

Technical Report No. 226
METEOROLOGICAL DATA ANALYSIS, 1972

John R. Nunn and C. F. Becker
Agricultural Engineering Division
University of Wyoming
Laramie, Wyoming

GRASSLAND BIOME
U.S. International Biological Program

June 1973

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ABSTRACT

Hourly averages of measured meteorological parameters were compiled for distribution under separate cover through Dr. Freeman M. Smith, Director for Integration of Abiotic Studies. Modifications to the data acquisition system were completed and corresponding data processing needs were fulfilled. A comparison of evapotranspiration on different grazing treatments was approached with special attempts to merger biotic and abiotic data. Keys for 1971 and 1972 are appended.

INTRODUCTION

The object of this study was to measure and supply the Natural Resource Ecology Laboratory (NREL) with meteorological and evapotranspiration (determined by lysimetry) data from the intensive site of the Grassland Biome. Data was recorded on computer compatible magnetic tape. In addition, the data was processed and edited, and on a cooperative effort with NREL personnel, was used to develop models depicting evapotranspiration of the grassland ecosystem, showing photosynthetically-active and net radiation from solar radiation, and describing daily and hourly soil temperature courses.

DATA PROCESSING

Materials and Methods

Meteorological and evapotranspiration data were measured at the Pawnee Site and supplied to the Natural Resource Ecology Laboratory on computer compatible magnetic tape. Continuous operation of the 36-channel data acquisition, begun in January 1972 (Table 1), was interrupted during April and May for implementing the transducers shown in Table 2. Satisfactory completion was on May 15 and 1-min integrated values were secured in a continuous fashion during the remainder of 1972.

Data were compacted to 800 bits per inch (bpi) on $\frac{1}{2}$ -inch computer compatible magnetic tape for January, February, and March. At an April meeting with Dr. Freeman Smith and others it was decided to terminate use of the 800 bpi compaction and utilize 556 bpi label tapes for all compacted meteorological data. Existing computer programs of the University of Wyoming were modified to expedite utilization and data screening as well as to increase compatibility with the Grassland Biome data bank.

Table 1. Variables measured at the Pawnee Site from January to April, 1972.

Parameter	Sensors (Number and Type)	Placement
Evapotranspiration	1 3-m weighing lysimeter	0 cm
Radiation (solar)	1 Eppley pyrheliometer	300 cm
Radiation (reflected)	2 Kipp-Zohnen solarimeters	300 cm
Radiation (longwave)	3 Eppley spectral pyranometers	300 cm
Radiation (net)	2 Beckman and Whitley radiometers	300 cm
Humidity in air	2 Cambridge model 880 hygrometers 2 wet bulb thermometer	50 and 300 cm 50 and 300 cm
Wind speed	4 electric speed indicator cup anemometers	50 and 300 cm
Air temperature	4 diodes	50 and 320 cm
Soil temperature	2 diodes	-3 to -122 cm
Wind direction	2 electric speed indicator wind vanes	300 cm
Barometric pressure	1 aneroid barometer	300 cm

Table 2. Variables measured at the Pawnee Site from April to December, 1972.

Parameter	Sensors (Number and Type)	Placement
Evapotranspiration	1 3-m weighing lysimeter	0 cm
Radiation (solar)	1 Eppley pyrheliometer	300 cm
Radiation (reflected)	1 Kipp-Zohnen solarimeter	300 cm
Radiation (longwave)	2 Eppley spectral pyranometers	300 cm
Radiation (net)	1 Beckman and Whitley radiometer	300 cm
Humidity in air	4 aspirated wet bulb thermistors	5, 50, 152, and 200 cm
Wind speed	2 Rimco anemometers	50 and 200 cm
	1 Hot-wire anemometer	5 cm
Air temperature	4 thermistors	5, 50, 152, and 200 cm
Wind direction	1 Electric Speed Indicator wind vane	200 cm
Precipitation	1 Belfort rain gauge	100 cm
Barometric pressure	1 aneroid barometer	200 cm
CO ₂ gradient	1 Lira infrared gas analyzer	50 and 200 cm
Radiation (visual)	1 Eppley spectral pyranometer	200 cm
Soil water	5 Coleman blocks	-3, -5, -10, -20, and -40 cm
Soil temperature	6 diodes	-3, -6, -10, -20, -51, and -122 cm

Depicting data availability in "informatic" form was deleted from the 1972 contract (personal communication with Drs. Freeman Smith, Jim Gibson, and C. F. Becker). As a replacement, listing of available data by keys (e.g., 060606 equals sixth month, sixth day, and sixth hour) is offered in Appendix I.

EVAPOTRANSPIRATION

A study of the water balance on the Pawnee Grassland is unquestionably a unique effort due to the persistent drought condition of the natural prairie sod. Annual rainfall of approximately 10 inches results in a vegetative canopy different from crop canopies where soil water is sufficient to minimize plant stress.

This section thus contains an evapotranspiration study on the grassland area with special emphasis on canopy resistance and plant phenology. The reader is referred to Rosenberg et al. (1968) and Bartholic et al. (1970) for a complete review of evapotranspiration theory.

Theory

Potential evapotranspiration from a vegetative surface is accurately defined by ambient weather conditions and the aerodynamic nature of the evaporating surface. This combination model is best described by van Bavel (1966) and takes the following form:

$$E_o = \frac{\frac{\epsilon H}{L} + \frac{\rho e d_a}{\rho R_a}}{\epsilon + 1}$$

E_o = potential evapotranspiration rate ($\text{g}/\text{cm}^2/\text{sec}$)

ϵ = dimensionless parameter (Δ/γ)

H = sum of energy inputs at surface exclusive of sensible and latent heat ($\text{cal/cm}^2/\text{sec}$)

L = latent heat of vaporization

ρ = density of air (g/cm^3)

e = water/air molecule ration (.622)

d_a = saturation vapor pressure deficit of air (mb)

p = ambient pressure (mb)

R_a = turbulent diffusion "resistance" (sec/cm)

where R_a is defined following Monteith and Szeicz (1962).

$$R_a = \frac{\ln (Z_a/Z_o)^2}{K^2} \cdot \frac{1}{u_a} \quad (2)$$

Z_a = elevation above crop surface (cm)

Z_o = roughness parameter (cm)

K = Von Karman coefficient (.41)

u_a = wind speed at level Z_a (cm/sec)

Equation 1 defines the potential rate of evapotranspiration from a vegetative canopy in which soil water is unlimited or, in other words, a surface covered with a thin layer of water exposed to ambient conditions. Under natural conditions the water evaporated from a vegetative canopy comes from within the plant and thus is transported by diffusion through the intricate plant. This route of water vapor flow can be restrictive, resulting in a resistance to transpiration more commonly termed "canopy resistance." This inherent plant characteristic has resulted in a modification of Equation 1 in order to define actual evapotranspiration. Monteith, Szeicz, and Waggoner (1965) have written this equation as follows:

$$ET = \frac{\frac{eH}{L} + \frac{\rho e d_a}{p R_a}}{e + 1 + R_s/R_a} \quad (3)$$

where R_s is canopy resistance, ET is actual evapotranspiration, and other symbols are as previously defined.

As soil drying proceeds under any vegetative canopy the stomata of plants may close rapidly or gradually in an effort to maintain a water balance in the plant. Determination of R_s is suggested as a logical method to characterize grassland plant response to water deficit and suggests the following form of Equation 3.

$$R_s = \frac{E_H R_a}{L \cdot ET} + \frac{\rho e d_a}{ET} - E R_a - R_a \quad (4)$$

Equation 4 quantitatively describes the response of the Pawnee Grassland to drought throughout the growing season. Earlier studies (van Bavel, 1966; Monteith et al., 1965) have characterized canopy resistances for domestic crops of alfalfa and barley. These crops were artificially watered; furthermore, R_s was not determined by Equation 4, but from a questionable method of a combination of potential and actual evaporation theory or profile data (Monteith, 1963).

Procedure

The type and method of meteorological observations are described in U.S. IBP Grassland Biome Technical Report No. 179 (Armijo, et al. 1972). Hourly and daily evapotranspiration rates were measured with a high quality lysimeter at the lysimeter enclosure (Armijo, 1972). Neutron probe readings and rainfall data collected from the non-grazed and heavy grazed micro-watersheds (Smith and Striffler, 1969) were used in Equation 5 to determine evaporation rates:

$$E = P - \Delta S \quad (5)$$

where

E = evaporation rate (mm/day)

P = rainfall (mm/day)

ΔS = change in soil water in top 120 cm of soil profile (mm/day).

The data acquisition system was run continuously throughout the study period of May through July at the lysimeter enclosure, and observations were used in Equation 4 to compute R_s for the lysimeter enclosure and the grazing treatments. Phenology, percent bare soil, aboveground biomass, and leaf area index (LAI) data were secured from the U.S. Grassland Biome data bank, Colorado State University, Fort Collins.

