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KWIC-SWID, A SYSTEM OF PROGRAMS FOR GENERATING FORTRAN SYMBOLIC NAME DOCUMENTATION

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ABSTRACT

KWIC-SWID is a set of four computer programs which generate FORTRAN symbolic name documentation for a large computer program. The documentation consists of three types of lists: a glossary, a significant word in definition (SWID) list, and a list of program inputs containing typical numerical values and references. Of the three computer printout lists, the SWID is the most unique. It allows one who is not too familiar with the documented program to determine if a symbolic name exists which will align with the user's concept of what might be in the program.

INTRODUCTION

When one has a FORTRAN program which uses over 850 unique symbolic names, he quite rapidly realizes that a simple listing of symbolic names and their meaning is not totally adequate. This was the situation which came about due to the development of the large grasslands ecosystem level model ELM 73 (Innis 1975). In developing ELM one of the implied objectives was that it be capable of being utilized by an ecologist-modeler. To this end the KWIC-SWID system was developed.

WHAT IS THE KWIC-SWID SYSTEM?

KWIC-SWID is a set of four computer programs which, when run with the appropriate input data, generate computer listings which allow the model user as well as the model developer

(1) to readily ascertain the meaning of a given FORTRAN symbolic name;

(2) to determine if a symbol exists in the model and what that symbol is, given a concept; and

(3) to provide a list of input variables, their definitions, typical values for a given site, and information relative to the origin of the values.

Throughout the remaining discussion, the ELM 73 will be used for purposes of discussion; however, as the title of this technical report implies, this system of documentation may be used for any FORTRAN-type program. In a more general sense, it probably is not restricted to computer programs, since the basic programs used were modifications of modifications to the C.D.C. Key Word in Context Programs (Control Data Corporation 1966).

For small numbers of variables use of the KWIC-SWID is probably not worthwhile, since a user is probably familiar with what variables are available; however, for the person who is not familiar with a large model, it is definitely worth the time and effort.

KWIC-SWID OUTPUT

To accomplish the objective previously stated, the system generates three types of computer output lists, i.e.,

(1) Alphabetic symbolic name list,

(2) Significant word in definition list, and

(3) Input list.

Sample pages from the ELM 73 runs are depicted in Fig. 1, 2, and 4, representing the above three lists.

Alphabetic Symbolic Name List

This list is a glossary of symbolic name meanings, which are alphabetized by symbolic name. For the ELM 73 example (Fig. 1) we chose to include in the definition the units of each variable. These are enclosed in brackets following the definition. The variable FSDPI, shown in Fig. 1, is typical.

The Alphabetic Symbolic Name List allows a person to determine which variables are available whose values can be printed or plotted via a normal SIMCOMP output request (Gustafson and Innis 1973). Since most variables can be output, it was decided to indicate which names could not. These names were termed "internal variables" and are so indicated by an asterisk immediately following the symbolic name.

