maps of the life zones."

Cost of the work: Allotment for the fiscal year 1933, \$46,190; allotment for the fiscal year 1934, \$44,800.

Results: Extensive files of data have been accumulated, forming the basis for over 300 published reports and papers, including many monographs that are the result of extensive studies of groups of birds and mammals of North America, and faunal studies of States or other large areas. This information enables the Biological Survey to plan intelligently undertakings for which it is responsible and to cooperate by furnishing information on the above subjects to game commissions, conservation boards, agricultural and livestock associations, universities, agricultural colleges, experiment stations, museums, and other educational institutions.

Biological surveys and life zone maps of several States, including Alabama, Arizona, Arkansas, Colorado, Florida, New Mexico, North Dakota, Oregon, Texas, Washington, and Wyoming, and parts of the Territory of Alaska, have been completed, and the results published in whole or in part, in the North American Fauna series and other Department publications, or in cooperation with other Federal or State agencies.

Studies of game conditions on Federal Reservations and National Forests and investigations of the wild life on National Parks have been made throughout the United States and Alaska. These include such important studies as those of deer on the Kaibab National Forest, Arizona, and in Pennsylvania, the elk of the Jackson Hole region including the herds of the Teton National Forest and the Grand Teton and Yellowstone National Parks, the more important wild life of the Yellowstone and Glacier National Parks, the Carlsbad Cavern, and the Grand Canyon National Park. Subjects of broader scope geographically include the antelope, mountain sheep, and moose, and the relationships of various predatory animals and rodents to the industries of agriculture and stock raising.

In connection with these explorations large collections have been obtained and these, with associated records, are of incalculable scientific value and afford the basis for determining the occurrence and distribution of forms which have highly important relationships to agriculture and forestry.

Economic importance: The information obtained has been of great help in the formulation of international treaties and other agreements looking to the protection of valuable species, in the conduct of many educational enterprises involving sound agricultural development and land utilization, and in the determination of administrative policies governing wild life management.

Estimated annual saving: The results are so largely fundamental and educational in character as a basis for wild life management and utilization that it is impossible to evaluate the work in dollars. However, the information obtained regarding the occurrence, habits, and distribution of species and the expert service of the personnel in identification affords an essential basis for guidance in wild life management plans of the Department and cooperating agencies.

State experiment stations: A limited amount of such work, more or less local in character, is done by the agricultural experiment stations, but the Biological Survey is generally looked upon as the primary source and clearing house for information in this field.

Submitted April, 1933.

BUREAU OF BIOLOGICAL SURVEY

Title of project: Investigations of migratory birds.

Date begun: 1916.

Date completed: The project is a continuing one since the status and habitat conditions of migratory birds, especially game birds, are continually changing, and critical conditions affecting their abundance often necessitate prompt assembling of reliable and comprehensive information as a basis for effective action by the Department. Separate investigations are completed every year by a survey of waterfowl conditions in their breeding, migrating, and wintering ranges to secure information required as a basis for issuance by the Department, on approval of the President, of regulations to govern open and closed seasons, bag limits, and other protective measures for waterfowl, as required by the Migratory Bird Treaty Act of July 3, 1918, enacted to give force to the treaty with Great Britain for the protection of birds migrating between the United States and Canada.

Authority: Annual appropriation acts of the Department of Agriculture, wording in this year's act, "for all necessary expenses for enforcing the provisions of the Migratory Bird Treaty Act of July 3, 1918. (U. S. C., Title 16, Secs. 703-711), for cooperation with local authorities in the protection of migratory birds, and for necessary investigations connected therewith."

Cost of the work: Allotment for the fiscal year 1933, \$32,800; allotment for the fiscal year 1934, \$32,400.