The period of observation covers the usual spring storms followed by a drying period with a soil water recharge during the first week of August.

Results

A graphic summary of data from the lysimeter enclosure is shown in Fig. 1. The magnitude of the resistance suggests that an average canopy resistance between 8 and 15 sec/cm is present on the grasslands during periods of peak evapotranspiration. As the soil water content is depleted the plant stomata become more active in closure in order to conserve water, thus increasing the resistance up to 50 sec/cm during late July. Studies of crop resistance have shown periods where the crop resistances have approached a very low value, thus the actual evapotranspiration equaling the potential evapotranspiration. This does not prevail for the grasslands (Table 3).

The author suggests that the grassland vegetation possesses a resistance to water vapor transport regardless of soil water conditions. (Stomata closure is not the only resistance; the total R_s value is also composed of cuticle, sub-stomatal cavity and cell-wall resistance.) This conclusion is supported by unpublished data of Dr. George Williams, Washington

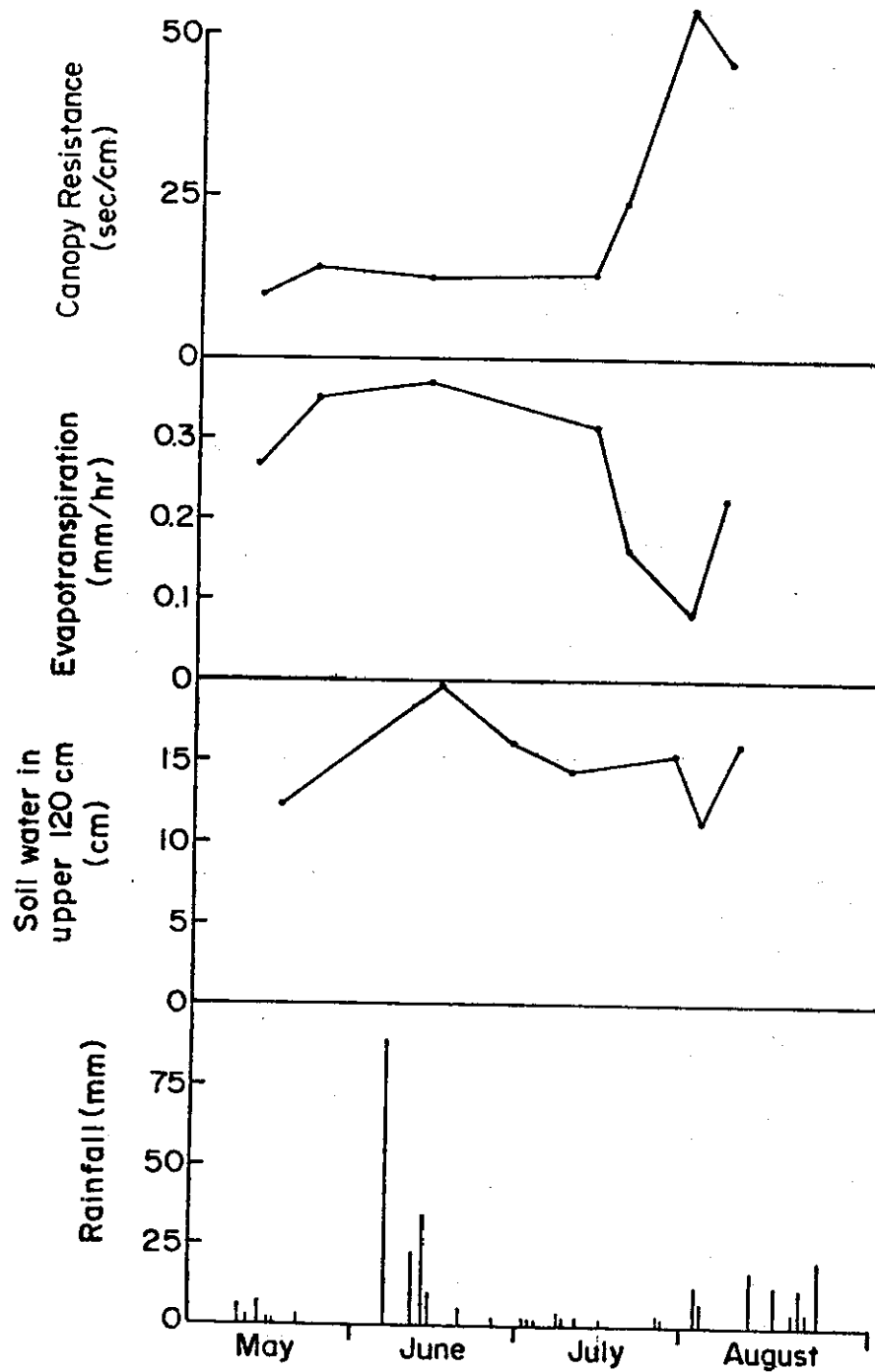


Fig. 1. Canopy resistance, evapotranspiration, soil water, and rainfall for lysimeter enclosure, 1972.

Table 3. Daily potential and actual evapotranspiration rates for lysimeter enclosure, 1972.

Date	Potential Evapotranspiration (mm/hr)	Actual Evapotranspiration (mm/hr)
May 14	.70	.27
May 20	.90	.35
June 9	1.00	.37
July 12	3.46	.31
July 17	1.50	.16
July 23	5.00	.13
July 30	5.56	.09
August 5	2.00	.21

State University, who demonstrated in a laboratory experiment a notable leaf resistance for grassland vegetation under ideal growing conditions.

Effect of Grazing

Galbraith (1971) demonstrated a significant difference in evapotranspiration from various grazing treatments, and soil water potential could not completely explain the variation. A more detailed and biologically oriented approach was utilized. A summary of canopy resistance values, phenology, and evapotranspiration rates are shown in Fig. 2 and Table 4.

Canopy resistances for the heavy grazed treatment were from 5 to 20% greater than for the non-grazed area, thus curtailing evapotranspiration from the heavy grazed area. This difference cannot be explained by green LAI because Knight (1972) has shown no significant difference in LAI between grazing treatments on the Pawnee Site. The author did show that 86% of the green LAI on the heavy grazed treatment and 60% of the green LAI on the non-grazed treatment was *Bouteloua gracilis*. This suggests that phenophase may play an active role in evapotranspiration on grazed treatments. Using phenophase data (verbal communication and unpublished data from French, 1972, Colorado State University, Fort Collins), two curves were developed to show phenology on the non-grazed and heavy grazed treatments. Green LAI data, used to weight species differences on each treatment, are summarized in Fig. 2.

The non-grazed area showed an average phenophase between late leaves fully expanded and developing floral buds, (Table 5, no. 6 and 7) during peak evapotranspiration while the heavy grazed treatment showed middle leaves fully visible (no. 4). Also, the non-grazed treatment phenophase