ELM 1973 ALPHABETIC SYMBOLIC NAME LIST 09/17/74

FLIT	TOTAL LITTER-PHOSPHORUS FLOW (GM P/DAY).	FLIT
FLNP1	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LIVE-ROOTS (GM P/GM DW).	FLNP1
FLSP1	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LIVE-SHOOTS (GM P/GM DW).	FLSP1
FLTP1	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LITTER (GM P/GM DW).	FLTP1
FLX	TRANSLOCATION OF PHOSPHORUS FROM CROWNS TO ROOTS (NOD).	FLX
FL79(I)	DECOMPOSER TO LABILE AND STABLE ORGANIC-PHOSPHORUS FLOW FOR NUTRIENT-STRATA I (GM P/M 2/DAY).	FL79(I)
FMBM(I)	DECOMPOSER-BIOMASS WITHIN NUTRIENT-STRATA I (GM /M2).	FMBM(I)
FMEFL(I)	DECOMPOSER-PHOSPHORUS EFFLUX IN NUTRIENT-STRATUM I. (IMMOBILIZATION) (GM P/GM DW/DAY)	FMEFL(I)
FMPCN	. DECOMPOSER-PHOSPHORUS CONCENTRATION OUTPUTABLE ONLY AS CONCENTRATION IN 4TH LAYER. (G M P/GM DW).	FMPCN
FMU	PHOSPHORUS-UPTAKE-RATE PER UNIT OF DECOMPOSER-BIOMASS (GM P/DAYS/GM DW).	FMU
FNEFP	NITROGEN EFFECT ON ROOT-PHOSPHORUS UPTAKE (NOD).	FNEFP
FNEPT(I)	TABLE-FUNCTION USED TO DETERMINE FNEFP (GM N/GM DW,NOD).	FNEPT(I)
FPC	SOLUTION INORGANIC-PHOSPHORUS CONCENTRATION (GM P/M3 H2O).	FPC
FPX(I)	RATE-CONSTANT IN NUTRIENT-STRATUM I, REGULATING THE FLOW FROM LABILE ORGANIC-PHOSPHOR US (MINERALIZATION) (1/DAYS).	FPX(I)
FRCK	RATE-CONSTANT FOR EXPONENTIAL-FUNCTION ASSOCIATED WITH FLX (GM DW/GM P).	FRCK
FRCS	VALUE OF CROWN-PHOSPHORUS CONCENTRATION AT WHICH REVERSE-FLOW FROM SHOOTS TO CROWNS S TARTS (GM P/GM DW).	FRCS
FRPCN	LIVE-ROOT PHOSPHORUS-CONCENTRATION (GM P/GM DW).	FRPCN
FRPU(I)	RELATIVE ROOT-PHOSPHORUS UPTAKE IN NUTRIENT-STRATUM I (NOD).	FRPU(I)
FRPUT(I)	RELATIVE PHOSPHORUS UPTAKE TABLE, FRPU VS. FVSW (CM H2O/CM SOIL, NOD).	FRPUT(I)
FRSK	RATE-CONSTANT FOR EXPONENTIAL-FUNCTION ASSOCIATED WITH FFLX (GM DW/GM P).	FRSK
FRSS	VALUE OF SHOOT-PHOSPHORUS CONCENTRATION AT WHICH REVERSE-FLOW FROM SHOOTS TO ROOTS ST ARTS (GM P/GM DW).	FRSS
FRU	UPTAKE-RATE OF PHOSPHORUS FROM LABILE-INORGANIC-PHOSPHORUS TO LIVE-ROOT-PHOSPHORUS (G M P/GM DW/DAY).	FRU
FR362	FRACTION OF LITTER-PHOSPHORUS THAT FLOWS TO LABILE INORGANIC-PHOSPHORUS (LEACHING) (N OD).	FR362
FR368	FRACTION OF LITTER-PHOSPHORUS THAT FLOWS TO STABLE ORGANIC-PHOSPHORUS (PHYSICAL-MIXIN G) (NOD).	FR368
FR369	FRACTION OF LITTER-PHOSPHORUS THAT FLOWS TO LABILE ORGANIC-PHOSPHORUS (PHYSICAL-MIXIN G) (NOD).	FR369
FR69	FRACTION OF PHOSPHORUS ROOT-DEATH WHICH FLOWS TO STABLE ORGANIC-PHOSPHORUS (NOD).	FR69
FR70	FRACTION OF LIVE TO DEAD CROWN-BIOMASS , USED IN PHOSPHORUS ROOT TO CROWN-TRANSLOCATI ON (NOD).	FR70
FR79	FRACTION OF FL79(I) THAT FLOWS TO LABILE ORGANIC-PHOSPHORUS (NOD).	FR79
FS(Y)	A FUNCTION WHICH RELATES SOIL-MOISTURE TO THE EFFECT OF SOIL-MOISTURE IN NUTRIENT-STR ATUM I (NOD).	FS(Y)
FSDP1	INITIAL-VALUE OF STANDING-DEAD PHOSPHORUS-CONCENTRATION (GM P/GM DW).	FSDP1
FSUM1	SUM OF ALL PHOSPHORUS-STATE-VARIABLES (GM P/M2).	FSUM1

Fig. 1. Alphabetic symbolic name list.

