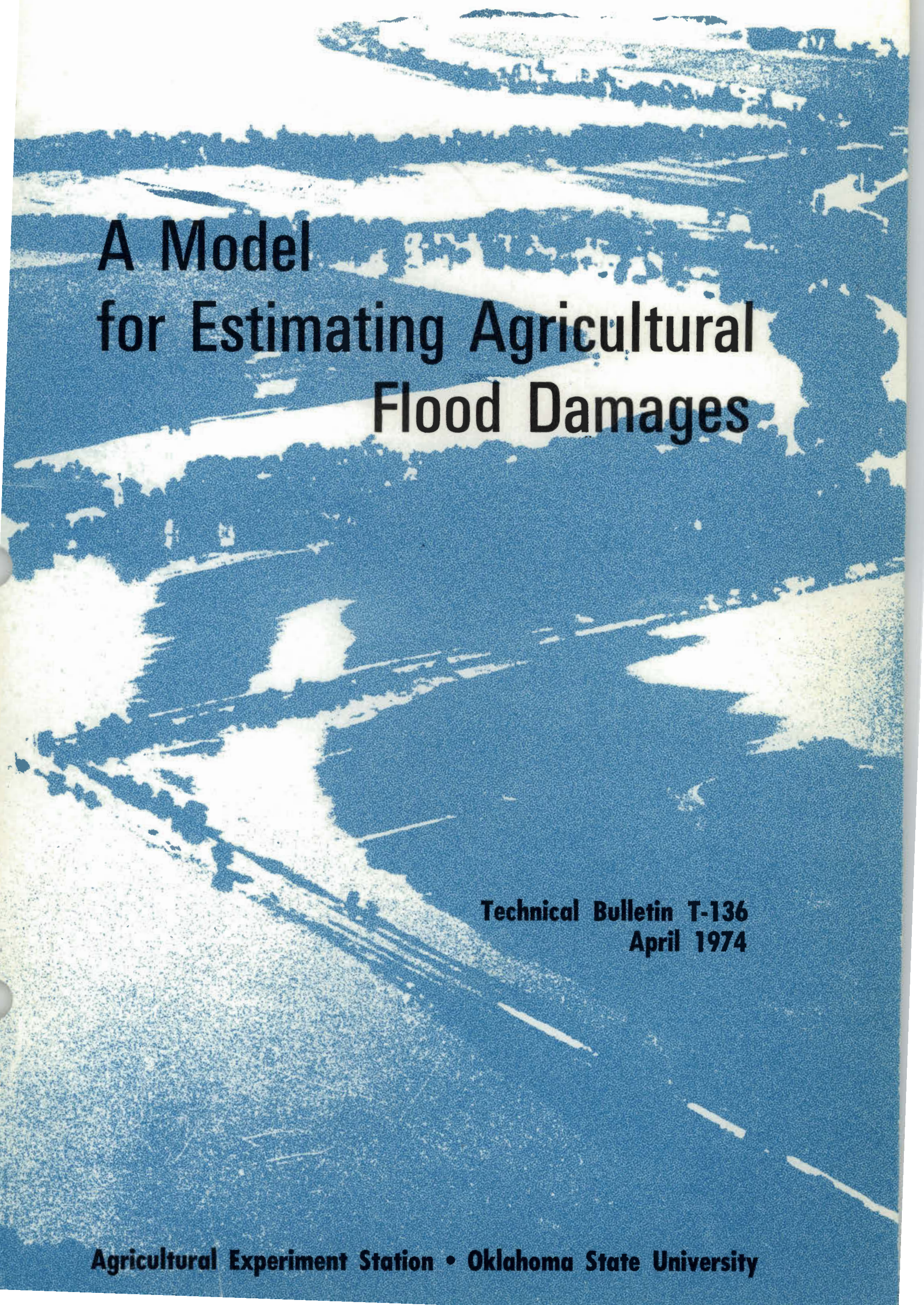

A Model for Estimating Agricultural Flood Damages

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CONTENTS

Abstract

This bulletin develops procedures for estimating flood damages by tract of land, considering the land use, productivity, depth of inundation, and location of the tract in the watershed. Two computer programs for applying the procedures in watershed planning are presented and their uses are illustrated.

One program, referred to as the General Routine, provides estimates of acres inundated by flood size, flood damages by flood size, average annual flood damages on any selected area of the watershed, average annual benefits by tract of land for proposed systems of structures, and flood damages for each land use pattern specified. The second program, referred to as the Optimizing Routine, estimates net returns and flood damages by tract for each land use considered. It selects the land use for each tract that maximizes expected returns net of production costs and flood damages. It also selects the second most profitable land use and computes the product price stability for the most profitable land use.

An application of the two routines in the Nuyaka Creek watershed in Eastern Oklahoma illustrates how the two programs can be used to evaluate alternative protection plans, estimate flood insurance premiums, calculate assessments on beneficiaries for flood protection, and select improved land use patterns. Although the methodology and programs were developed for use in watershed planning and evaluation, the application indicates they may be very useful in farm management extension programs.

A Model for Estimating Agricultural Flood Damages

Vernon R. Eidman and Ronald D. Lacewell*

Flood damages in agricultural areas have been increasing in the United States during recent years [12, p. 3]. The increased flood damages have resulted from a number of factors, but have occurred primarily because of more intensive use of flood plain acreage (land subject to flooding) [12, p. 13]. Flood plain acreage was originally in uses characterized by low per acre returns and a high degree of tolerance to flood water (such as native pasture and woodland). These uses have been replaced in many areas by cropping enterprises requiring more nonland inputs. These enterprises (cotton, grain, alfalfa, improved pasture, and others) often have in many flood plain locations both a higher potential per acre return and a higher average return even in the event of flooding. Because of the greater nonland inputs and higher potential yields, they also tend to incur a larger loss from a flood of given severity. Consequently, flooding of the same frequency and severity results in greater damages after a flood plain has been devoted to more intensive uses.