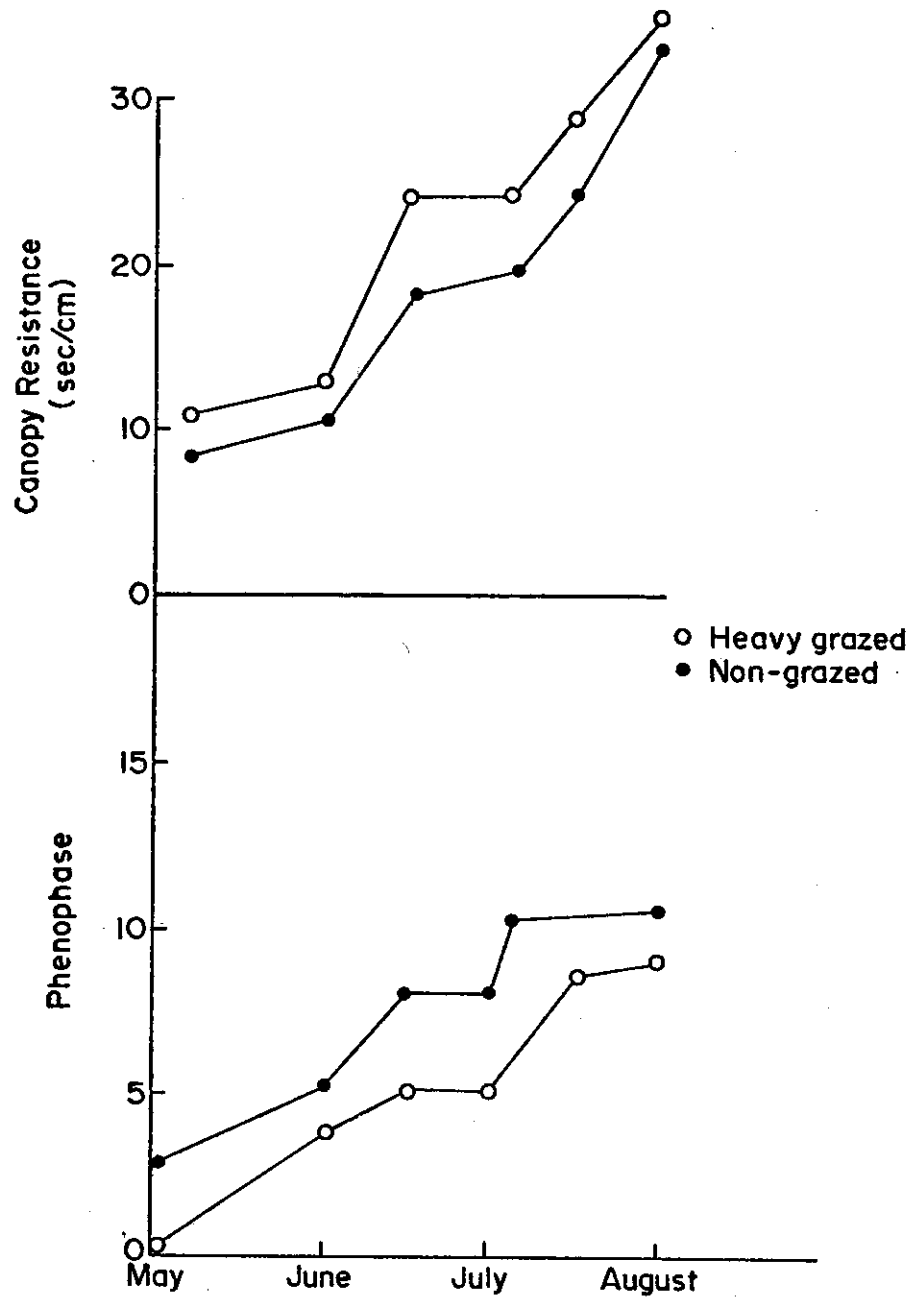


Fig. 2. Canopy resistance and phenophase (Table 5) for non-grazed and heavily grazed microwatersheds, 1972.

Table 4. Daily evapotranspiration and canopy resistance for non-grazed and heavy grazed treatments, 1972.

Date	Evapotranspiration (mm/day)		Canopy resistance (sec/cm)	
	Non-grazed	Heavy grazed	Non-grazed	Heavy grazed
May 5	0.59	0.92	8.5	11.0
June 1	0.74	1.09	10.5	13.0
June 15	2.45	2.70	18.0	24.0
July 5	2.44	2.93	19.1	24.0
July 15	1.93	2.55	24.8	28.9
July 30	1.36	1.47	33.5	34.6

Table 5. Definitions of 14 phenophases in the Grass-land Biome.

-
1. Pre-emergence growth/winter dormancy
 2. First visible growth
 3. First leaves fully expanded
 4. Middle leaves fully visible
 5. First leaves senescent; middle leaves fully expanded
 6. Late leaves fully expanded
 7. Developing floral buds; middle-late vegetative
 8. Mature floral buds; late vegetative
 9. Floral buds and open flowers
 10. Buds, flowers, and green fruit
 11. Buds, flowers, green fruit, and ripe fruit
 12. Green fruit and ripe fruit
 13. Ripe fruit and dispersing seeds
 14. Flowering induced dormancy
-

was consistently more advanced than the heavy grazed treatment. Using photosynthesis rates to depict transpiration rates (valid in a temperature regime less than 35°C), maximum transpiration rates occur between a phenophase of late leaves fully expanded and developing floral buds (no. 6 and 7) (verbal communication and unpublished data from Trlica, 1972, Colorado State University, Fort Collins). The author, therefore, suggests that differences in evapotranspiration among grazing treatments can be explained by plant phenology. An attempt was also made to relate aboveground herbage and percent bare soil (Fig. 3) to evapotranspiration rates. No obvious relationship was noted.

A comparison of canopy resistance and evapotranspiration is shown in Fig. 4 for the Pawnee Site, for O'Neill, Nebraska (Monteith et al., 1965), and for Arizona (van Bavel, 1966). Generally, good agreement was found between alfalfa under limited soil water conditions and the Pawnee Grasslands. When compared to the natural prairie at O'Neill, Nebraska, the Pawnee Site was consistently higher in canopy resistance. A possible explanation for this might be the higher relative humidity in Nebraska, difference in plant species, or difference in application of evapotranspiration theory.

The combination evapotranspiration model utilizing canopy resistance is a satisfactory method for characterizing plant water relationships. It is suggested that canopy resistance be used to index evapotranspiration within the Grassland Biome.

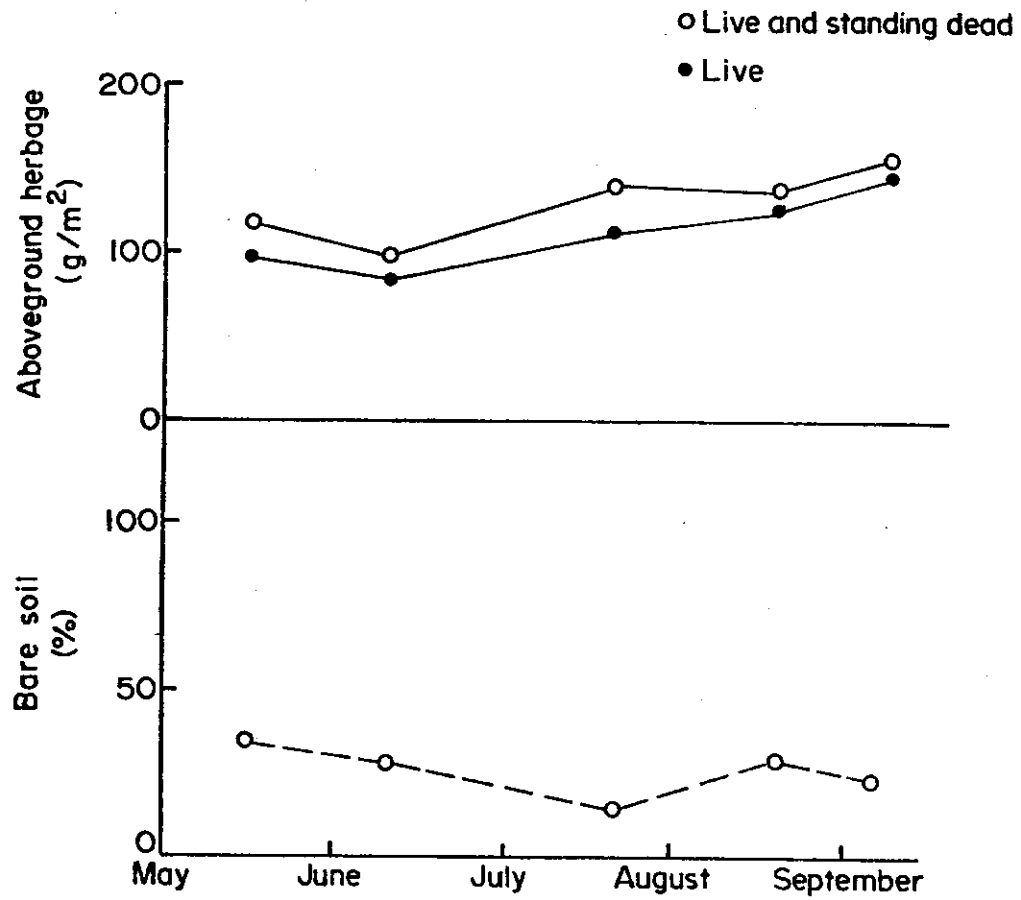


Fig. 3. Aboveground herbage and percent bare soil for 1972 growing season.

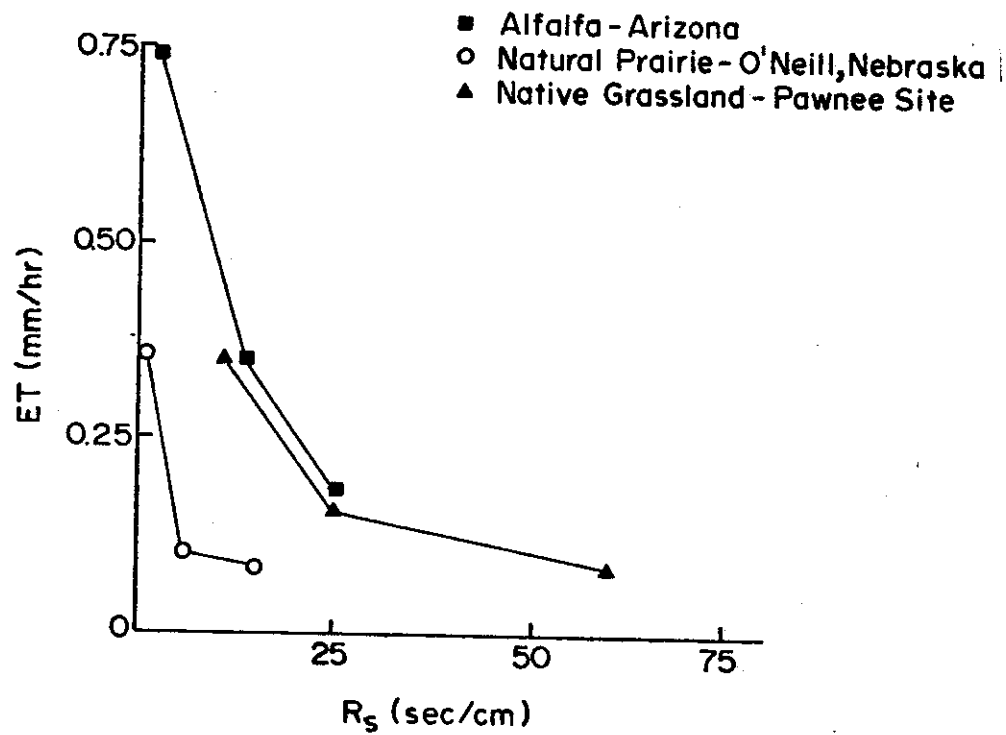


Fig. 4. Relationship of evapotranspiration (ET) to canopy resistance (R_s).