Results: Extended surveys have been made of migratory birds, chiefly in the United States and Canada, and also to a limited extent in Mexico. A vast amount of information has been assembled, and reports, charts, and maps, have been prepared for use in connection with the annual meetings of the Advisory Board, Migratory Bird Treaty Act; for the guidance of administrative officials of the Bureau and of the Department, in working out regulations; and in the educational work of the Bureau with reference to conservation needs. Many bulletins and articles have been published to make available for public use essential information regarding the abundance of waterfowl, conditions on their breeding and wintering ranges, and showing their migration routes; also the effect of drainage, pollution, drought, poisons, diseases, food shortages, and hunting practices. Knowledge of the flight routes followed by migratory waterfowl is useful also in selecting areas that are favorably situated for lease or purchase, or establishment on Executive Order, as refuges, and in withdrawing marginal or other land or water areas from agricultural use for waterfowl sanctuaries. Recommendations have been made as to modification of the protected status of birds in view of their relation to agricultural and other interests. When field investigation has shown damage to be serious recommendations have been made for orders of the Secretary permitting reduction of the numbers of the species concerned under suitable restrictions. Such changes so far have affected chiefly robins in fruit-growing regions and fish-eating birds in numerous localities.

THE UNITED STATES

UNITED STATES OF AMERICA

UNITED STATES

The United States is a country in the Western Hemisphere, and is one of the most powerful nations in the world. It is a country of many different peoples, and of many different languages. It is a country of many different religions, and of many different customs. It is a country of many different climates, and of many different seasons. It is a country of many different mountains, and of many different rivers. It is a country of many different cities, and of many different towns. It is a country of many different people, and of many different lives.

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Economic importance: The migratory birds constitute a most important economic and recreational asset. Reliable and comprehensive information regarding their abundance and migratory movements is essential as a basis for proper guidance in conservation measures and in effecting cooperation with conservation departments of the States in formulating and putting into effect protective regulations and laws needed to conserve and properly utilize one of our valuable natural resources and to fulfill our obligations under the provisions of the Treaty with Great Britain for the protection of birds migrating between the United States and Canada. The work serves to conserve and protect a natural resource that has important relations to agriculture and forestry and one that supports large investments in recreational facilities, and in the manufacture of supplies and equipment, and that provides large financial returns to land and marsh owners, guides, and others, for services rendered sportsmen engaged in hunting. State revenues derived from the sale of hunting licenses total between six and seven million dollars annually. In the Report to the United States Senate, of the Special Committee on Conservation of Wild Life Resources (Report 1329), dated January 21, 1931, attention was directed to figures showing that the value of sporting firearms sold to the public during the year 1929 amounted to \$21,970,367, and the value of ammunition was \$43,779,020, and that, including cost of equipment, transportation, wear and tear on automobiles going to and from shooting grounds, the total expenditure of the citizens of the United States in their quest for outdoor recreation in shooting and fishing alone during 1929 would doubtless amount to fully three-quarters of a billion dollars. A large part of this expenditure would be for waterfowl shooting.

Estimated annual saving: It is very difficult to evaluate the saving, as the work is concerned primarily with conservation and use of an important natural resource. However, on the basis of normal values there is an estimated saving of \$50,000 annually on crop losses; the protection of city water supplies, and the safeguarding of aviation fields, through permits to control Federally protected birds, are vital services but difficult to estimate in money values. The interest in this project of sportsmen, conservationists, and students of birds, is such that the Bureau receives cooperative services the value of which is estimated conservatively at \$150,000 annually.

State Experiment Stations: There is no duplication but some assistance is rendered by members of agricultural college and experiment station staffs through furnishing information and operating local trapping stations to mark birds for record in tracing migration routes.

BUREAU OF BIOLOGICAL SURVEY

Title of project: Research in forest wild life.

Date begun: July 1, 1929.

Date completed: The project is a continuing one since the act approved May 23, 1928 contemplates graduated increases in appropriations for this work over a period of 10 years and continuance thereafter as may be necessary of studies to determine the beneficial and harmful relationships of mammals, birds, and other vertebrate animals, to forest production.

