

COMPUTER APPLICATION TO DRAWINGS FOR SPECIAL PERMITS

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ABSTRACT

Contemporary conservationists are frequently faced with the problem of issuing special permits when there are more applicants than there are permits available. The objectives of this project were to develop a computer technique for handling the selection of eligible applicants and to test its use and effectiveness in a fully automated computer system for handling drawings for special permits. Computer programs were designed to conduct the actual selection and to analyze results. A random interval sampling technique was used for selecting eligible applicants. The system was put through an actual test involving over 16,000 deer permit applicants competing for their choice of one of 35 hunt dates on 11 different wildlife management areas. Tests indicated that the fully automated system yielded comparable results with manual systems at reduced costs and time, and provided the applicant with a greater variety of choices of hunt dates and areas. Methods, associated problems, advantages, and disadvantages are discussed.

INTRODUCTION

Limiting public participation in various recreational activities where a limited resource is available is becoming commonplace in various kinds of conservation programs. Managers are frequently faced with the problem of issuing special permits in situations where there are more applicants than there are permits. The "first-come, first-serve" basis is unsatisfactory, and drawings are usually held to determine who receives permits. The public drawing for deer hunting permits on intensively managed wildlife management areas in Tennessee is an example.

These public drawings are usually conducted in the following manner: The hunter secures an application for the management area on which he desires to hunt and completes it, indicating his preference for one of the several hunt dates available on that area. He mails the completed application and required fee to the central office, where applications are sorted by the area on which the hunts are to be held. The applications are then taken to the headquarters or checking station of that area, and the public drawing is held on a specified date. All applications are returned to the central office, where permits and lists are prepared. Successful applicants are mailed their permits with the assigned hunt date, and unsuccessful applicants are notified they were not drawn, and their fee is returned.

Although successful in accomplishing its objectives, the manual drawing consumes a considerable amount of time and manpower. It was felt that by applying electronic computer techniques the job could be accomplished more efficiently.

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PROCEDURE

The computer used was an IBM 360, Model 20 8K, card system, with a MFCM. The programs were written in RPG language.

One program randomly selected the hunter (or party); then he was assigned his first available choice. If his first choice was full, his second choice was checked and assigned if it was not full. If it was full, his third choice was checked, and so on until all of his choices were checked. The assigned hunt code and the number of that choice were punched into his card by the computer. The next program takes the cards with the hunt assignment and prints a permit and checking station list of permit holders. The permit is designed to be used with window envelopes for mailing.

There were two other programs used to test and evaluate the results of the drawing. One summarized the hunters' choices before the drawing, and the other summarized the hunt assignments and what number choice it was.

The requirements for the selection program were: (1) all hunters (or parties) have an equal chance of being selected; (2) all hunters have a choice if all the quotas are not filled; (3) the drawing to be completed in a reasonable period of time. Standard sampling procedures would not meet these requirements.

A random interval sampling technique was devised so that the computer could select cards at random, which in turn gave us a random selection of hunters. The random sampling technique is where the computer generates a random number and the cards (hunters) are counted and rejected until the count is equal to the random number and this card is selected. The computer generates a new random number and the cards are counted and rejected until the count is equal to this new random number, and this process is repeated over and over.

The cards that were rejected are placed at the back of the card file that is being fed the computer and repeated as many times as necessary to complete the drawing.

By setting a limit on the maximum size of the random number which is acceptable, the percent of cards selected is controlled. When this limit is reduced by one-half, the percent of selection is doubled. In the program as written, the percent can be varied from 2 to 100.

RESULTS

This system was used to handle the selection of eligible applicants for deer hunting permits during the 1968 hunting season on Tennessee wildlife management areas. Applicants for deer permits competed for their choice of one of 35 different hunt dates on 11 different areas, and could indicate as many as 35 preferences. There was a total of 16,746 applications for 18,500 permits. Although there were 18,500 vacancies, only 6,900 of these were opening day hunts. These were the most highly desirable hunts, and the closing day vacancies were the least desirable hunts. Even though there were more total vacancies than total applicants, there were four times as many applicants for some of the more desirable hunts as there were vacancies. The deadline for submitting applications was August 20, 1968, and during the period August 20 through September 30, key punch operators prepared punch cards for each applicant. After all the punch cards had been prepared, the cards were run through the computer to summarize what the hunters' choices were.