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APPENDIX I

KEYS FOR 1971

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DUE TO SYSTEM FAILURE, ALL FILES UPDATED OR CREATED BETWEEN
5 AM AND 5 30 AM TUESDAY APRIL 17 WERE LOST. ALSO, ALL FILES DELETED
BETWEEN 5 AM APRIL 16 AND 5 30 AM APRIL 17 MUST BE RE-DELETED

312 RECORDS READ

STOP 0

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62502	62704	62906	70115	70317	70519	70721	70923	71209	71710
62503	62705	62907	70116	70318	70520	70722	71000	71210	71711
62504	62706	62908	70117	70319	70521	70723	71001	71211	71712
62505	62707	62909	70118	70320	70522	70800	71002	71212	71713
62506	62708	62910	70119	70321	70523	70801	71003	71213	71714
62507	62709	62911	70120	70322	70524	70802	71004	71214	71715
62508	62710	62912	70121	70323	70525	70803	71005	71215	71716
62509	62711	62913	70122	70400	70600	70804	71006	71465	71717
62510	62712	62914	70123	70401	70601	70805	71007	71501	71718
62511	62713	62915	70124	70402	70602	70806	71008	71502	71719
62512	62714	62916	70200	70403	70603	70807	71009	71503	71720
62513	62715	62917	70201	70404	70604	70808	71010	71504	71721
62514	62716	62918	70202	70405	70605	70809	71011	71505	71722
62515	62717	62919	70203	70406	70606	70810	71012	71514	71723
62516	62718	62920	70204		70607				

[illegible]

		SYSTEM ID = 00000119
TOTAL JOB TIME	4.153	
PROCESSOR EXECUTION TIME	.166	
PROCESSOR I/O TIME	.119	
PROCESSOR OVERHEAD TIME	.146	
USER EXECUTION TIME	.169	
USER I/O TIME	3.462	
USER OVERHEAD TIME	.091	
NO. OF CARDS READ	62	
NO. OF PROCESSOR PAGES PRINTED	5	
NO. OF USER PAGES PRINTED	2	
NO. OF TAPE ACCESSES	1262	
NO. OF RAD ACCESSES	86	
NO. OF DISC PACK ACCESSES	118	
NO. OF (256 WORD) IPOOL BUFFERS	4	
NO. OF (512 WORD) FPOOL BUFFERS	4	
NO. OF BACKGROUND MEMORY PAGES	100	
JOB RAN WHILE BTM WAS UP		
NO. OF ACTIVE TERMINALS	11	
MAX. PAGES FOR ACCOUNT	500	
MAX. RUN TIME FOR ACCOUNT	60.000	
TIME LEFT	60.529	
FILE LEFT	540	

DUE TO SYSTEM FAILURE, ALL FILES UPDATED OR CREATED BETWEEN
5 AM AND 5 30 AM TUESDAY APRIL 17 WERE LOST. ALSO, ALL FILES DELETED
BETWEEN 5 AM APRIL 16 AND 5 30 AM APRIL 17 MUST BE RE-DELETED

LIST KEYS FOR TAPE # 3075

1

91014	91216	91418	91620	91822	92100	92302	92504	92706	92909
91015	91217	91419	91621	91823	92101	92303	92505	92707	92910
91016	91218	91420	91622	91900	92102	92304	92506	92708	92911
91017	91219	91421	91623	91901	92103	92305	92507	92709	92912
91018	91220	91422	91700	91902	92104	92306	92508	92710	92913
91019	91221	91423	91701	91903	92105	92307	92509	92711	92914
91020	91222	91500	91702	91904	92106	92308	92510	92712	92915
91021	91223	91501	91703	91905	92107	92309	92511	92713	92916
91022	91300	91502	91704	91906	92108	92310	92512	92714	92917
91023	91301	91503	91705	91907	92109	92311	92513	92715	92918
91100	91302	91504	91706	91908	92110	92312	92514	92716	92919
91101	91303	91505	91707	91909	92111	92313	92515	92717	92920
91102	91304	91506	91708	91910	92112	92314	92516	92718	92921
91103	91305	91507	91709	91911	92113	92315	92517	92719	92922
91104	91306	91508	91710	91912	92114	92316	92518	92720	92923
91105	91307	91509	91711	91913	92115	92317	92519	92721	93000
91106	91308	91510	91712	91914	92116	92318	92520	92722	93001
91107	91309	91511	91713	91915	92117	92319	92521	92723	93002
91108	91310	91512	91714	91916	92118	92320	92522	92800	93003
91109	91311	91513	91715	91917	92119	92321	92523	92801	93004
91110	91312	91514	91716	91918	92120	92322	92600	92802	93005
91111	91313	91515	91717	91919	92121	92323	92601	92804	93006
91112	91314	91516	91718	91920	92122	92400	92602	92805	93007
91113	91315	91517	91719	91921	92123	92401	92603	92806	93008
91114	91316	91518	91720	91922	92200	92402	92604	92807	93009
91115	91317	91519	91721	91923	92201	92403	92605	92808	93010
91116	91318	91520	91722	92000	92202	92404	92606	92809	93011
91117	91319	91521	91723	92001	92203	92405	92607	92810	93012
91118	91320	91522	91800	92002	92204	92406	92608	92811	93013
91119	91321	91523	91801	92003	92205	92407	92609	92812	93014
91120	91322	91600	91802	92004	92206	92408	92610	92813	93015
91121	91323	91601	91803	92005	92207	92409	92611	92814	93016
91122	91400	91602	91804	92006	92208	92410	92612	92815	93017
91123	91401	91603	91805	92007	92209	92411	92613	92816	93018
91200	91402	91604	91806	92008	92210	92412	92614	92817	93019
91201	91403	91605	91807	92009	92211	92413	92615	92818	93020
91202	91404	91606	91808	92010	92212	92414	92616	92819	93021
91203	91405	91607	91809	92011	92213	92415	92617	92820	93022
91204	91406	91608	91910	92012	92214	92416	92618	92821	93023
91205	91407	91609	91811	92013	92215	92417	92619	92822	100100
91206	91408	91610	91812	92014	92216	92418	92620	92823	100101
91207	91409	91611	91813	92015	92217	92419	92621	92900	100102
91208	91410	91612	91814	92016	92218	92420	92622	92901	100103
91209	91411	91613	91815	92017	92219	92421	92623	92902	100104
91210	91412	91614	91816	92018	92220	92422	92700	92903	100105
91211	91413	91615	91817	92019	92221	92423	92701	92904	100106
91212	91414	91616	91818	92020	92222	92500	92702	92905	100107
91213	91415	91617	91819	92021	92223	92501	92703	92906	100108
91214	91416	91618	91820	92022	92300	92502	92704	92907	100109
91215	91417	91619	91821	92023	92301	92503	92705	92908	100110

#STDP# Q

		SYSTEM ID = 00000110
TOTAL JOB TIME	4.164	
PROCESSOR EXECUTION TIME	.093	
PROCESSOR I/O TIME	.091	
PROCESSOR OVERHEAD TIME	.113	
USER EXECUTION TIME	.102	
USER I/O TIME	3.671	
USER OVERHEAD TIME	.094	
NO. OF CARDS READ	62	
NO. OF PROCESSOR PAGES PRINTED	5	
NO. OF USER PAGES PRINTED	2	
NO. OF TAPE ACCESSSES	1334	
NO. OF RAD ACCESSSES	86	
NO. OF DISC PACK ACCESSSES	118	
NO. OF (256 WORD) IPOOL BUFFERS	4	
NO. OF (512 WORD) FPOOL BUFFERS	4	
NO. OF BACKGROUND MEMORY PAGES	100	
JOB RAN WHILE BTM WAS UP		
NO. OF ACTIVE TERMINALS	12	
MAX. PAGES FOR ACCOUNT	500	
MAX. RUN TIME FOR ACCOUNT	60.000	
TIME LEFT	51.297	
FILE LEFT	540	