Flood plain land typically has a relatively high level of natural productivity which encourages conversion to more intensive enterprises. In addition, changing technology can be expected to increase the per acre value of nonland inputs for intensive enterprises. Because of these changes, floods of given intensity are expected to cause even greater losses in future years given the present level of flood protection [13, p. 27].

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*Professor, Department of Agricultural Economics, Oklahoma State University, and Assistant Professor, Department of Agricultural Economics, Texas A&M University, respectively. This research was conductd by the Department of Agricultural Economics in cooperation with the Natural Resources Economics Division of the Economic Research Service, U. S. Department of Agriculture. Ronald Lacewell was on the staff of the National Resources Economics Division at the time of the research.

The authors are indebted to Neil Cook, Gordon Sloggett, Don Jones, Darrell Kletke and the Soil Conservation Service of the U.S. Department of Agriculture for their assistance and cooperation. Gratitude is also expressed to the many others that reviewed the manuscript and research during the various stages of development.

This trend in agricultural flood losses suggests that individual flood plain evaluations should involve two distinct but related types of analyses. One is flood protection as a means of curbing or reducing losses attributable to flooding. This type of evaluation involves an economic appraisal of the reduction in flood damage resulting from alternative flood protection measures formulated for a particular watershed. A thorough flood plain evaluation also considers a second type of evaluation—land use adjustment. This type of evaluation involves estimating flood damages for alternative land uses throughout the flood plain.

Both types of flood plain evaluation require procedures for estimating flood damages. Furthermore, procedures that estimate the incidence of flood damages are needed for these evaluations since this permits the calculation of returns net of average annual flood damages and production costs by land use and flood plain location.[1] It is useful to identify both average annual flood damages and expected profit by land use throughout the flood plain since efforts to minimize or reduce flood damages do not necessarily maximize profits. For example, flood plain land use adjustments made to increase profits may also increase flood damages because of an allocation of flood plain land to higher value land uses. Conversely, increased flood damages could bring about reduced profits or inefficient flood plain use.

Government agencies working with flood losses and involved in watershed evaluation have formulated procedures for estimating losses resulting from floodwater. These procedures estimate flood damages with either an historical or a frequency method. The frequency method calculates flood damages for as many as six flood sizes, selected to represent the distribution of floods in the watershed; i.e., once-a-year flood, floods occurring every 2 years, 5 years, etc., up to a 50- or 100-year flood[2]. The procedures formulated are particularly useful in estimating flood losses for relatively large areas such as an evaluation reach.[3] Damage estimates are typically based on a composite acre for the evaluation reach.[4] Basing estimates on the composite acre and elevations on the cross sections precludes making estimates for areas smaller than the evaluation reach because both land use and elevation (and hence level of inundation) at a given location are unspecified. Thus, criticism of present estimating procedures is not directed toward the accuracy of the model for relatively large areas, but toward the inaccuracy and difficulty

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[1] Average annual flood demages refers to the damages that would be expected in any given year for a specified land use considering alternative flood sizes and their probability of occurrence.

[2] A modification of the frequency method was used in this study and is discussed in conjunction with the computational procedure. The historical method computes damages based on the record of actual floods in the watershed, and considers up to 150 separate storms.

[3] An evaluation reach typically includes flood plains on both sides of the channel and one or more cross sections. The cross sections are frequently more than 3,000 feet apart.

[4] A composite acre is a hypothetical acre of flood plain, composed of the proportion of each land use found in the evaluation reach.

of obtaining flood damage estimates for a large number of individual fields.

This publication discusses a procedure that may be used to more accurately estimate flood damages by small tract located on flood plains used for agriculture. Two computer programs that may be used to apply the methodology in planning watersheds are presented and explained. The computer programs are used to apply the procedure to the Nuyaka Creek flood plain in Eastern Oklahoma to illustrate that the disaggregated damage estimates can be used to establish: (1) more equitable assessments of the local costs of flood protection, (2) annual premiums for flood insurance, and (3) cropping patterns having the greatest expected net returns.

The Methodology

The model integrates some procedures presently used in estimating agricultural flood damages with some new techniques. The model uses the basic mechanics of the frequency method of flood damage estimation. However, the computation of flood damages is based on a point sample method, rather than the concept of a composite acre [1]. The point sample used is a uniform assignment of sample points throughout the flood plain, with each sample point representing a specified number of acres. Flood damages are computed for each of the sample points assigned throughout the flood plain, with the damages based on unique characteristics of the point (land use, location, soil productivity, elevation of the sample point, and flood elevation).

The computational procedure uses data presently available in flood damage studies; i.e., crop damage factors, cross section data, and hydrology through which flood elevation data are determined. Crop damage factors, typically used in discrete form, are converted to continuous functions, thus increasing the sensitivity of flood damages to depth of inundation.[5]

The model is composed of a series of computational steps for each sample point contained in the portion of the flood plain being studied. The sequential steps for a sample point are: (1) calculate elevation, (2) calculate depth of inundation for specified flood sizes, (3) weight seasonal damage factors by the seasonal probability of flooding and convert to a continuous function of inundation depth, (4) calculate flood damages, (5) determine proportion of potential gross revenue lost to expected flooding, and (6) calculate returns net of production costs and average annual flood damages. A modification of the model adds a seventh

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[5] Crop damage factors are the percentage reduction in gross value for a given depth of inundation increment and season.

step to determine the land use that maximizes returns net of production costs and average annual flood damages for the sample point.

These estimates can be made for a sample point or any combination of sample points up to the number representing the entire flood plain. Thus, flood damage estimates can be derived for one sample point, one field, one farm, a group of farms or the entire flood plain, depending on the requirements of the person using the model. The input data required, type of computational procedures, and results obtained for each step or segment of the model are presented below.