A total number of 86,647 choices was indicated by the applicants. This amounted to an average of 5.1 choices per hunter. Distribution of these choices is shown in Table I. Eleven percent of the hunters indicated only one choice, and 89 percent of the hunters indicated two or more choices. Seventy-two percent wanted three or more choices. Forty-seven percent indicated four or more choices; 40 percent, five choices. Twenty percent wanted eight or more choices; 12 percent indicated more than ten choices. Only nine applicants out of the 16,746 listed all 35 choices. A quick review of Table I shows hunters' strong preferences for opening day hunts. The main item to emphasize is that it would have been

possible to fill many of the hunts with fourth or fifth choices rather than with first or second choices. This is one of the main pitfalls we wanted to avoid.

The actual selection of eligible applicants required 3½ hours. Approximately 89 percent, or 14,805, of the applicants were successful in obtaining permits. The random group control number was set to select approximately 10 percent of the hunters. A special effort was made not to fill any hunt until all of the cards had been passed through the machine at least once. At this 10 percent rate, two and one-third passes of the card file were made before any hunt was filled. Later on in the drawing, the rate of selection was increased. The drawing was continued until every applicant had been selected and either issued a permit or rejected because there were no vacancies for which he had indicated a choice. After the selection had been completed, permits to successful applicants, notices to unsuccessful applicants, and checking station lists of each hunt required an additional 8½ hours of machine time. The fully automated drawing took a total of 12 hours.

After the drawing was completed, the machine was programmed to determine the choices on which hunts were assigned. The results from this program (Table II) indicated that 49 percent of all the permits issued were first choices, that 75 percent were either first or second choices, and less than 10 percent were fourth or higher choices. One of the requirements of this program was to be certain that the hunts assigned were representative of what the hunters wanted. The data clearly indicated that the hunters were randomly selected, and when selected, they received their highest possible choice. Excellent examples of this would be hunts C-10 and D-10 (Tables I and II). There were particularly large numbers of people who indicated they would accept these hunts as third, fourth, and fifth choices; yet nearly all of the permits were issued as a first choice. Even though all the hunts were grouped together in the drawing, the hunt assignments would not have been different had separate drawings been held on each of the areas in that the hunts were not filled with hunters whose first choices were other areas. Thus, from this, it was judged that the system of selection used in the automated drawing brought comparable results with a manual system.

ADVANTAGES

There was a two-fold advantage in having all the hunts grouped together in one centralized drawing. First, it gave the hunter a much broader range of choices in his hunt dates: and second, it filled vacancies that would not have been filled otherwise by assigning the applicant a second choice area in the event his first choice area was filled.

The time element was obviously an advantage. The entire selection of applicants, the printing of permits to successful applicants, the printing of notification to unsuccessful applicants, the printing of lists of both, and various bookkeeping tasks were all completed in 12 hours. It also decreased the time interval in notifying the hunter concerning his application.

Another advantage that was hard to measure was that hunters seemed to be more satisfied with the decision of an impersonal machine.

One of the major advantages of the automated drawing was that it provided the administrator with a tool, a programmed computer, to use in handling drawings for special permits.

DISADVANTAGES

The manual drawing had come to be somewhat of a tradition in that sportsmen looked forward to a day of seeing old friends and acquaintances and exchanging tall tales. The obvious disadvantage is that it took this day of activity out of the life of the sportsmen who enjoyed attending the drawings on the areas.