DUE TO SYSTEM FAILURE, ALL FILES UPDATED OR CREATED BETWEEN
5 AM AND 5 30 AM TUESDAY APRIL 17 WERE LOST. ALSO, ALL FILES DELETED
BETWEEN 5 AM APRIL 16 AND 5 30 AM APRIL 17 MUST BE RE-DELETED

LIST KEYS FOR TAPE # 3077

1

111913	112115	112317	112618	112820	113022	120120	120522	120822	121024
111914	112116	112318	112619	112821	113023	120121	120523	120823	121025
111915	112117	112319	112620	112822	120100	120322	120630	120904	121036
111916	112118	112320	112621	112823	120101	120323	120631	120905	121037
111917	112119	112321	112622	112900	120102	120400	120602	120806	121038
111918	112120	112322	112623	112901	120103	120401	120603	120807	121039
111919	112121	112323	112700	112902	120104	120402	120604	120808	121040
111920	112122	112400	112701	112903	120105	120403	120605	120809	121041
111921	112123	112401	112702	112904	120106	120404	120606	120810	121042
111922	112200	112402	112703	112905	120108	120405	120607	120811	121043
111923	112201	112403	112704	112906	120109	120406	120608	120812	121044
112000	112202	112404	112705	112907	120110	120407	120609	120813	121045
112001	112203	112405	112706	112908	120111	120408	120610	120814	121046
112002	112204	112406	112707	112909	120112	120409	120611	120815	121047
112003	112205	112407	112708	112910	120113	120410	120612	120816	121048
112004	112206	112408	112709	112911	120114	120411	120613	120817	121049
112005	112207	112409	112710	112912	120115	120412	120614	120818	121050
112006	112208	112410	112711	112913	120116	120413	120615	120819	121051
112007	112209	112411	112712	112914	120117	120414	120616	120820	121052
112008	112210	112412	112713	112915	120119	120415	120617	120821	121053
112009	112211	112413	112714	112916	120120	120416	120618	120822	121054
112010	112212	112414	112715	112917	120122	120417	120619	120823	121055
112011	112213	112415	112716	112918	120123	120418	120620	120824	121056
112012	112214	112416	112717	112919	120125	120419	120621	120825	121057
112013	112215	112417	112718	112920	120126	120420	120622	120826	121058
112014	112216	112418	112719	112921	120127	120421	120623	120827	121059
112015	112217	112419	112720	112922	120129	120422	120624	120828	121060
112016	112218	112420	112721	112923	120121	120423	120625	120829	121061
112017	112219	112421	112722	113000	120122	120500	120626	120830	121062
112018	112220	112422	112723	113001	120123	120501	120627	120831	121063
112019	112221	112423	112800	113002	120124	120502	120628	120832	121064
112020	112222	112500	112801	113003	120125	120503	120629	120833	121065
112021	112223	112501	112802	113004	120126	120504	120630	120834	121066
112022	112300	112502	112803	113005	120127	120505	120631	120835	121067
112023	112301	112503	112804	113006	120128	120506	120632	120836	121068
112100	112302	112504	112805	113007	120129	120507	120633	120837	121069
112101	112303	112505	112806	113008	120120	120508	120634	120838	121070
112102	112304	112506	112807	113009	120121	120509	120635	120839	121071
112103	112305	112507	112808	113010	120122	120510	120636	120840	121072
112104	112306	112508	112809	113011	120123	120511	120637	120841	121073
112105	112307	112509	112810	113012	120124	120512	120638	120842	121074
112106	112308	112510	112811	113013	120125	120513	120639	120843	121075
112107	112309	112511	112812	113014	120126	120514	120640	120844	121076
112108	112310	112512	112813	113015	120127	120515	120641	120845	121077
112109	112311	112513	112814	113016	120128	120516	120642	120846	121078
112110	112312	112514	112815	113017	120129	120517	120643	120847	121079
112111	112313	112515	112816	113018	120130	120518	120644	120848	121080
112112	112314	112516	112817	113019	120131	120519	120645	120849	121081
112113	112315	112517	112818	113020	120132	120520	120646	120850	121082
112114	112316	112518	112819	113021	120133	120521	120647	120851	121083

121206	121408	121610	121812	122014	122216	122418	122620	122822	2
121207	121409	121611	121813	122015	122217	122419	122621	122823	0
121208	121410	121612	121814	122016	122218	122420	122622	122900	0
121209	121411	121613	121815	122017	122219	122421	122623	122901	0
121210	121412	121614	121816	122018	122220	122422	122700	122902	0
121211	121413	121615	121817	122019	122221	122423	122701	122903	0
121212	121414	121616	121818	122020	122222	122500	122702	122904	0
121213	121415	121617	121819	122021	122223	122501	122703	122905	0
121214	121416	121618	121820	122022	122300	122502	122704	122906	0
121215	121417	121619	121821	122023	122301	122503	122705	122907	0
121216	121418	121620	121822	122100	122302	122504	122706	122908	0
121217	121419	121621	121823	122101	122303	122505	122707	122909	0
121218	121420	121622	121900	122102	122304	122506	122708	122910	0
121219	121421	121623	121901	122103	122305	122507	122709	0	0
121220	121422	121700	121902	122104	122306	122508	122710	0	0
121221	121423	121701	121903	122105	122307	122509	122711	0	0
121222	121500	121702	121904	122106	122308	122510	122712	0	0
121223	121501	121703	121905	122107	122309	122511	122713	0	0
121300	121502	121704	121906	122108	122310	122512	122714	0	0
121301	121503	121705	121907	122109	122311	122513	122715	0	0
121302	121504	121706	121908	122110	122312	122514	122716	0	0
121303	121505	121707	121909	122111	122313	122515	122717	0	0
121304	121506	121708	121910	122112	122314	122516	122718	0	0
121305	121507	121709	121911	122113	122315	122517	122719	0	0
121306	121508	121710	121912	122114	122316	122518	122720	0	0
121307	121509	121711	121913	122115	122317	122519	122721	0	0
121308	121510	121712	121914	122116	122318	122520	122722	0	0
121309	121511	121713	121915	122117	122319	122521	122723	0	0
121310	121512	121714	121916	122118	122320	122522	122800	0	0
121311	121513	121715	121917	122119	122321	122523	122801	0	0
121312	121514	121716	121918	122120	122322	122600	122802	0	0
121313	121515	121717	121919	122121	122323	122601	122803	0	0
121314	121516	121718	121920	122122	122400	122602	122804	0	0
121315	121517	121719	121921	122123	122401	122603	122805	0	0
121316	121518	121720	121922	122200	122402	122604	122806	0	0
121317	121519	121721	121923	122201	122403	122605	122807	0	0
121318	121520	121722	122000	122202	122404	122606	122808	0	0
121319	121521	121723	122001	122203	122405	122607	122809	0	0
121320	121522	121800	122002	122204	122406	122608	122810	0	0
121321	121523	121801	122003	122205	122407	122609	122811	0	0
121322	121600	121802	122004	122206	122408	122610	122812	0	0
121323	121601	121803	122005	122207	122409	122611	122813	0	0
121400	121602	121804	122006	122208	122410	122612	122814	0	0
121401	121603	121805	122007	122209	122411	122613	122815	0	0
121402	121604	121806	122008	122210	122412	122614	122816	0	0
121403	121605	121807	122009	122211	122413	122615	122817	0	0
121404	121606	121808	122010	122212	122414	122616	122818	0	0
121405	121607	121809	122011	122213	122415	122617	122819	0	0
121406	121608	121810	122012	122214	122416	122618	122820	0	0
121407	121609	121811	122013	122215	122417	122619	122821	0	0

914 RECORDS READ
STOP 0

	SYSTEM ID = 0000011E
TOTAL JOB TIME	5.755
PROCESSOR EXECUTION TIME	.109
PROCESSOR I/O TIME	.099
PROCESSOR OVERHEAD TIME	.106
USER EXECUTION TIME	.341
USER I/O TIME	5.000
USER OVERHEAD TIME	.100
NO. OF CARDS READ	62
NO. OF PROCESSOR PAGES PRINTED	5
NO. OF USER PAGES PRINTED	2
NO. OF TAPE ACCESSSES	1830
NO. OF RAD ACCESSSES	86
NO. OF DISC PACK ACCESSSES	118
NO. OF (256 WORD) IPOOL BUFFERS	4
NO. OF (512 WORD) FPOOL BUFFERS	4
NO. OF BACKGROUND MEMORY PAGES	100
JOB RAN WHILE BTM WAS UP	
NO. OF ACTIVE TERMINALS	10
MAX. PAGES FOR ACCOUNT	500
MAX. RUN TIME FOR ACCOUNT	60.000
TIME LEFT	45.542
FILE LEFT	540