Authority: Agricultural appropriation acts, "for investigations of the relations of wild animal life to forests, under Section 5, of the Act, approved May 23, 1928. (U. S. C., Supp. V, Title 16, Sec. 581d).

Cost of the work: Allotment for the fiscal year 1933, \$18,900; allotment for the fiscal year 1934, \$16,000.

Results: Trained naturalists are now assigned to this work in four forest experiment station districts. Important collections of birds, mammals, and other scientific specimens have been secured as a basis for exact knowledge of species present, and as a result of detailed studies under natural field conditions and on experimental plots where control and check conditions are maintained a great many pertinent facts have been recorded regarding the life history, habits, abundance, and relations of the animal population to natural growth, to planted seeds and seedlings, and to forage production on forest grazing lands. Data have been obtained regarding the effects of burning practices and forest fires on various kinds of birds and mammals, and the effect of soil working by burrowing animals on soil fertility, erosion, and crop production. Many public addresses have been given relative to the work, some of which, along with other papers, have been published. Counsel has been given relative to forest and wild life management practices. As an example of what may be done to develop the potential value of a fur animal a colony of beavers have been planted on the Pisgah National Forest to demonstrate methods of increasing fur production and the value of their activities in storage of water, the checking of run-off, and erosion, and improvement of conditions for fish production.

Economic importance: The wild life of a forested area is of vast importance as a productive asset. The influence of birds, mammals, and other vertebrates, is very great, either for good or ill, as regards the control of insects, rodents, and other injurious species, actual injury to growing plants, and the consumption, distribution, and planting of the seeds of forest trees and shrubs. Investigations have already shown that the local wild life population is a definitely limiting factor in the planting of seeds and seedlings and in other silvicultural practices.

REPORT OF THE COMMISSIONER OF THE GENERAL LAND OFFICE

IN RESPONSE TO A RESOLUTION OF THE HOUSE OF REPRESENTATIVES

PASSED MAY 1, 1890

THE COMMISSIONER OF THE GENERAL LAND OFFICE has the honor to acknowledge the receipt of a resolution of the House of Representatives, passed May 1, 1890, relative to the report of the Commissioner of the General Land Office, and in response to the same, to submit herewith a report of the progress of the work of the office during the year ending June 30, 1891.

The report of the Commissioner of the General Land Office for the year ending June 30, 1891, is herewith submitted, and it is respectfully requested that the same may be printed and distributed to the members of the House of Representatives.

Very respectfully,
J. M. WILSON, Commissioner.

The report of the Commissioner of the General Land Office for the year ending June 30, 1891, is herewith submitted, and it is respectfully requested that the same may be printed and distributed to the members of the House of Representatives.

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Estimated annual saving: The rapidly increasing interest and activity in the natural production of valuable species of game and fur-bearing animals on forested lands has been stimulated, guided, and developed, through the dissemination and application of results accomplished under this project. Improved planting methods prevent destruction of planted seeds of forest trees and provides a basis for natural or artificial prevention of damage to growing trees and for maximum production of game and fur-bearers by use of otherwise waste food products.

State: In Arizona and Minnesota the work is conducted in cooperation with a limited amount of related work by experiment station workers, the undertakings being coordinated to avoid duplication and to effect a well balanced program of investigation of wild life problems.

Submitted April, 1933.

BUREAU OF BIOLOGICAL SURVEY

21

Title of project: Muskox investigations.

Date begun: July 1, 1930.

Date completed: Investigations are conducted at the Bureau's Experiment Station at College, Alaska, to carry the young animals brought from Greenland to breeding age, to afford them required protection until established, and to determine practical means of management in their development as an important game or domesticated resource, and to what extent it is practicable to employ them as a means of utilizing forage resources. Eventually these animals will be taken to the northern part of Alaska to establish themselves.