Significant Word in Definition List

Perhaps the most unique thing about the KWIC-SWID system is its ability to provide a list of significant words which point the user to a variable name. This concept is not new, since the program used in KWIC-SWID is a modification of the basic Key Word in Context Program, which is generally used to supply key words in journal and book titles.

Fig. 2 carries on the illustration for variable FSDPI. Here we note that the hyphenated words "STANDING-DEAD," which is part of the definition, is a significant word. The entries are sorted alphabetically by significant word.

One word of caution is necessary! The KWIC-SWID programs will select all words which appear in the definition. Consequently, a judicious selection of words (called STOP WORDS) which you *do not* wish the program to select is mandatory. The program must be supplied with these words. Fig. 3 is a partial list of the STOP WORDS used for the ELM 73 runs. The total list is about two and one-half times as large.

The selection of the words is very artsy-craftsy. About the only warning that can be given is not to make the STOP WORD list so small that your list becomes excessive or, conversely, so large that you eliminate at least one entry for each variable. The reader will note in Fig. 2 that the significant word "STANDING-DEAD" is hyphenated. KWIC-SWID interprets this as one word. This was done intentionally to make the significant word more meaningful. Further perusal of the definition of FSDPI will indicate that this particular example was a compromise when compared to the hyphenation in variable X(926). By hyphenating, you of course lose the sorting by each word. Obviously, you must determine which way you want the categorizations to go.