Sample Point Elevation

The first segment estimates the elevation of each sample point by relating the sample point to the appropriate cross section. Input data are the measured elevations at Stations across the channel (cross section stations), feet between stations, total stations on each channel side, and sample point location.[6] For instance, the elevation of a sample point on the left channel bank is computed using the following relationships:

$$(1) \quad \text{LDIST} = \text{LSTA} \bullet \text{LINTER}$$

$$(2) \quad D_p = \text{XOCATE} \bullet \text{LDIST}$$

$$(3) \quad \frac{D_p}{\text{LINTER}} = \text{SSTA} \rightarrow \text{ELV}$$

where

LDIST = total feet of flood plain from channel to left boundary,
LSTA = number of stations on cross section for flood plain located left of the channel,
LINTER = feet between stations left of the channel,
D_p = feet sample point would lie from channel bottom if it were located on the cross section,
XOCATE = sample point location as a proportion of the distance from the channel bottom to flood plain edge,
SSTA = number of stations of the sample point would lie from channel bottom if located on the cross section, and
ELV = elevation of the sample point that corresponds to the elevation on the cross section at station SSTA.

The procedure determines where the sample point would lie if it were located on the cross section. The elevation of the cross section at that point is assigned to the sample point. The elevation of a sample point falling between two stations on a cross section is calculated by using the elevation of the nearest station on each side of the sample point, and applying linear interpolation procedures.

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[6] The location of a sample point is designated by channel side, and by the point's distance from the channel expressed as a proportion of the distance from the channel to the flood plain boundary.

Depth of Inundation

The frequency method of computing flood damages requires the selection of a series of discrete storm (flood) sizes to represent the distribution of floods in the watershed. Hydrologists typically select the storm sizes and calculate peak flood evaluations throughout the watershed for each storm size. The second segment of the model uses this information to determine the depth of inundation at each sample point for each flood size. Inundation depth for each sample point by storm size is calculated as:

(4) $\mathrm{DEPTH}_k = \mathrm{FELV}_k - \mathrm{ELV}$

where

DEPTH_k = depth of inundation for flood size k, and

FELV_k = flood elevation at the cross section which represents the sample point.

Depth of inundation for flood size k equals the peak elevation of the flood minus the sample point land elevation computed in the previous step. Each sample point has a depth of inundation associated with each of the flood sizes. A negative inundation depth for a specific flood size indicates that the land elevation of the sample point exceeds that of the flood and, hence, no flooding occurs.

An accounting procedure is included in the model to measure acres inundated by flood size. The number of sample points with a positive inundation depth are summed for each flood size and expanded to the acres the points represent.

Damage Factors

Damage factors used in current methods of estimating flood losses represent the percent reduction in expected gross returns by crop and season for an increment of inundation, such as inundation from 0 to 1 foot, 1 foot to 3 feet, and 3 feet or more.[7] These factors expressed as a decimal are used as input data by the model but are weighted by the seasonal probability of flooding to allocate the flood over all seasons and prevent overestimating flood damages. The weighted seasonal damage factor is computed as:

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[7] The Soil Conservation Service of the U.S. Department of Agriculture estimates seasonal damage factors for individual crops or groups of crops based on flood occurrence and experiments. The variable considered most important in accounting for the amount of loss on a given crop in a specified season is depth of inundation. Thus, damage factors are estimated for several depth of inundation intervals. However, these damage factors are inaccurate to the extent that other variables, such as duration of inundation, floodwater velocity and sediment deposition, deviate from the average of these conditions found on the flood plains on which the damage factors were obtained.

(5) $SDAMA_{ij} = SWAIT_i \bullet FACTOR_{ij}$
where

$SDAMA_{ij}$ = proportion of reduction in gross returns from flooding in season i at inundation depth increment j, adjusted for seasonal probability of flooding,
$SWAIT_i$ = probability of a flood occurring in season i, and
$FACTOR_{ij}$ = proportion of reduction in gross returns from flooding in season i for inundation depth increment j.[8]

The model converts these weighted damage factors for the jth discrete inundation increment to a linear function of inundation depth. To convert from a single damage factor for an inundation depth increment to a functional relationship between damage factors and inundation depth, the weighted damage factor for an inundation increment is assumed to be the factor for the midpoint of that increment and is assigned to the median depth of inundation for the increment. Using these midpoints as boundaries of redefined inundation intervals and connecting the plotted values with straight-line segments, a unique damage factor for each depth of inundation is obtained. The computations are accomplished algebraically for a given depth of inundation μ (where μ is a specific level of inundation rather than an interval) and crop for season i as:

(6) $SDAMA_{i\mu} = SDAMA_{ij} + b_{ij}(DEPTH_{\mu} - DE_j)$
where

$SDAMA_{i\mu}$ = weighted damage factor applicable in season i for depth of inundation μ,
$SDAMA_{ij}$ = weighted crop damage factor for season i at the start of the redefined interval j within which $DEPTH_{\mu}$ is located,
$DEPTH_{\mu}$ = depth of inundation for which a damage factor is sought,
DE_j = depth of inundation at the beginning of the redefined interval j, in which $DEPTH_{\mu}$ is contained; i.e., the level of inundation at which $SDAMA_{i\mu} = SDAMA_{ij}$, and
b_{ij} = change in the weighted damage factor for season i per unit change in depth of inundation for the redefined inundation interval j in which $DEPTH_{\mu}$ occurs.

The value of b_{ij} is 0 for the upper inundation interval (such as 3 feet or more). Thus the damage factor reaches a maximum and remains constant for greater inundation levels.

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[8] The more complete definition of $FACTOR_{ij}$ as used by the Soil Conservation Service, U.S. Department of Agriculture is: The value of the yield reduction plus the variable costs of extra cultural operations necessitated by the flooding minus the variable costs of operations reduced or eliminated as a consequence of the flooding, divided by expected flood-free gross returns.

Calculating Flood Damages

The fourth segment of the model uses the crop damage factors to compute average annual damages by flood size for each sample point. Expected damage per acre from flood size k for a sample point r are given by

$$(7)\quad DAMA_{kr} = \sum_{i=1}^{n} [(GVAL_r)\,(SDAMA_{i\mu})]$$

where

$DAMA_{kr}$ = expected annual damages per acre resulting from flood size k at sample point r,
$GVAL_r$ = gross value per acre of the crop produced on sample
n = point r, assuming no flooding, and
total seasons considered.