Authority: Agricultural appropriation acts for the fiscal year 1931, and succeeding years.

Cost of the work: 340,000 was appropriated for use during the fiscal year 1931, in securing and establishing these animals in Alaska. The allotment for the fiscal year 1933 for their maintenance, care, and study \$11,520; the allotment for the fiscal year 1934 is \$7,820.

Results: Thirty-four muskoxen were secured in Greenland during the summer of 1930, and were successfully transported and established at the Experiment Station at College, Alaska. Five of these animals have been lost by accident, disease, and predatory animals since that time. The remaining twenty-nine animals are in excellent condition and have made a most satisfactory growth. They are proving to be more readily handled and managed than reindeer. For the most part the animals are handled in large pastures under fence for protection, but are corralled as required for closer examination and other purposes. Feeding experiments have been conducted in cooperation with the Bureau of Animal Industry to determine the extent to which these animals can utilize the native forage and food products raised on Alaska farms. One article in the Department yearbook and a few other papers have been published and much new information is being obtained regarding the behavior and habits of these animals.

Economic importance: Muskoxen were exterminated shortly before European occupation of the Territory, and the present effort is to restore them as one of its attractions and productive resources.

Estimated annual saving: Establishment of muskoxen in Alaska is a productive undertaking designed to establish another important meat producing animal adapted to production in this rigorous climate and to utilize profitably the native forage.

Similar work at State Experiment Stations: No similar work is conducted at State Experiment Stations.

Submitted April, 1935

BUREAU OF BIOLOGICAL SURVEY

Title of project: Reindeer investigations.

Date begun: 1920.

Date completed: The investigations are still in progress as much remains to be done through breeding, feeding, and management experiments, and the investigation of forage resources as a basis for the allotment of grazing lands to herd owners, and management practices essential to success with these animals and maintenance of a sustained yield of forage.

Authority: Agricultural appropriation act for 1921, and subsequent years, "for investigations, experiments and demonstrations in the establishment, improvement, and increase, of the reindeer in Alaska."

Cost of the work: The allotment for the fiscal year 1933, \$19,170; allotment for fiscal year 1934 \$16,370.

Results: Necessary buildings have been constructed and equipped, and 8,559 acres of land have been provided and fenced for the Experiment Station, with 25 miles of fence erected for corral and pasturage purposes. A deer well has been drilled and equipped, and other improvements made.

Investigations have been conducted at many points throughout the coastal and interior regions of Alaska, and at the Reindeer Experiment Station at College, Alaska, in cooperation with the Alaska College of Agriculture & School of Mines. These show the character and suitability of the various areas for reindeer production, their carrying capacity, and the grazing conditions under which sustained yield can be maintained. Extended experiments have been conducted in working out practical feeding, handling, and management practices. Experiments in cross-breeding reindeer with caribou have been conducted successfully with a herd established on Nunivak Island and on a more limited scale at the Experiment Station. Crossbred animals have been developed which reproduce readily and average about fifty pounds greater in weight, and which have better conformation for meat production purposes than either of the parent forms.

A close and important advisory relationship has been maintained with the Department of the Interior, including officials of the Territory of Alaska, and reindeer owners.

The following publications have been issued by the Department: Department Bulletin No. 1086, Reindeer in Alaska; Department Bulletin No. 1423, Progress of Reindeer Grazing Investigations in Alaska; Department Circular No. 82, Improved Reindeer Handling. Two manuscripts entitled "Reindeer in Alaska" and "Progress of Reindeer-Caribou Cross-Breeding Experiments on Nunivak Island, Alaska", have been submitted for publication, and several other numbers of more popular character have been published in outside periodicals.

Economic importance: The rapidly increasing herds of reindeer present new and pressing problems that affect the animals themselves, the conservation of the grazing ranges, and the economic and social welfare of the native and white population of Alaska. Investigations of the biological aspects

Economic importance (cont'd.)

aiding both native and white owners to cope with the diseases and parasites of reindeer, to adopt improved methods of herding and range management in utilization of the vast forage resources of the Territory, and to improve the quality of the animals for meat production purposes by proper care and selective breeding.