SIGNIFICANT-WORD	ARTICLE	REFERENCE
STABLE	STABLE ORGANIC-PHOSPHORUS IN NUTRIENT-STRATUM 4 (GM P/M2).	X(938)
STABLE	STABLE ORGANIC-PHOSPHORUS IN NUTRIENT-STRATUM 3 (GM P/M2).	X(928)
STANDING-DEAD	INITIAL-VALUE OF STANDING-DEAD PHOSPHORUS-CONCENTRATION (GM P/GM DW).	FSDPI
STANDING-DEAD	CONTRIBUTION OF MOISTURE TO MOVEMENT OF STANDING-DEAD TO LITTER (NOD).	PFALM
STANDING-DEAD	MEAN PHENOPHASE OF THE STANDING-DEAD OF PRODUCER I (NOD).	PHEND(I)
STANDING-DEAD	CONTRIBUTION OF RAINFALL TO MOVEMENT OF STANDING-DEAD TO LITTER (NOD).	PFALR
STANDING-DEAD	EFFECT OF MOISTURE AND TEMPERATURE ON THE TRANSFER RATE OF STANDING-DEAD TO LITTER (NOD).	PEOMT
STANDING-DEAD	MAXIMUM FRACTION OF STANDING-DEAD FLOWABLE TO LITTER PER DAY IN PRODUCER I (NOD).	PSLOS(I)
STANDING-DEAD	LOWER STORM SIZE LIMIT TO AFFECT STANDING-DEAD FALL TO LITTER (CM).	PSLRL
STANDING-DEAD	RATE OF TRANSFER OF STANDING-DEAD TO LITTER COMBINED FOR ALL PRODUCERS (G CB/DAY).	PSDFR
STANDING-DEAD	UPPER STORM SIZE LIMIT ABOVE WHICH NO FURTHER INCREASE IS OBTAINED IN MOVEMENT OF STANDING-DEAD TO LITTER (CM).	PSLRU
STANDING-DEAD	COEFFICIENT USED TO CALCULATE STANDING-DEAD PHENOLOGIES FROM PETDY(I), FOR PRODUCER I (CM H2O*C).	PP9(I)
STANDING-DEAD	MAXIMUM FRACTION OF PRODUCER I SHOOTS THAT CAN FLOW TO STANDING-DEAD PER DAY (GM CB/DAY).	PSDTM(I)
STANDING-DEAD	TOTAL OF ALL STANDING-DEAD (G DW/M2).	PTOSD
STANDING-DEAD	STANDING-DEAD STATE VARIABLES (GM CB/M2).	X(I),I=228-229
STANDING-DEAD-BIOMASS	TOTAL STANDING-DEAD-BIOMASS OF ALL PRODUCERS (G/M2).	STBSD
STANDING-DEAD-NITROGEN	INITIAL-VALUE OF STANDING-DEAD-NITROGEN CONCENTRATION (GM N/GM DW).	SSDNI
STANDING-DEAD-NITROGEN	STANDING-DEAD-NITROGEN (GM N/M2 .	X(801)
STANDING-DEAD-PHOSPHORUS	STANDING-DEAD-PHOSPHORUS (GM P/M2).	X(926)
STANDING-DEAD-PHOSPHORUS	SUM OF SHOOT AND STANDING-DEAD-PHOSPHORUS FLOW TO CONSUMERS (GM P/M2/DAY).	FFL1
STARVATION	PHOSPHORUS SHOOT CONCENTRATION STARVATION LEVEL (GM P/GM DW).	PSPL
STARVATION	NITROGEN SHOOT CONCENTRATION STARVATION LEVEL (GM N/GM DW).	PSNL
STARVATION	WEIGHT DEVIATION MARGIN BELOW EXPECTED FOR INITIATING DEATH BY STARVATION (NOD).	CWDM(I)
STARVATION	MINIMUM FOOD CARBON BELOW WHICH STARVATION OCCURS FOR CONSUMER I (G/M2).	CPKFB(I)
STARVATION	SUBROUTINE TO CALCULATE DEATH FROM CHORT, STARVATION, AND ADJUSTS VARIABLES FOR THESE PLUS PREDATION.	CDETH(I,J)
STARVATION	PROPORTION (FRACTION) OF ANIMAL POPULATION DYING FROM STARVATION IN SUBROUTINE CDETH (NOD).	CPROP
STARVES	FRACTION BELOW WHICH ANIMAL STARVES (NOD).	CSPMX
STOCHASTIC	IS THE FRACTIONAL INCREASE OR DECREASE OF THE DAILY RAINFALL SIMULATED BY THE STOCHASTIC WEATHER SIMULATOR.	ATRA
STOCHASTIC	IS THE DECREASE OR INCREASE (DEG. C) OF MAXIMUM AND MINIMUM AIR TEMPERATURE SIMULATED BY THE STOCHASTIC WEATHER SIMULATOR.	APTP
STOCHASTIC	IS THE FRACTIONAL INCREASE OR DECREASE OF THE WIND SPEED SIMULATED BY THE STOCHASTIC WEATHER SIMULATOR.	APWN
STOCHASTICALLY	THIS SUBROUTINE SIMULATES DAILY WEATHER OBSERVATION STOCHASTICALLY.	ASTCH
STOPS	RATIO SHOOTS/(SHOOTS+CROWNS+LIVE ROOTS) THAT STOPS CROWN TO SHOOT FLOW (NOD).	PUSTR(I)

Fig. 2. Significant word in definition list.

STOP WORDS

ABLE
ACCUMULATES
ADAMO
AEV
ALINT
ALWAYS
AMX
ANIMALS
APPLIED
ARE
ASSIGNED
ATMOSPHERIC
AWAY
BARES
BCT
BEGIN
BHODD+BHOPD
BIOMASS
BSTAG
CABPA
CALCULATIONS
CAPACITY
CATEGORIES
CB
CENTIGRADE
CFXA
CHANGE
CHAG
CNUAM
COMPARTMENT
CONCERT
CONSTITUENTS
CONTINUOUS
CONVERTS
COWNU
CPOP
CRANK
CURRENT
DATE
DEC
DEFNP
DETERMINE
DEVELOPMENT
DIFFERENT
DMER
DRIVING
DTEMP
ECOLOGICAL
EITHER
EQ
ESTABLISH
EXCEED
EXPONENT
FAR
FINIS
FL79
FORMATION
FREQUENCY
FUNC
GENERATED
GGES
GT
HE
HIM
IF