TABLE 1. Hunters Preferences Listed By Choices For Each Hunt

Hunt Identification	Number of Times Hunt was Indicated as a Choice								
	Quota	First	Second	Third	Fourth	Fifth	Sixth	Seventh* Choices	
A-12	500	753	235	152	84	42	24	129	1,419
A-14	500	213	613	98	117	36	24	88	1,189
B-10	600	646	839	716	594	209	119	539	3,662
B-11	600	51	276	85	151	386	291	912	2,152
B-16	300	5	9	82	51	93	108	1,295	1,643
C-10	1,000	1,970	782	709	661	240	116	555	5,033
C-13	1,000	12	519	373	280	331	220	1,430	3,165
C-16	500	11	28	333	96	151	181	1,407	2,207
D-10	600	1,147	805	766	629	290	179	548	4,364
D-13	600	14	495	218	262	313	216	1,415	2,933
D-16	300	4	21	304	79	45	200	1,329	1,982
E-10	1,000	1,058	526	376	844	225	157	693	3,879
E-11	1,000	57	501	111	109	368	321	1,005	2,467
E-16	500	0	21	289	124	68	196	1,356	2,054
F-1	400	2,211	208	344	348	216	94	541	3,962
F-2	400	19	2,013	146	315	344	213	619	3,669
F-3	400	26	37	1,902	110	279	317	808	3,479
F-4	400	17	15	37	1,823	116	272	1,066	3,346
F-5	400	11	30	16	28	1,793	128	1,265	3,271
F-6	400	85	43	47	34	30	1,788	1,354	3,381
F-7	400	451	80	20	46	20	7	534	1,158
F-8	400	67	450	33	14	51	14	522	1,151
G-11	500	1,411	201	108	29	83	49	40	1,921
G-13	500	92	1,042	98	40	25	27	80	1,404
H-15	400	776	147	180	140	23	35	168	1,469
J-9	100	441	16	17	58	12	18	63	625
J-10	100	188	364	14	27	25	7	61	686
J-11	100	22	53	320	16	62	22	57	552
J-13	100	18	186	42	295	22	21	45	629
J-15	100	3	11	53	20	278	54	49	468
J-17	100	15	13	167	22	20	275	65	577
J-18	100	2	6	10	42	19	24	358	461
K-10	1,400	4,790	242	308	56	192	74	554	6,216
K-13	1,400	109	3,974	189	180	56	141	719	5,368
K-17	1,400	51	98	3,412	112	127	72	733	4,605
TOTAL	18,500	16,746	14,899	12,075	7,836	6,585	6,004	22,402	86,547

TABLE 2. Choices on Which Hunt Assignments Were Made

Hunt Identification	Number of Hunt Assignments as Choices								No. of Permits Issued
	Quota	First	Second	Third	Fourth	Fifth	Sixth	Seventh	
A-12	500	451	45	21	2	...	...	...	500
A-14	500	213	232	30	26	4	...	...	505
B-10	600	404	125	52	17	4	...	...	604
B-11	600	51	89	11	18	92	16	21	298
B-16	300	5	1	5	4	...	...	...	15
C-10	1,000	981	19	2	...	...	...	...	1,002
C-13	1,000	12	292	118	59	17	3	20	521
C-16	500	11	4	13	1	...	...	...	29
D-10	600	585	9	...	6	...	...	...	600
D-13	600	14	287	38	25	29	3	...	396
D-16	300	4	...	...	...	...	...	...	4
E-10	1,000	753	126	42	83	7	...	...	1,011
E-11	1,000	57	135	24	24	57	9	5	311
E-16	500	0	1	0	3	0	7	...	11
F-1	400	402	...	...	...	...	...	...	402
F-2	400	8	392	...	...	...	...	...	400
F-3	400	11	7	383	...	...	...	...	401
F-4	400	13	4	8	355	1	6	13	400
F-5	400	11	3	5	4	338	9	30	400
F-6	400	85	22	9	12	1	47	15	191
F-7	400	366	21	6	7	...	...	...	400
F-8	400	68	88	11	4	...	...	...	171
G-11	500	492	8	...	...	...	...	...	500
G-13	500	73	416	9	2	...	...	...	500
H-15	400	392	8	...	...	...	...	...	400
J-9	100	100	...	...	...	...	...	...	100
J-10	100	61	39	...	...	...	...	...	100
J-11	100	16	17	69	...	...	...	...	102
J-13	100	16	56	4	21	0	0	5	102
J-15	100	3	1	18	3	73	2	...	100
J-17	100	15	3	55	6	0	23	...	102
J-18	100	2	1	3	7	1	6	...	20
K-10	1,400	1,398	3	...	...	...	...	...	1,401
K-13	1,400	67	1,300	32	2	...	...	...	1,401
K-17	1,400	51	42	1,236	30	14	5	27	1,405
Total	18,500	7,193	3,796	2,185	721	638	136	136	14,805