The expected damages per acre from flood k ($DAMA_{kr}$) are the total gross value of the crops assuming no flooding occurs ($GVAL_r$), multiplied by the weighted damage factor for each season ($SDAMA_{i\mu}$) expressed as a decimal. The resulting expected damage value ($DAMA_{kr}$) applies to a given flood size k, and land use at point r, with no specification as to the season in which the flood occurred. Since flood k is a possible rather than an actual flood, there is no way of knowing in which season it occurs. Therefore, the damages that result in each season if flood size k occurs are weighted by the seasonal probability of flooding. Summing the weighted seasonal damage estimates gives estimated annual damages from flood size k.

The expected damages ($DAMA_{kr}$) computed for each of the several flood sizes selected are used to estimate average annual flood damages on the acres represented by a sample point as follows:[9]

$$(8)\quad TDAMA_r = \sum_{k=1}^{K} \left[\frac{(DAMA_{kr} + DAMA_{(k+1)r})}{2} \bullet (SWEIGH_r - SWEIGH_{(k+1)})\right] \bullet SPA$$

where

$TDAMA_r$ = average annual flood damages on the acres represented by sample point r,
$SWEIGH_i$ = probability of the k^{th} flood size occurring in any given year,
SPA = expansion factor (the number of acres each sample point represents, and
K = the number of floods considered.

Hydrologists specify the frequency of occurrence for each of the k flood sizes. The probability of each flood occurring in a given year ($SWEIGH_k$) is obtained by simply dividing the number 1 by the frequen-

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[9] The assistance of Don Jones, Soil Conservation Service, U.S. Department of Agriculture, in developing this equation is gratefully acknowledged.

cy of the flood in years. Multiplying the average damages expected considering two consecutive flood sizes by the difference in the probability of occurence of the two floods in any given year results in the expected annual damages per acre with the two flood sizes and avoids double counting. One other frequency point is added when applying the equation. A flood that is equal to the largest flood size specified is included and assumed to have a frequency of occurrence of infinity or probability of occurrence of zero. The procedure underlying equation (8) will relate damages from a specific flood size to the total damages in the same proportion that the specific storm relates to the total storm series. Summing average annual crop damages per acre over each two consecutive flood sizes and multiplying by the acres each sample represents gives estimated average annual damages on the acres represented by a sample point.

Average annual crop damages for any combination of R sample points (such as one field or one farm) is obtained by summing average annual damages for each sample point included in the delineated area. The calculation is as follows:

$$(9) \quad XDAMA = \sum_{r=1}^{R} TDAMA_r$$

where

XDAMA = average annual damages for the R points, and

R = number of sample points representing the portion of the flood plain for which average annual damages are desired.

Summing the expanded average annual flood damages for all sample points representing any portion of the flood plain, whether it is one field, one farm, or a group of farms gives total expected average annual damages for that area. Likewise, summing the expanded average annual damages of all sample points comprising the flood plain gives the expected average annual flood damages for that flood plain.

Proportion of Gross Value Lost to Flooding

Gross returns, assuming no flooding, is computed for the entire flood plain as:

$$(10) \quad COMRET = \sum_{r=1}^{R} [(GVAL_r)\ (SPA)]$$

where

COMRET = total flood plain gross value of crops if no flooding occurs, and

R = all sample points in the flood plain.

This procedure expands the expected gross value of crops for each sample point, if no flooding occurs, from a per acre basis to a total value for all acres represented by the sample point. Summing the expanded value for all sample points gives the expected gross returns for the flood plain assuming no flooding.

Watershed planners are frequently interested in determining the average proportion of potential gross returns lost to flooding. The percent that average annual flood damages represent of the expected aggregate gross returns is computed as follows:

$$(11)\ \mathrm{CDAMPE} = \frac{\mathrm{XDAMA}}{\mathrm{COMRET}} \bullet 100$$

where

CDAMPE = percent that flood plain average annual damages represent of flood plain gross returns with no flooding.

The calculation consists of dividing average annual damages for the flood plain by gross returns with no flooding. The result gives some indication of the extent of flood damages relative to gross returns.

Net Returns Considering Flooding

The computation of returns net of production costs and average annual flood damages is included in the model as a user's option. The computation for sample point r can be expressed as:

$$(12)\ \mathrm{PROFIT}_r = \mathrm{GCVAL}_r - [(\mathrm{COST}_r \bullet \mathrm{SPA}) + \mathrm{TDAMA}_r]$$

where

PROFIT_r = returns net of production costs and average annual flood damages for the acres represented by sample point r,

GCVAL_r = gross value for the crop produced on the acres represented by sample point r assuming no flooding, and

COST_r = per acre production cost for the crop produced on sample point r.

Net returns can be obtained for any portion of the flood plain by accumulating the net returns for the sample points included in the designated land tract.

General Routine

Application of the above methodology to a series of sample points involves many computations. A computer program, referred to as the general routine, is given in Appendix B. The general routine can be used to compute the elevation, inundation depth by flood size, flood damages, the proportion of potential revenue lost to flooding and returns net of production costs and average annual flood damages for each sample point in a designated portion of the flood plain.

In planning flood plains it is frequently desirable to determine the optimum land use for each level of protection being considered. The additional computations required to determine the most profitable land use at each sample point are outlined in the following section. A second computer program, referred to as the optimization routine, can be used to apply the methodology to flood plains.

Optimization Routine

The optimization routine computes the returns net of production costs and average annual flood damages for each alternative land use (crop at a sample point) and selects that land use having the greatest expected net returns. Net returns by crop for each sample point are calculated by subtracting the crop's average annual flood damages from its net revenue, assuming no flooding. The computation is :

(13) $\text{PROFIT}_{sr} = (\text{DTRTN}_{sr} \bullet \text{SPA}) - \text{TDAMA}_{sr}$

where

$\text{PROFIT}_{sr}=$ net returns for crop s on acres represented by sample point r, considering flooding,
$\text{DTRTN}_{sr}=$ per acre net returns for crop s on sample point r, assuming no flooding, and
$\text{TDAMA}_{sr}=$ average annual flood damages for crop s on the acres represented by sample point r.