ABOVE
ACHIEVED
ADDED
AFFECT
ALINT1
AM
AN
ANLYS
APPLIES
AREA
ASSOCIATED
ATR
BAG
BARS
BDD1
BEING
BHOP
BODY
BURIED
CAL
CALLED
CARBON
CATEGORY
CBI
CENTIMETERS
CFXB
CHECK
CMAGE
CODING
COMPARTMENTS
CONDITIONS
CONTAINED
CONTRIBUTION
COORDINATES
COWON
CPROT
CRFOB
CURVE
DATO
DECREASE
DEG
DETERMINED
DEVELOPMENTAL
DIMENSIONS
DMOIS
DROPS
DUE
EDGE
ELEMENTS
EQUAL
ESTIMATE
EXCEEDS
EXPONENTIAL
FAVORABLE
FIRST
FNEFP
FORTRAN
FROM
FUNCTION
GENUS
GOING
HA
HEAT
HOURS
IMPLIES

ABOVEGROUND
ACLD
ADEP
AFIEL
ALL
AMN
AND
ANOBS
APPORTIONED
AROUND
AT
AVAILABLE
BALANCING
BASAL
BE
BELOW
BHOPA
BORN
BUT
CALCULATE
CAN
CARD
CAUF
CBIRT
CERTAIN
CF4
CHOMR
CMLOS
COLDER
COMPONENT
CONFIDENCE
CONTAINING
CONTROL
CORRESPONDING
COWS
CPRIN
CROP
CYCLE
DAY
DECREASES
DELIMITING
DETERMINES
DFREZ
DISCUSSION
DNCP
DRY
DURING
EFFECT
EMPTY
EQUALLY
ETC
EXCLUDING
EXTENT
FOLH
FLAG
FOLLOWING
FORWARD
FRPU
FVSW
GIVEN
GRAM
HAD
HELD
HOW
IN

ABS
ACRIR
ADJUST
AFTER
ALLOW
AMOD
ANI
ANY
APRA
ARRAY
ATMAX
AVERAGE
BAMAX
BASE
BECAUSE
BETWEEN
BHOPD
BOTH
BY
CALCULATED
CANCC
CARRIED
CAUSE
CBITT
CEV
CF4A
CINFL
CMORT
COMBINES
COMPONENTS
CONJUNCTION
CONTAINS
CONTROLLING
COULD
CO2
CPROF
CTEM9
CYCL1
DAYLIGHT
DEEPEST
DESCRIBING
DETERMINING
DFZTM
DISTRIBUTIONS
DO
DRYD
DW
EFFECTIVE
END
EQUALS
EVAPORATED
EXPECTED
FACTOR
FFLX
FLOW
FOOD
FOURTH
FS
FVSWC
GIVES
GRAMS
HALF
HER
HOWEVER
INCHES

ABSOLUTE
ACTIVE
ADJUSTS
AH
ALONG
AMONG
ANIM
APBS
APRF
ARRIVAL
ATMIN
AVSTM
BAPRO
BASIC
BECOMES
BGPRO
BHOPE
BOX
CABCK
CALCULATES
CANCL
CARWD
CAUSES
CODIG
CEWKG
CF4B
CLEAR
CM2
COMING
COMPUTES
CONSIDERED
CONTENT
CONVERSION
COWAG
CPHEN
CPRON
CTI
DAILY
DAYS
DEFINING
DESIGNATED
DEVELOP
DID
DLAYR
DOES
DRYING
EACH
EFFECTS
ENERGY
EQUATION
EVAPORATIVE
EXPELLED
FAHRENHEIT
FIELD
FLOWS
FOR
FRACTION
FSUM1
GENERAL
GIVING
GREAT
HAS
HG
H2O
INCLUDES