DUE TO SYSTEM FAILURE, ALL FILES UPDATED OR CREATED BETWEEN
5 AM AND 5 30 AM TUESDAY APRIL 17 WERE LOST. ALSO, ALL FILES DELETED
BETWEEN 5 AM APRIL 16 AND 5 30 AM APRIL 17 MUST BE RE-DELETED

10212	10414	10616	10818	11020	11223	11501	11703	11905	12115
10213	10415	10617	10819	11021	11223	11502	11704	11906	12116
10214	10416	10618	10820	11022	11224	11503	11705	11907	12117
10215	10417	10619	10821	11023	11225	11504	11706	11908	12118
10216	10418	10620	10822	11024	11226	11505	11707	11909	12119
10217	10419	10621	10823	11025	11227	11506	11708	11910	12120
10218	10420	10622	10824	11026	11228	11507	11709	11911	12121
10219	10421	10623	10825	11027	11229	11508	11710	11912	12122
10220	10422	10624	10826	11028	11230	11509	11711	11913	12123
10221	10423	10625	10827	11029	11231	11510	11712	11914	12124
10222	10424	10626	10828	11030	11232	11511	11713	11915	12125
10223	10425	10627	10829	11031	11233	11512	11714	11916	12126
10224	10426	10628	10830	11032	11234	11513	11715	11917	12127
10225	10427	10629	10831	11033	11235	11514	11716	11918	12128
10226	10428	10630	10832	11034	11236	11515	11717	11919	12129
10227	10429	10631	10833	11035	11237	11516	11718	11920	12130
10228	10430	10632	10834	11036	11238	11517	11719	11921	12131
10229	10431	10633	10835	11037	11239	11518	11720	11922	12132
10230	10432	10634	10836	11038	11240	11519	11721	11923	12133
10231	10433	10635	10837	11039	11241	11520	11722	11924	12134
10232	10434	10636	10838	11040	11242	11521	11723	11925	12135
10233	10435	10637	10839	11041	11243	11522	11724	11926	12136
10234	10436	10638	10840	11042	11244	11523	11725	11927	12137
10235	10437	10639	10841	11043	11245	11524	11726	11928	12138
10236	10438	10640	10842	11044	11246	11525	11727	11929	12139
10237	10439	10641	10843	11045	11247	11526	11728	11930	12140
10238	10440	10642	10844	11046	11248	11527	11729	11931	12141
10239	10441	10643	10845	11047	11249	11528	11730	11932	12142
10240	10442	10644	10846	11048	11250	11529	11731	11933	12143
10241	10443	10645	10847	11049	11251	11530	11732	11934	12144
10242	10444	10646	10848	11050	11252	11531	11733	11935	12145
10243	10445	10647	10849	11051	11253	11532	11734	11936	12146
10244	10446	10648	10850	11052	11254	11533	11735	11937	12147
10245	10447	10649	10851	11053	11255	11534	11736	11938	12148
10246	10448	10650	10852	11054	11256	11535	11737	11939	12149
10247	10449	10651	10853	11055	11257	11536	11738	11940	12150
10248	10450	10652	10854	11056	11258	11537	11739	11941	12151
10249	10451	10653	10855	11057	11259	11538	11740	11942	12152
10250	10452	10654	10856	11058	11260	11539	11741	11943	12153</

LIST KEYS FOR TAPE # 3030

[illegible]

LIST KEYS FOR TAPE # 3031

13115	20217	20419	20621	21000	21202	21404	21606	21808	22010
13116	20218	20420	20622	21001	21203	21405	21607	21809	22011
13117	20219	20421	20623	21002	21204	21406	21608	21810	22012
13118	20220	20422	20700	21003	21205	21407	21609	21811	22013
13119	20221	20423	20701	21004	21206	21408	21610	21812	22014
13120	20222	20500	20702	21005	21207	21409	21611	21813	22015
13121	20223	20501	20703	21006	21208	21410	21612	21814	22016
13122	20300	20502	20704	21007	21209	21411	21613	21815	22017
13123	20301	20503	20705	21008	21210	21412	21614	21816	22018
20100	20302	20504	20706	21009	21211	21413	21615	21817	22019
20101	20303	20505	20707	21010	21212	21414	21616	21818	22020
20102	20304	20506	20708	21011	21213	21415	21617	21819	22021
20103	20305	20507	20709	21012	21214	21416	21618	21820	22022
20104	20306	20508	20710	21013	21215	21417	21619	21821	22023
20105	20307	20509	20711	21014	21216	21418	21620	21822	22024
20106	20308	20510	20712	21015	21217	21419	21621	21823	22025
20107	20309	20511	20713	21016	21218	21420	21622	21824	22026
20108	20310	20512	20714	21017	21219	21421	21623	21825	22027
20109	20311	20513	20715	21018	21220	21422	21624	21826	22028
20110	20312	20514	20716	21019	21221	21423	21625	21827	22029
20111	20313	20515	20717	21020	21222	21500	21702	21904	22114
20112	20314	20516	20718	21021	21223	21501	21703	21905	22115
20113	20315	20517	20719	21022	21224	21502	21704	21906	22116
20114	20316	20518	20720	21023	21300	21503	21705	21907	22117
20115	20317	20519	20721	21100	21301	21504	21706	21908	22118
20116	20318	20520	20722	21101	21302	21505	21707	21909	22119
20117	20319	20521	20723	21102	21303	21506	21708	21910	22120
20118	20320	20522	20800	21103	21305	21507	21709	21911	22121
20119	20321	20523	20801	21104	21306	21508	21710	21912	22122
20120	20322	20500	20802	21105	21307	21509	21711	21913	22123
20121	20323	20601	20803	21106	21308	21510	21712	21914	22200
20122	20400	20602	20804	21107	21309	21511	21713	21915	22201
20123	20401	20603	20805	21108	21310	21512	21714	21916	22202
20200	20402	20604	20806	21109	21311	21513	21715	21917	22203
20201	20403	20605	20807	21110	21312	21514	21716	21918	22204
20202	20404	20606	20808	21111	21313	21515	21717	21919	22205
20203	20405	20607	20809	21112	21314	21516	21718	21920	22206
20204	20406	20608	20911	21113	21315	21517	21719	21921	22207
20205	20407	20609	20912	21114	21316	21518	21720	21922	22208
20206	20408	20610	20913	21115	21317	21519	21721	21923	22209
20207	20409	20611	20914	21116	21318	21520	21722	21924	22210
20208	20410	20612	20915	21117	21319	21521	21723	21925	22211
20209	20411	20613	20916	21118	21320	21522	21724	21926	22212
20210	20412	20614	20917	21119	21321	21523	21725	21927	22213
20211	20413	20615	20918	21120	21322	21524	21726	21928	22214
20212	20414	20616	20919	21121	21323	21525	21727	21929	22215
20213	20415	20617	20920	21122	21324	21526	21728	21930	22216
20214	20416	20618	20921	21123	21325	21527	21729	21931	22217
20215	20417	20619	20922	21124	21326	21528	21730	21932	22218
20216	20418	20620	20923	21125	21327	21529	21731	21933	22219

22220	22422	22700	30102	30304	0	0	0	0	0
22221	22423	22701	30103	30305	0	0	0	0	0
22222	22500	22702	30104	30306	0	0	0	0	0
22223	22501	22703	30105	30307	0	0	0	0	0
22300	22502	22704	30106	30308	0	0	0	0	0
22301	22503	22705	30107	30309	0	0	0	0	0
22302	22504	22706	30108	30310	0	0	0	0	0
22303	22505	22707	30109	0	0	0	0	0	0
22304	22506	22708	30110	0	0	0	0	0	0
22305	22507	22709	30111	0	0	0	0	0	0
22306	22508	22710	30112	0	0	0	0	0	0
22307	22509	22711	30113	0	0	0	0	0	0
22308	22510	22712	30114	0	0	0	0	0	0
22309	22511	22713	30115	0	0	0	0	0	0
22310	22512	22714	30116	0	0	0	0	0	0
22311	22513	22715	30117	0	0	0	0	0	0
22312	22514	22716	30118	0	0	0	0	0	0
22313	22515	22717	30119	0	0	0	0	0	0
22314	22516	22718	30120	0	0	0	0	0	0
22315	22517	22719	30121	0	0	0	0	0	0
22316	22518	22720	30122	0	0	0	0	0	0
22317	22519	22721	30123	0	0	0	0	0	0
22318	22520	22722	30200	0	0	0	0	0	0
22319	22521	22723	30201	0	0	0	0	0	0
22320	22522	22800	30202	0	0	0	0	0	0
22321	22523	22801	30203	0	0	0	0	0	0
22322	22600	22802	30204	0	0	0	0	0	0
22323	22601	22803	30205	0	0	0	0	0	0
22401	22603	22805	30207	0	0	0	0	0	0
22402	22604	22806	30208	0	0	0	0	0	0
22403	22605	22807	30209	0	0	0	0	0	0
22404	22606	22808	30210	0	0	0	0	0	0
22405	22607	22809	30211	0	0	0	0	0	0
22406	22608	22810	30212	0	0	0	0	0	0
22407	22609	22811	30213	0	0	0	0	0	0
22408	22610	22812	30214	0	0	0	0	0	0
22409	22611	22813	30215	0	0	0	0	0	0
22410	22612	22814	30216	0	0	0	0	0	0
22411	22613	22815	30217	0	0	0	0	0	0
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22414	22616	22818	30220	0	0	0	0	0	0
22415	22617	22819	30221	0	0	0	0	0	0
22416	22618	22820	30222	0	0	0	0	0	0
22417	22619	22821	30223	0	0	0	0	0	0
22418	22620	22822	30300	0	0	0	0	0	0
22419	22621	22823	30301	0	0	0	0	0	0
22420	22622	30120	30302	0	0	0	0	0	0
22421	22623	30121	30303	0	0	0	0	0	0