The model continues by checking each of the net return values (PROFIT_{sr}) on sample point r. The largest value for the variable PROFIT_{sr} on sample point r is selected as the optimum land use and the next largest value as second best land use. In notation form the optimum can be given as:

(14) $\text{OPTUM}_r = \max_s \text{PROFIT}_{sr}$

where

$\text{OPTUM}_r =$ the largest net return value on the acres represented by sample point r considering flooding.

Selection of the second most probitable use can be expressed as:

(15) $\text{OPTUM2}_r = \text{2nd}_s \text{PROFIT}_{sr}$

where

$\text{OPTUM2}_r =$ the second largest net return value on the acres represented by sample point r considering flooding.

The optimum and second most profitable land uses for sample point r (LDUSE_r) are identified from the subscript s on max PROFIT_{sr} and 2nd_s PROFIT_{sr}.

The above procedure selects the optimum and second best land uses at sample point r for a given set of prices. As product prices change the optimum land use may change. Some insight into the stability of the optimum land use solution is provided by computing the product price for the optimum land use required to make $PROFIT_{sr}=2nd_s\ PROFIT_{sr}$. The optimum land use price at sample point r that gives net returns equal to the second best land use is computed by:

$$(16)\quad CPRICE_{hr} = \frac{\left(\dfrac{OPTUM2_r}{SPA}\right) + PCOST_{hr}}{YIELD_{hr} - (Fac_{hr} \bullet YIELD_{hr})}$$

where

$CPRICE_{hr}=$ price of optimum land use (h) on point r that gives net returns equal to second best land use,

$PCOST_{hr}=$ per acre production costs of optimum land use (h) on point r.

$YIELD_{hr}=$ per acre yield of optimum crop on point r, and

$Fac_{hr}=$ percentage reduction in gross returns due to flooding on sample point r with optimum land use (h).

To place the price change ($CPRICE_{hr}$) into prospective, the optimizing routine calculates the percentage decrease in the price of the profit maximizing land use required to make $PROFIT_{sr}=2nd_s\ PROFIT_{sr}$. The calculation is expressed as:

$$(17)\quad XPRICE_{hr} = \frac{PRICE_{hr} - CPRICE_{hr}}{PRICE_{hr}} \times 100$$

where

$XPRICE_{hr}=$ percentage decrease in the per unit price of optimum land use h on point r that gives net returns equal to second best land use,

$PRICE_{hr}=$ current price of optimum land use h on point r.

The computer program referred to as the optimization routine is listed in Appendix B. This routine applies to the above procedure and provides, by sample point, estimates of: (1) average annual flood damages of each crop considered in the flood plain, (2) gross returns with no flooding for all crops considered, and (3) net returns for all crops considering flooding. Data calculated and accumulated over the flood plain for optimum and second best land use, respectively, include: (1) acreages of each crop with optimum and second best land use, (2) gross returns with no flooding, (3) expected net returns considering flooding, (4) production costs, and (5) average annual flood damages.

Data Requirements and Sources

The model outlined above uses much of the same information on crop damage factors, cross section elevation data, and hydrology that is normally developed for flood damage studies. The input data requirements of the model can be separated into three classifications. The first classification is the data applicable to the flood plain as a whole or the aggregate flood plain, and includes statistics on historical flooding, specific flood sizes used in the analysis, crop damage factors, and crop characteristics (yield, price per unit and production costs) by designated soil productivity groups.

The second classification refers to the data required for the part of a flood plain represented by a specific cross section. Input data include elevations of the flood plain at each station on a cross section and the elevation at each cross section for each flood size considered in the analysis.

The last classification refers to sample point data and includes land use, location in the flood plain, and soil productivity group. The productivity groups for a flood plain may be designated by combining soil types having similar physical characteristics (including texture, slope, depth of topsoil, permeability, and water-holding capacity) resulting in similar yield response to variable inputs (seeding rate, fertilizer levels, irrigation water, pesticides and cultural practices). Thus, soils within a productivity group have about the same gross returns, cash production costs, and net returns per acre for a given crop. If either the yields or the variable production expenses differ by crop for two soils, they should be placed in separate productivity groups. Defining the productivity group of a sample point requires identifying the soil type and determining which productivity group includes the soil.

Some of the above data are modified or serve only as a facility for obtaining other data before being applied to the point sample procedure of flood damage estimation. The following discussion indicates possible sources of specific data and presents a means of organizing and developing input data utilized by the model.[10]

Flood Plain

Study Area Delineation—Large scale aerial photos (1″=400′ for example) are an effective vehicle for delineating the flood plain boundaries and establishing the location of sample points. Boundaries of the flood plain with no detention structures are normally established by SCS hydrologists in developing a watershed plan. Also, SCS personnel locate

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[10] Formation of input data and organization of the data deck for the two computer routines are explained in Appendix C.

cross sections on the channel and outline that part of the flood plain each cross section represents.

With the flood plain boundaries located, a grid of sample points is assigned within the flood plain. The density of sample points is based on the physical characteristics of the flood plain. Since computations for a sample point are on a per acre basis, an expansion factor is necessary to expand the data to the area represented by a sample point. Assuming the sample point density rate is such that each sample point represents five acres, the expansion factor is five.

The current version of the computer routines accommodate no more than 196 sample points for each cross section area (the part of the flood plain represented by a cross section), but there is no limit on the number of cross sections that may be analyzed. If the number of sample points assigned to one cross section area exceeds 196, the area must be divided into two or more parts. Then the original cross section area defined by SCS hydrologists is treated as two or more cross sections within the model. This feature provides the user some flexibility in selecting the number of acres to be represented by one sample point.

Floods—Data on the frequency and intensity of flooding in the area are used to select several flood sizes considered to be representative of expected flooding. The historical flood record is also used to estimate the seasonal probability of flood occurrence. The probability of flooding in a particular season is determined by rearranging the historical flood record by season of occurrence and dividing each seasonal total by the total number of floods in the historical record.