ACCESSIBILITY
ACTIVITY
ADT
AIR
ALSO
AMOUNT
ANIMAL
APEVA
APTH
AS
ATMOSPHERE
AW
BARE
BASIN
BEFORE
BGRES
BHT
BREAK
CABI
CALCULATING
CANFC
CATAGORY
CAVF
CDETH
CFX
CGRAMS
CH
CH3
COMPARES
CONCENTRATION
CONSISTS
CONTENTS
CONVERTING
COWKG
CPKFB
CPT
CTWKG
DATA
DEAD
DEFINITION
DESIRE
DEVELOPED
DIFFERENCE
DLYER
DRIVE
DT
EASY
EFFECTS
ENOUGH
EQUIVALENT
EVOLVED
EXPENDITURE
FALLS
FILLS
FLX
FORM
FRACTIONAL
FTPCN
GENERALLY
GM
GROUND
HAVE
HIGH
IDENTIFY
INCLUDING

Fig. 3. Stop word list.

Input List

The third and final printout is shown in Fig. 4. The main purpose of this list is to provide a means for documenting a set of typical values for inputs to the ELM model and to indicate the source of the information. The list is organized alphabetically by an arbitrary scheme of classification of the inputs. These are shown in the leftmost column. The hyphenation of the words within this classification is purposely done to force all variables from the same submodel to be sorted together. The first letter is the same as the first letter assigned by the modelers to a particular submodel of the ELM. By using this letter, the system will sort all variables of a given model together. Again, this method of grouping the categories of inputs was arbitrary for the ELM model. The KWIC-SWID system will sort according to these variables; it is just a case of how you wish to categorize as to how your input list will be ordered.

The reader will note that for all three lists the symbolic name definition is included. This was done purposely so that cross referencing between lists is not necessary.

INPUT DATA FORMAT

Fig. 5 depicts the required 80-column card input format for all cards. Lines 1, 8, and 9 illustrate the definition format. The symbolic name is included within columns 1 to 15; the definition is included from columns 18 to 80 with continuation on following cards up to six cards maximum. The definition may not extend past column 72 on the sixth card. The termination of the definition is indicated by a ". $." Examples are shown on lines 12, 17, and 18. Notice that all cards must have the symbolic name in columns 1 to 15.