Estimated annual saving: This is a constructive project designed to improve and increase reindeer production and to utilize profitably the enormous annual forage growth of Alaska. The importance of the industry as a basis for the economic and social development of the Territory fully warrants its continuance. Moreover, deaths and suffering in the herds are being lessened as barbarous methods of branding and castration at roundup times are being supplanted by modern practices and the inauguration of sanitary methods results in better quality meat products. Improved practices in herding and utilization of the grazing areas conserves the slow-growing lichen and other forage.

Similar work at State Experiment Stations: No similar work is conducted at State Experiment Stations.

1. The purpose of this document is to provide information regarding the activities of the [redacted] and the [redacted] in the [redacted] area. This information is being provided for your information and is not to be distributed outside of your agency.

2. The [redacted] has been identified as a [redacted] and is currently active in the [redacted] area. The [redacted] has been identified as a [redacted] and is currently active in the [redacted] area. The [redacted] has been identified as a [redacted] and is currently active in the [redacted] area.

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Title of project: Commercial Fur Production.

Date begun: 1931.

Date completed: This project although not completed will be discontinued after 1933 as funds for its maintenance were cut out of the 1934 appropriation act.

Authority: Agricultural Appropriation Act under item in the appropriation for the Bureau of Biological Survey "For investigations, experiments, demonstrations, and cooperation in connection with the production and utilization of fur-bearing animals raised for meat and fur, in the United States and Alaska."

Cost of work: Cooperative project. Biological Survey, \$1,500 annually; University of Maryland, \$1,000 annually; and Conservation Department of Maryland, \$1,200 annually.

Results: On January 1, 1933, the Bureau entered into a cooperative agreement with the National Association of the Fur Industry for the purpose of establishing an organized system for collecting and filing information on the distribution and conservation of fur animals of North America; laws for their protection; and on annual market offerings of pelts. The results of this preliminary study were published in the 1935 yearbook of the association. On October 6, 1930, the Bureau entered into a cooperative agreement with the University of Maryland and the Maryland Conservation Department for the purpose of conducting experiments with muskrats under natural and controlled conditions in the State of Maryland. During the past two years valuable information has been obtained on raising muskrats in pens. Studies were also made of the food preferences of muskrats in captivity and data has been obtained regarding their breeding habits. Considerable data has been added to our files on the numbers and kinds of fur animals taken annually in the various States and the Territory of Alaska. It requires constant attention to keep these files up-to-date, but the State Game Commissions are beginning to realize the value of these statistics and many more of them are keeping data on the annual catch of fur animals than formerly.

Economic importance: How fast the fur animals are being depleted is not known. The numbers and origin of fur animals trapped annually in the United States is not available. Financially alone this lack of definite information has been highly detrimental to those engaged in the fur industry. For unwarranted and unnecessary expansion and contraction of bank credits result when basic statistics are lacking. With the importance of the fur industry not generally appreciated because of the lack of a statistical background, uncertainty and inadequacy of support prevail. The need for a comprehensive study of our fur resources and for assembling, filing, charting, and interpreting statistical information of value to conservationists and to fur tradesmen is felt universally.

Estimated annual saving: Beavers are no longer available in commercial quantities and all states where they now occur prohibit their being trapped. Martens and fishers are now extinct in much of their former range. A keener appreciation of conditions would be possible if the work under this project

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Estimated annual saving (cont'd.)

could be expanded instead of discontinued; it would have the result that a greatly increased quantity of pelts with fur of superior quality would reach the markets, thus increasing the financial returns to the trappers and at the same time allowing increased numbers of breeders to remain in the country.

Similar work at State Experiment Stations: No similar work is being conducted at State Experiment Stations.