Crop Damage Factors—A crop damage factor is an estimate of the proportionate reduction in gross returns due to flooding. Therefore, the factor includes adjustments in expenditures for cleaning up residue left by the flood, reduced harvesting costs due to reduced yield and any other changes in variable costs resulting from the flood. Crop damage factors are available from the Soil Conservation Service of the U. S. Department of Agriculture (SCS). In several areas, the damage factors are available for up to 12 seasons and four inundation depth increments.

Crop Characteristics—The final data applicable to the aggregate flood plain are: crops to be considered, productivity groups, crop prices, and crop production costs. Among the important factors that affect the crops to be considered are length of growing season, climatic conditions, and soil potential. Consultation with soil scientists and observing present land use can facilitate selection of appropriate crops for the analysis.

With a selection of crops, associated expected yields are also needed. A given flood plain is normally composed of several soil types. Although yield potential on some soil types is very similar, there may be large yield variations among others. This model has the capability of including, as part of the computational procedure, crop yields which are associated with different soil productivity groups. Published enterprise budgets for the area are an excellent source of yield data.[11]

The productivity groups of the flood plain and the yield potential of each can be developed using the county "Soils Survey." It is necessary to classify soils into relatively homogeneous groups in order to maintain the number of productivity groups at a manageable level. It is recommended that no more than 10 groups be considered. Soil and yield data available through state Soil Conservation Service offices in conjunction with enterprise budgets, are normally sufficient to define soil productivity groups and associated expected crop yields.

A market price for each crop is needed to determine the gross value per acre of each crop associated with each productivity group. In determining the appropriate price for each crop, the objectives of the study, as well as government programs and past price trends, need to be considered.

Production costs are required to utilize the optimizing routine as well as to compute net return values for a specified land use pattern. Estimates of production costs should reflect the alternative per acre input requirements associated with the different land types considering economic and physical principles of production. Once again, published enterprise budgets are a good source of the required data.

The above data, applicable to the total flood plain, are sufficient for estimating average annual flood damages and net returns for a specified land use and for determining a land use pattern that maximizes net returns to the flood plain. The following section discusses data requirements for a cross section area, which is the first level of disaggregation below the total flood plain.[12]

Cross Section Area

A cross section area serves as a basis of analysis for the two routines. As mentioned above, Soil Conservation Service personnel normally locate cross sections on the channel and specify the portion of the flood plain each cross section represents. Cross section area input data include station elevations of the cross section and the elevation at the cross section of each flood size.

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[11] Many states have published enterprise budgets available through the Experiment Station or Extension Service. Also the U.S. Department of Agriculture publishes budgets for many sections of the U.S. For example, Strickland, P.L., and R. Lynn Harwell, *Selected U.S. Crop Budgets, Yields, Inputs and Variable Costs, Volume V, South Central Region,* U.S. Department of Agriculture, Economic Research Service, ERS-461, April, 1971.

[12] A cross section area is that part of the flood plain a particular cross section represents. The flood plain is divided into several mutually exclusive cross section areas.

Stations on a cross section refer to points across the flood plain with a specified interval between points, i.e., one point every x feet. The appropriate interval in feet between points on the cross section is left to the judgment of the researcher and depends on the consistency of elevation change across the channel. This interval between stations can differ between cross sections and between channel sides. Surveyed cross sections are normally illustrated on graph paper with elevation on the vertical axis and distance on the horizontal axis (see Figure I). Station elevations can then be read off the graph by starting at the channel and recording the elevation for each interval of x feet until the flood plain boundary is reached.

The model uses peak flood elevations for each flood size selected to represent the distribution of floods in the study area. SCS hydrologists

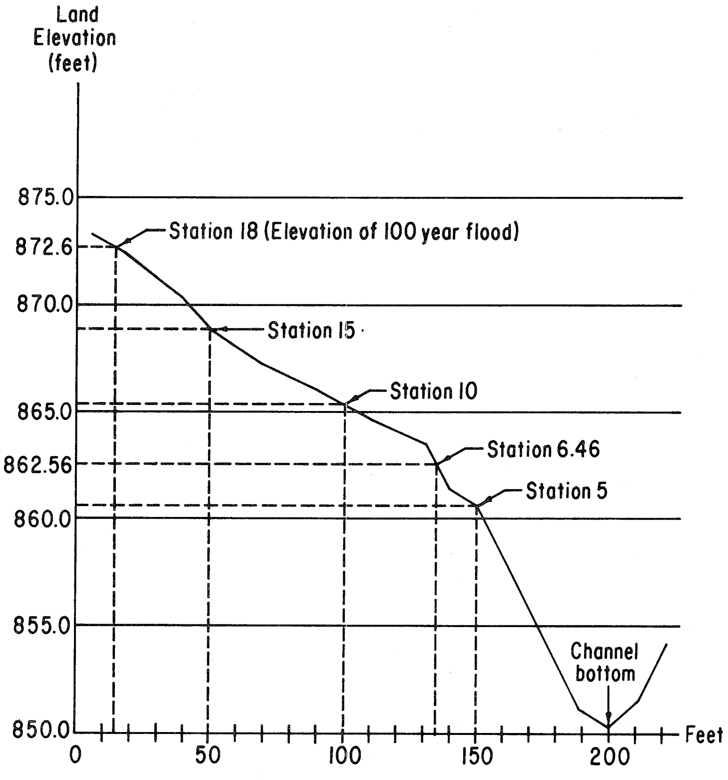

Figure I. Illustration of the Left Bank of a Hypothetical Cross Section.

compute the peak elevation of each flood at each cross section.[13] These peak elevations at each cross section for each flood size are input to the model.

The remaining data requirements relate to a sample point, which is the final level of disaggregation. Sample point characteristics needed as input to estimate flood damages are discussed below.

Sample Point

To estimate flood damages and returns for a specific flood plain and land use pattern, the use at each sample point must be specified. Present land use can be obtained by field observation and by interviewing flood plain farmers. The procedure for establishing the productivity group applicable to a sample point involves identifying the soil type at the sample point and determining the productivity group to which it belongs.