D-DEPTH-STRUCTURE	INTEGER ARRAY CONTAINING THE INDICES OF THE SOIL WATER LAYERS (SEE ADEP) DELIMITING T HE UPPER (DLAYR(1) TO DLAYR(2)), MIDDLE (DLAYR(3) TO DLAYR(4)) AND LOWER (DLAYR(5) TO DLAYR(6)) BELOWGROUND LITTER COMPARTMENTS (NOD).	DLAYR(I)
	1,2,3,3,4,7 (ED)	
D-LEACHING	ARRAY OF PARAMETERS DEFINING THE EFFECT OF THE RATE OF WATER MOVEMENT INTO THE SOIL O N THE LEACHING OF THE LABILE COMPONENT OF SURFACE LITTER (1/(DAYS*CM H20),I=1) (CM H2 O, I=2).	DLECH(I)
	0.5,1.0 (DD * BROWN AND FREDERICK, 1968)	
D-LEACHING	ARRAY GIVING THE COORDINATES OF J POINTS (J<4) DEFINING THE RELATIONSHIP BETWEEN THE TEMPERATURE (I=1) AND ITS EFFECT ON THE RATE OF LEACHING(I=2) (C,I=1) (NOD,I=2).	DLECP(I,J)
	-16.7,0.,42.,1. (DD * NYKVIST, 1959)	
D-MECHANICAL-TRANSFER	THE RATE OF MECHANICAL-TRANSFER OF SURFACE LITTER AND DECOMPOSERS TO THE UPPER BELOWG ROUND LITTER LAYER (1/DAYS).	DMELI
	0.00014 (ED)	
D-MECHANICAL-TRANSFER	PARAMETER CONTROLLING THE EFFECT OF WATER INTERCEPTED BY STANDING DEAD ON THE RATE OF TRANSFER OF STANDING DEAD TO LITTER (G CB/(CM H20*M2)).	DSCMO
	2000 (ED)	
D-MISCELLANEOUS	FACTOR FOR CONVERTING VARIABLES FROM CARBON TO DRY WEIGHT. (GM DW/GM CB).	DCBIO
	2.5 (BASED ON THE ELEMENTAL COMPOSITION OF CARBOHYDRATES)	
D-RESPIRATION	MAXIMUM GROWTH YIELD FOR DECOMPOSERS (GM DECOMPOSER CB/GM SUBSTRATE CB).	DECOE
	0.6 (DC * PAYNE, 1970)	
D-RESPIRATION	ARRAY OF PARAMETERS DEFINING THE EFFECT OF TEMPERATURE ON THE MAINTENANCE ENERGY REQU IREMENT (DMER) OF ACTIVE DECOMPOSERS (I=1, 1/DAYS; I=2, DEG. KELVIN; I=3, NOD).	DMAIP(I)
	2.51,-10000.,32.24 (DD * MARR, ET AL., 1963, SCHULZE AND LIPE, 1964)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN THE STANDING DEAD OF PRODUCER I, I=1, IPSPS (NOD).	DLASD(I)
	0.21,0.21,0.25,0.21,0.17 (DD * WALLACE, 1969)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN INSECTS (NOD).	DLABG
	0.3 (ED)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN SEEDS (NOD).	DLASE
	0.2 (ED)	
D-SUBSTRATE	THE ARRAY OF PARAMETERS RELATING THE PROPORTION OF LABILE CONSTITUENTS IN ABOVEGROUND LIVE PLANTS TO THE NITROGEN TO CARBON RATIO. (I=1, NOD; I=2, (G CB/ G N)**DNCP(3); I =3, NOD).	DNCP(I)
	-.0216,1.348,.333 (DD * PINCK ET AL., 1950)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN MAMMALS (NOD).	DLABM
	0.3 (ED)	
D-SUBSTRATE	THE PROPORTION OF RESISTANT MATERIAL IN DECOMPOSERS (NOD).	DMICM
	0.497 (DC * JENSEN, 1932)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN DECOMPOSERS (NOD).	DMICS
	0.5 (DC * JENSEN, 1932)	
D-SUBSTRATE	THE PROPORTION OF LABILE MATERIAL IN FECES (NOD).	DLABF
	0.08 (DD * FLOATE, 1970)	
F-CONCENTRATIONS-INITIAL	INITIAL-VALUE OF STANDING-DEAD PHOSPHORUS-CONCENTRATION (GM P/GM DW).	FSDPI
	0.0006 (ED)	
F-CONCENTRATIONS-INITIAL	INITIAL-VALUE OF CROWN-PHOSPHORUS CONCENTRATION (GM P/GM DW).	FCRPI
	6.0E-4 (COLE,C.V. AND J.C. DENTON, 1974)	
F-CONCENTRATIONS-INITIAL	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LITTER (GM P/GM DW).	FLTPI
	6.0E-4 (COLE, C.V. AND J.C. DENTON, 1974)	
F-CONCENTRATIONS-INITIAL	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LIVE-ROOTS (GM P/GM DW).	FLRPI
	7.0E-4 (COLE,C.V. AND J.C. DENTON, 1974)	
F-CONCENTRATIONS-INITIAL	INITIAL-VALUE OF PHOSPHORUS-CONCENTRATION IN LIVE-SHOOTS (GM P/GM DW).	FLSPI
	0.0021 (COLE, C.V. AND J.C. DENTON, 1974)	
F-CONSUMER-PARAMETER	FRACTION OF CONSUMER-INTAKE-PHOSPHORUS THAT IS EXPELLED AS URINE (NOD).	FURNC
	0.05 (TILLMAN, A.D. ET. AL., 1958,1959)	
F-CONSUMER-PARAMETER	CONSUMER-PHOSPHORUS CONCENTRATION (GM P/GM CB).	FCIV
	0.0463 (DD, SEE TEXT)	
F-CONSUMER-PARAMETER	FRACTION OF CONSUMER-INTAKE-PHOSPHORUS THAT IS EXPELLED AS FECES (NOD).	FFECC
	0.95 (TILLMAN,A.D.,ET.AL., 1958,1959)	