51010	51215	51417	51619	51821	52003	52602	52806	53008
51011	51216	51418	51620	51822	52004	52603	52807	53009
51012	51217	51419	51621	51823	52005	52604	52808	53010
51013	51218	51420	51622	51824	52006	52605	52809	53011
51014	51219	51421	51623	51901	52007	52606	52810	53012
51015	51220	51422	51700	51902	52008	52607	52811	53013
51016	51221	51423	51701	51903	52009	52608	52812	53014
51020	51222	51500	51702	51904	52010	52609	52813	53015
51021	51223	51501	51703	51905	52011	52610	52814	53016
51022	51300	51502	51704	51906	52012	52611	52815	53017
51023	51301	51503	51705	51907	52013	52612	52816	53018
51024	51302	51504	51706	51908	52014	52613	52817	53019
51101	51303	51505	51707	51909	52015	52614	52818	53020
51102	51304	51506	51708	51910	52016	52615	52819	53021
51103	51305	51507	51709	51911	52017	52616	52820	53022
51104	51306	51508	51710	51912	52018	52617	52821	53023
51105	51307	51509	51711	51913	52019	52618	52822	53024
51106	51308	51510	51712	51914	52020	52619	52823	53025
51107	51309	51511	51713	51915	52021	52620	52824	53026
51108	51310	51512	51714	51916	52022	52621	52825	53027
51109	51311	51513	51715	51917	52023	52622	52826	53028
51110	51312	51514	51716	51920	52024	52623	52827	53029
51111	51313	51515	51717	51921	52025	52624	52828	53030
51112	51314	51516	51718	51922	52026	52625	52829	53031
51113	51315	51517	51719	51923	52027	52626	52830	53032
51114	51316	51518	51720	52000	52028	52627	52831	53033
51115	51317	51519	51721	52001	52029	52628	52832	53034
51116	51318	51520	51722	52002	52030	52629	52833	53035
51117	51319	51521	51723	52003	52031	52630	52834	53036
51118	51320	51522	51800	52004	52032	52631	52835	53037
51119	51321	51523	51801	52005	52033	52632	52836	53038
51120	51322	51600	51802	52006	52034	52633	52837	53039
51121	51323	51601	51803	52007	52035	52634	52838	53110
51122	51400	51602	51804	52008	52036	52635	52839	53111
51123	51401	51603	51805	52009	52037	52636	52840	53112
51200	51402	51604	51806	52010	52038	52637	52841	53113
51201	51403	51605	51807	52011	52039	52638	52842	53114
51202	51404	51606	51808	52012	52040	52639	52843	53115
51203	51405	51607	51809	52013	52041	52640	52844	53116
51204	51406	51608	51810	52014	52042	52641	52845	53117
51205	51407	51609	51811	52015	52043	52642	52846	53118
51206	51408	51610	51812	52016	52044	52643	52847	53119
51207	51409	51611	51813	52017	52045	52644	52848	53120
51208	51410	51612	51814	52018	52046	52645	52849	53121
51209	51411	51613	51815	52019	52047	52646	52850	53122
51210	51412	51614	51816	52020	52048	52647	52851	53123
51211	51413	51615	51817	52021	52049	52648	52852	53124
51212	51414	51616	51818	52022	52050	52649	52853	53125
51213	51415	51617	51819	52023	52051	52650	52854	53126
51214	51416	51618	51820	52024	52052	52651	52855	53127

LIST KEYS FOR TAPE # 3023

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60110	60312	60515	61406	61611	61813	62016	62218	62422	0
60111	60313	60516	61407	61612	61814	62017	62219	62423	0
60112	60314	60517	61408	61613	61815	62018	62220	62500	0
60113	60315	60518	61409	61614	61816	62019	62221	62501	0
60114	60316	61208	61410	61615	61817	62020	62222	62502	0
60115	60317	61209	61411	61616	61818	62021	62223	62503	0
60116	60318	61210	61412	61617	61819	62022	62300	62504	0
60117	60319	61211	61413	61618	61820	62023	62301	62505	0
60118	60320	61212	61414	61619	61821	62100	62302	62506	0
60119	60321	61213	61415	61620	61822	62101	62303	62507	0
60120	60322	61214	61416	61621	61823	62102	62304	62508	0
60121	60323	61215	61417	61622	61900	62103	62305	62509	0
60122	60400	61216	61418	61623	61901	62104	62306	62510	0
60123	60401	61217	61419	61700	61902	62105	62307	62511	0
60200	60402	61213	61420	61701	61903	62106	62310	62512	0
60201	60403	61219	61421	61702	61904	62107	62311	62513	0
60202	60404	61220	61422	61703	61905	62108	62312	62514	0
60203	60405	61221	61423	61704	61906	62109	62313	62515	0
60204	60406	61222	61500	61705	61907	62110	62314	62516	0
60205	60407	61223	61501	61706	61909	62111	62315	62517	0
60206	60408	61300	61502	61707	61910	62112	62316	62518	0
60207	60409	61301	61503	61708	61911	62113	62317	62519	0
60208	60410	61302	61504	61709	61912	62114	62318	62520	0
60209	60411	61303	61505	61710	61913	62115	62319	62521	0
60210	60412	61304	61506	61711	61914	62116	62320	62522	0
60211	60413	61305	61507	61712	61915	62117	62321	62523	0
60212	60414	61306	61511	61713	61916	62118	62322	62600	0
60213	60415	61307	61512	61714	61917	62119	62323	62613	0
60214	60416	61308	61513	61715	61918	62120	62400	62614	0
60215	60417	61309	61514	61716	61919	62121	62401	62615	0
60216	60418	61310	61515	61717	61920	62122	62402	62616	0
60217	60419	61311	61516	61718	61921	62123	62403	62617	0
60218	60420	61312	61517	61719	61922	62200	62404	62618	0
60219	60421	61313	61518	61720	61923	62201	62405	62619	0
60220	60422	61314	61519	61721	62000	62202	62406	0	0
60221	60423	61315	61520	61722	62001	62203	62407	0	0
60222	60500	61316	61521	61723	62002	62204	62408	0	0
60223	60501	61317	61522	61800	62003	62205	62409	0	0
60220	60502	61318	61523	61801	62004	62206	62410	0	0
60301	60503	61319	61600	61802	62005	62207	62411	0	0
60302	60504	61320	61601	61803	62006	62208	62412	0	0
60303	60505	61321	61602	61804	62007	62209	62413	0	0
60304	60506	61322	61603	61805	62008	62210	62414	0	0
60305	60508	61323	61604	61806	62009	62211	62415	0	0
60306	60509	61400	61605	61807	62010	62212	62416	0	0
60307	60510	61401	61606	61808	62011	62213	62417	0	0
60308	60511	61402	61607	61809	62012	62214	62418	0	0
60309	60512	61403	61608	61810	62013	62215	62419	0	0
60310	60513	61404	61609	61811	62014	62216	62420	0	0
60311	60514	61405	61610	61812	62015	62217	62421	0	0