The last data requirement of the model is the coordinate location of each sample point, expressed as the percent of the distance from the channel to the flood plain boundary. This sample point value, used to compute the elevation of a sample point, is calculated from aerial photos bearing the grid of sample points, channel location and the flood plain boundaries.

The above discussion indicates data required by the model and suggests some possible sources of data. The proper format for the input data and organization of the data deck for the two computer routines is presented in Appendix C.

An Application and Potential Uses of the Routines

The flood damage data estimated through the procedures presented in this bulletin have several alternative uses. An application of the two routines and the resulting estimates are discussed in this section to indicate how the procedure can be applied in several areas of study. Evaluations of alternative land use adjustments, estimating flood protection benefits, assessing beneficiaries of flood protection, and evaluation of flood insurance are discussed below. Other possible uses of the routine include tax assessment and zoning studies.

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[13] Even though these flood elevation data are provided by SCS, it might be well to briefly summarize the procedures through which they are obtained. The first step is to determine the rainfall necessary to produce each of the chosen floods in the flood plain under analysis. These data are available in the form of maps with iso-rainfall curves illustrating the rainfall necessary to reach each flood size. Associated with rainfall is runoff, which is obtained from current conversion curves. Using hydrologic relationships developed for the study area, runoff is converted to CFS (cubic feet per second) for each cross section and flood size without retention structures or with any given system of retention structures. The hydrology of the flood plain is further used to convert from the CFS value above to a peak elevation at each cross section for the given flood size and retention structure system, if any. A more thorough discussion of these procedures is contained in the SCS National Engineering Handbook, Section 4, Hydrology [15].

The general and optimizing routines were applied to a specific watershed to verify the model and illustrate its use. The Nuyaka Creek flood plain, a part of the Okfuskee Tributaries located in Southeastern Oklahoma, was selected because of the availability of planning information and flood plain applicability for model development. Two watershed protection plans (referred to as SSI and SSII) had been developed by an SCS watershed planning party. One plan, SSII, has been approved by Congress for construction. The two routines were applied to the watershed without protection and with each of the two protection plans. The complete results of the analysis are presented elsewhere [5]. Information in this bulletin is limited to a comparison of present flood plain conditions (referred to as without protection) and SSII (referred to as with protection).

The Nuyaka Creek Watershed consists of 54,221 acres of which 3,740 acres are flood plain. The flood plain soils are mostly dark, medium textured, permeable, of recent alluviums and are very productive. Sixty-nine floods were recorded in the watershed from 1941 through 1960. Forty-one occurred in April, May, and June, a period when row crops are immature and wheat is nearing harvest—months of low crop tolerance to flooding. In September and October, when row crops are nearing harvest, 11 floods were recorded. Therefore, 52 of the 69 floods during this historic period occurred in a season when substantial damage can be expected.

The frequency of historic flooding, as well as the availability of planning information, made the Nuyaka Creek Watershed a desirable location to verify the general and optimizing routines. In addition, the watershed does not possess unique physical characteristics; i.e., levies, dikes or erratic elevation changes across the flood plain, which would render unacceptable the linear interpolation procedures used by the model. A relatively large number or crops are adaptable to the soils and climate of the watershed, permitting consideration of several alternative crops in establishing an optimum cropping system.

The incidence of flood damages was estimated for the present land use (1968 land use) under present flood plain conditions (no protection) and assuming the SSII flood control structures (with protection). These estimates were completed using the general routine. The land use that maximizes profit was also estimated with and without flood protection.

The basic data on cross section elevations, storm frequencies, and hydrology developed by the Soil Conservation Service in preparing the flood protection plan were used in this analysis. Soil productivity groups were developed and the appropriate cost and return estimates for alternative crops were taken from published research relating to the bottomland in the area [8]. The amortized value of land clearing and preparation for crop production ($7.72 per acre) was included as a cost for alternative crops for sample points currently in woodland pasture [11].

Eleven alternative crops are considered in the analysis. The alternate crops are not considered when present land use is specified, but are important in determining the sample point optimum land use. Adjusted normalized prices which remove the influence of government price support programs [17, p. 4] are assumed.[14] These product prices were selected for illustrative purposes because they are typically used in project evaluations. However, the appropriate set of product prices must be selected based upon the type of benefits (local, regional, and national) to be estimated.[15]

Land Use Adjustment

The optimum land use and second best land use are selected by sample point.[16] The 3,740 acres of flood plain is composed of 748 sample points (since each sample point represents 5 acres). Optimum land use and second best land use with corresponding net returns are presented in Table 1 for nine sample points of a cross section area located in the Nuyaka Creek flood plain.

Column 2 of Table 1 lists the optimum land use (computed without flood protection) for each of the nine sample points. Crops selected as optimum on one or more of the nine sample points include soybeans, alfalfa, and native pasture. Net returns per sample point (5 acres) range from $18.42 on sample point 5 to $179.10 on sample point 8. The frequency of flooding and depth of inundation associated with sample point 5 results in the selection of native pasture, a crop with more tolerance to floodwater than the others, as the most profitable crop.

The second best land use provides an alternative to the profit maximizing land use and is used to establish the stability of the optimum solution at each sample point. For example, on sample point 1, production of the second best crop, alfalfa, rather than soybeans, reduces net returns $2.75 (from $173.03 to $170.28) and on sample point 5, native

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[14] The crops and corresponding prices utilized in this study are as follows: (1) grain sorghum @ $1.69 cwt., (2) corn @ $1.05 bu., (3) soybeans @ $2.45 bu., (4) wheat @ $1.30 bu., (5) oats @ $0.60 bu., (6) barley @ $0.85 bu., (7) bermuda grass pasture @ $2.50 per animal unit month (AUM) [10, p. 21], (8) alfalfa @ $22.00 ton, (9) native hay @ $22.00 ton, (10) woodland pasture @ $2.50 AUM [10 p. 21], and (11) native pasture @ $2.50 AUM [10, p. 21].