Fig. 4. Input list.

IBM

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

PROGRAM | PUNCHING INSTRUCTIONS | GRAPHIC | PAGE OF
PROGRAMMER | DATE | PUNCH | CARD ELECTRO NUMBER

INTERNAL VAR.
INPUT VAR.

			FORTRAN STATEMENT		IDENTIFICATION SEQUENCE	
VARIABLE	(I, J, K)	**DEFINITION .	$			1
"	"	VARIABLE-TYPE		30 CHARACTER LIMIT		2
"	"	ALE	VALUE 1, VALUE 2, VALUE 3, VALUE 4, VALUE 5, VALUE 6, VALUE 7, VALUE 8, VALUE 9, V			3
"	"	ALE	ALUE 10, VALUE 11 (SOURCE)			4
"	"	BISON	VALUE 1, ...			5
		:				6
"	"	PAWNEE	VALUE 1, ...			7
VARIABLE	(I, J)	DEFINITION .	$			8
VAR		DEFINITION .	$			9
						10
						11
FMBM	(I	*MICROBIAL BIOMASS WITHIN STRATA I.	(GM/M2). $			12
"	"	P-PARAMETER-VECTOR				13
"	"	ALE	0.0045, 0.010, 0.010, 4*100.0, 500 (COLE, 1942)			14
"	"	:				15
"	"	PAWNEE	...			16
FCIV		INITIAL VALUE OF CONSUMER PHOSPHORUS CONCENTRATION FOR THE FIRST NUTRIENT STRATA ...			(GM P/GM CB)	17
"		. $				18
FRRT	(I)	I = 1. AMOUNT ...				19

Fig. 5. Examples of how data must be formatted for inputting to the KWIC-SWID system.

Column 16 is reserved to indicate whether a symbolic name can be output via SIMCOMP. An asterisk implies that it cannot; therefore, it is considered to be an internal variable. An asterisk in column 17 implies that the variable is an input to the model. These asterisks are the symbols which the KWIC-SWID program utilizes as information to make decisions as to how to handle the input data.

With the information discussed so far KWIC-SWID can generate the lists shown in Fig. 1 and 2. For Fig. 4, the Input List, cards of the type shown on lines 2, 3, and 4 (Fig. 5) are required. The line 2 card specifies the categorization by which list 3 is sorted. The information is punched on a separate card with the symbolic name. The variable-type, as it is called on line 2, is limited to 30 characters, starting in column 18. An ELM 73 example is shown in line 13.

To indicate the numerical values and the reference or source of the values, cards similar to lines 3 and 4 are required. The site designation is included (after the symbolic name) starting in column 18 and ending in column 27. (A site may also be considered as another set of input data, since it results in a different Input List.) The numerical values start in column 28 and may continue on as many as 24 cards in all (see lines 3 and 4). For other sites, a similar set of cards is required. Another feature is the ALL site categorization (see line 14). This allows the same set of values to apply to all sites. The number of sites is limited only by the time it takes the program to search for the designated sites input cards. Following the last numerical value, the source or some notation may be included in a set of parentheses. If no reference is made, then a right parenthesis must be included, since this alerts the program that the information is ended.

HOW TO RUN THE KWIC-SWID PROGRAMS

For information on the KWIC-SWID programs and how to operate the system, interested persons should contact the senior author at the NREL Data Processing Group (Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, Colorado 80523).

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