LIST KEYS FOR TAPE # 3024

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62612	62916	70119	70321	70523	70801	71603	71206	71408	71610
62613	62917	70120	70322	70600	70802	71604	71207	71409	71611
62614	62918	70121	70323	70601	70803	71605	71208	71410	71612
62615	62919	70122	70400	70602	70804	71606	71209	71411	71613
62616	62920	70123	70401	70603	70805	71607	71210	71412	71614
62617	62921	70200	70402	70604	70806	71608	71211	71413	71615
62618	62922	70201	70403	70605	70807	71609	71212	71414	71616
62619	62923	70202	70404	70606	70808	71610	71213	71415	71617
62620	63000	70203	70405	70607	70809	71611	71214	71416	71618
62621	63001	70204	70406	70608	70810	71612	71215	71417	71619
62622	63002	70205	70407	70609	70811	71613	71216	71418	71620
62623	63003	70206	70408	70610	70812	71614	71217	71419	71621
62700	63004	70207	70409	70611	70813	71615	71218	71420	71622
62701	63005	70208	70410	70612	70814	71616	71219	71421	71623
62702	63006	70209	70411	70613	70815	71617	71220	71422	71700
62703	63007	70210	70412	70614	70816	71618	71221	71423	71701
62704	63008	70211	70413	70615	70817	71619	71222	71500	71702
62705	63009	70212	70414	70616	70818	71620	71223	71501	71703
62808	63010	70213	70415	70617	70819	71621	71300	71502	71704
62809	63011	70214	70416	70618	70820	71622	71301	71503	71705
62810	63012	70215	70417	70619	70821	71623	71302	71504	71706
62811	63013	70216	70418	70620	70822	71624	71303	71505	71707
62812	63014	70217	70419	70621	70823	71625	71304	71506	71708
62813	63015	70218	70420	70622	70824	71626	71305	71507	71709
62814	63016	70219	70421	70623	70825	71627	71306	71508	71710
62815	63017	70220	70422	70624	70826	71628	71307	71509	71711
62816	63018	70221	70423	70625	70827	71629	71308	71510	71712
62817	63019	70222	70500	70701	70903	71630	71309	71511	71713
62818	63020	70223	70501	70702	70904	71631	71310	71512	71714
62819	63021	70300	70502	70703	70905	71632	71311	71513	71715
62820	63022	70301	70503	70704	70906	71633	71312	71514	71716
62821	70100	70302	70504	70705	70907	71634	71313	71515	71717
62822	70101	70303	70505	70706	70908	71635	71314	71516	71718
62823	70102	70304	70506	70707	70909	71636	71315	71517	71719
62900	70103	70305	70507	70708	70910	71637	71316	71518	71720
62901	70104	70306	70508	70709	70911	71638	71317	71519	71721
62902	70105	70307	70509	70710	70912	71639	71318	71520	71722
62903	70106	70308	70510	70711	70913	71640	71319	71521	71723
62904	70107	70309	70511	70712	70914	71641	71320	71522	71801
62905	70108	70310	70512	70713	70915	71642	71321	71523	71802
62906	70109	70311	70513	70714	70916	71643	71322	71524	71803
62907	70110	70312	70514	70715	70917	71644	71323	71525	71804
62908	70111	70313	70515	70716	70918	71645	71324	71526	71805
62909	70112	70314	70516	70717	70919	71646	71325	71527	71806
62910	70113	70315	70517	70718	70920	71647	71326	71528	71807
62911	70114	70316	70518	70719	70921	71648	71327	71529	71808
62912	70115	70317	70519	70720	70922	71649	71328	71530	71809
62913	70116	70318	70520	70721	70923	71650	71329	71531	71810

LIST KEYS FOR TAPE + 3024

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71811	72013	72215	72421	72701	72903	73105	80208	80415
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71813	72015	72217	72423	72703	72905	73107	80210	80417
71814	72016	72218	72500	72704	72906	73108	80211	80418
71815	72017	72219	72501	72705	72907	73109	80212	80419
71816	72018	72220	72502	72706	72908	73110	80213	80420
71817	72019	72221	72503	72707	72909	73111	80214	80421
71818	72020	72222	72504	72708	72910	73112	80215	80422
71819	72021	72223	72505	72709	72911	73113	80216	80423
71820	72022	72300	72506	72710	72912	73114	80217	80500
71821	72023	72301	72507	72711	72913	73115	80218	80501
71822	72100	72302	72508	72712	72914	73116	80219	80502
71823	72101	72303	72509	72713	72915	73117	80220	80503
71900	72102	72304	72510	72714	72916	73118	80221	80504
71901	72103	72305	72511	72715	72917	73119	80222	80505
71902	72104	72306	72512	72716	72918	73120	80223	80506
71903	72105	72307	72514	72717	72919	73121	80300	80507
71904	72106	72308	72515	72718	72920	73122	80301	80508
71905	72107	72309	72516	72719	72921	73123	80302	80509
71906	72108	72310	72517	72720	72922	80100	80303	80510
71907	72109	72311	72518	72721	72923	80101	80304	80511
71908	72110	72312	72519	72722	73000	80102	80305	80512
71909	72111	72313	72520	72723	73001	80103	80306	80513
71910	72112	72314	72521	72800	73002	80104	80307	80514
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80724	80924	81128	81517	81721	81923	82125	82327	82529	82731
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80746	80946	81150	81539	81743	81945	82147	82349	82551	82753
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LIST KEYS FOR TAPE # 3025

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LIST KEYS FOR TAPE # 3026

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91522	91800	92002	92204	92406	92608	92811	93013	100215	100417
91523	91901	92003	92205	92407	92609	92812	93014	100216	100418
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91603	91805	92007	92209	92411	92613	92816	93018	100220	100422
91604	91806	92008	92210	92412	92615	92817	93019	100221	100423
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91709	91911	92113	92315	92517	92720	92922	100200	100401	100602
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LIST KEYS FOR TAPE # 3026

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106608	100810	101012	101214	101416	101618	101820	102022	102300	102503
106609	100811	101013	101215	101417	101619	101821	102023	102301	102504
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106612	100814	101016	101218	101420	101622	101824	102026	102304	102507
106613	100815	101017	101219	101421	101623	101825	102027	102305	102508
106614	100816	101018	101220	101422	101624	101826	102028	102306	102509
106615	100817	101019	101221	101423	101625	101827	102029	102307	102510
106616	100818	101020	101222	101424	101626	101828	102030	102308	102511
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106618	100820	101022	101300	101502	101704	101906	102108	102310	102513
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106635	100837	101039	101317	101519	101721	101923	102125	102327	102530
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106638	100840	101042	101320	101522	101724	101926	102128	102330	102533
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106642	100844	101046	101324	101526	101728	101930	102132	102334	102537
106643	100845	101047	101325	101527	101729	101931	102133	102335	102538
106644	100846	101048	101326	101528	101730	101932	102134	102336	102539
106645	100847	101049	101327	101529	101731	101933	102135	102337	102540
106646	100848	101050	101328	101530	101732	101934	102136	102338	102541
106647	100849	101051	101329	101531	101733	101935	102137	102339	102542
106648	100850	101052	101330	101532	101734	101936	102138	102340	102543
106649	100851	101053	101331	101533	101735	101937	102139	102341	102544
106650	100852	101054	101332	101534	101736	101938	102140	102342	102545
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106664	100866	101068	101346	101548	101750	101952	102154	102356	102559
106665	100867	101069	101347	101549	101751	101953	102155	102357	102560
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106669	100871	101073	101351	101553	101755	101957	102159	102361	102564
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106672	100874	101076	101354	101556	101758	101960	102162	102364	102567
106673	100875	101077	101355	101557	101759	101961	102163	102365	102568
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106677	100879	101081	101359	101561	101763	101965	102167	102369	102572
106678	100880	101082	101360	101562	101764	101966	102168	102370	102573
106679	100881	101083	101361	101563	101765	101967	102169	102371	102574
106680	100882	101084	101362	101564	101766	101968	102170	102372	102575
106681	100883	101085	101363	101565	101767	101969	102171	102373	102576
106682	100884	101086	101364	101566	101768	101970	102172	102374	102577
106683	100885	101087	101365	101567	101769	101971	102173	102375	102578
106684	100886	101088	101366	101568	101770	101972	102174	102376	102579
106685	100887	101089	101367	101569	101771	101973	102175	102377	102580
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106687	100889	101091	101369	101571	101773	101975	102177	102379	102582
106688	100890	101092	101370	101572	101774	101976	102178	102380	102583
106689	100891	101093	101371	101573	101775	101977	102179	102381	102584
106690	100892	101094	101372	101574	101776	101978	102180	102382	102585
106691	100893	101095	101373	101575	101777	101979	102181	102383	102586
106692	100894	101096	101374	101576	101778	101980	102182	102384	102587
106693	100895	101097	101375	101577	101779	101981	102183	102385	102588
106694	100896	101098	101376	101578	101780	101982	102184	102386	102589
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106696	100898	101100	101378	101580	101782	101984	102186	102388	102591
106697	100899	101101	101379	101581	101783	101985	102187	102389	102592
106698	100900	101102	101380	101582	101784	101986	102188	102390	102593
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106700	100902	101104	101382	101584	101786	101988	102190	102392	102595
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106707	100909	101111	101389	101591	101793	101995	102197	102399	102602
106708	100910	101112	101390	101592	101794	101996	102198	102400	102603
106709	100911	101113	101391	101593	101795	101997	102199	102401	102604
106710	100912	101114	101392	101594	101796	101998	102200	102402	102605
106711	100913	101115	101393	101595	101797	101999	102201	102403	102606
106712	100914	101116							