[15] It is important to determine the type of benefits (local, regional or national) to be estimated and to use a set of prices reflecting that level of benefits. The extent to which the adjusted normalized prices used in this study reflect national benefits has been debated in the literature. Readers interested in this issue are referred to Knetsch [4, p. 6] for a discussion of the considerations involved.

[16] Optimum land use is defined as the crop having the highest returns per acre net of specified production costs and average annual flood damages. The second best use has the next largest net return per acre. The optimum flood plain land use pattern for a farm may differ from the model optimum because the amounts of upland, labor, capital, and allotments available may also affect the intensity of bottomland use.

Table 1. Optimum and Second Best Land Use With Corresponding Net Returns and Stability of the Optimum Crop for the Area Represented by Each of Nine Sample Points, Present Flood Plain Conditions.[1]

	Land Use				
Sample Point (1)	Optimum[2] (2)	Net Returns (3)	Second Best[3] (4)	Net Returns (5)	Optimum Solution Stability[4] (6)
		Dollars		Dollars	Percent
1	Soybeans	173.03	Alfalfa	170.28	0.91
2	Soybeans	171.19	Alfalfa	168.60	0.87
3	Alfalfa	149.41	Soybeans	143.26	1.46
4	Soybeans	171.19	Alfalfa	168.60	0.87
5	Native Pasture	18.42	Native Hay	4.96	74.04
6	Soybeans[5]	160.95	Alfalfa[5]	160.95	0.00[5]
7	Soybeans	164.56	Alfalfa	163.65	0.31
8	Soybans	179.10	Alfalfa	175.86	1.06
9	Alfalfa	163.89	Soybeans	161.74	0.49

[1] Present flood plain conditions refers to no flood protection.

[2] Optimum land use is the land use at each sample point that returns maximum profit.

[3] Second best land use is land use at each sample point with the second largest net return value.

[4] Solution stability is measured by the percentage price decline required to equate optimum land use net returns with second best land use net returns; i.e., percentage price decline that yields a condition of indifference between optimum and second best land use based on net returns.

[5] When the optimum and second best land use have the same net return (as in sample point 6), the two crops should be considered as alternative ways to achieve optimum land use.

hay in place of optimum native pasture reduces net returns from $18.42 to $4.96.

The stability of the optimum solution is measured by the percentage price decline required to equate optimum and second best land use net returns. The greater the percent price decline the greater the solution stability (column 6, Table 1). An optimum solution of soybeans or alfalfa is nullified by a very small percentage price decline; i.e., a soybean price decline of 0.91 percent equates soybean net returns with alfalfa net returns on sample point 1 and an alfalfa price decline of 1.46 percent equates alfalfa net returns with soybean net returns on sample point 3. Sample point 6 is a unique example where there is no appreciable difference in the net return from two land uses; hence, in this case, no change in price is needed to equate net returns between soybeans and alfalfa.

The flood plain farmer could select either the optimum or second best land use for sample points 1-4 and 6-9 and have very little effect on his expected net returns; i.e., the optimum solution is relatively instable. However, sample point 5 represents a relatively stable solution and the flood plain farmer would experience a significant reduction in net returns by selecting the second best land use.

The aggregate effect of land use adjustments on gross revenue, production costs, average annual flood damages and net returns for the flood plain can also be evaluated. The dollar values are shown for the Nuyaka Creek flood plain for present land use, both with and without flood protection, in Table 2. Corresponding values are also presented for the optimum land use.

The present land use (1968 land use) is given in column 3 of Table 2. A total of 2,910 acres are in pasture, 325 acres are in soybeans or alfalfa and the remaining acres are in cotton, corn, small grains, bermuda grass, and native hay. Estimated gross revenue to the 3,740 acres of flood plain with the present land use pattern is $54,600. Without flood protection, average annual flood damages are $11,600 and specified production costs total $31,300, leaving an estimated $11,700 return to land, management, and risk—a net return of $3.12 per acre of flood plain.

Table 2. Present and Optimum Flood Plain Land Use Patterns and Associated Dollar Values, Without Flood Protection and With Flood Protection, Nuyaka Creek Flood Plains.

Item (1)	Unit (2)	Present Land Use[1] Without Protection[3] (3)	Present Land Use[1] With Protection[4] (4)	Optimum Land Use[2] Without Protection[3] (5)	Optimum Land Use[2] With Protection[4] (6)
Crops					
Cotton	Acre	10	10	--	--
Corn	Acre	10	10	--	--
Soybeans	Acre	35	35	1,435	2,370
Wheat	Acre	55	55	--	--
Oats	Acre	80	80	--	--
Barley	Acre	35	35	--	--
Bermuda Grass	Acre	250	250	--	--
Alfalfa	Acre	290	290	1,060	540
Native Hay	Acre	65	65	190	165
Woodland Pasture	Acre	1,745	1,745	630	450
Native Pasture	Acre	1,165	1,165	425	215
Flood Plain Values					
Gross Revenue	$1,000	54.6	54.6	216.5	228.8
Production Costs	$1,000	31.3	31.3	105.9	102.8
Average Annual Flood Damages	$1,000	11.6	4.9	29.9	19.0
Net Returns	$1,000	11.7	18.4	80.7	107.2
New Returns/Acre	$	3.12	4.92	21.57	28.66

[1] Present Land Use refers to 1968 land use.

[2] Optimum Land Use is the profit maximizing land use pattern for the flood plain.

[3] Without Protection refers to present flood plain conditions or flood plain conditions before a flood protection project.

[4] With Protection refers to flood plain conditions after a flood protection project is completed.

The land use that maximizes returns net of production costs and average annual flood damages without flood protection (present flood plain conditions) is given in column 5 of Table 2. Substantial shifts in acreage from pasture and small grains to soybeans and alfalfa are indicated. The optimum land use includes 2,495 acres of soybeans and alfalfa, with only 1,055 acres of pasture.

A change of flood plain use from present to the optimum, with no flood protection, quadruples gross returns and increases net returns sevenfold (from $11,700 to $80,700). However, associated with the increase in net revenue (from $3.12 to $21.57 per acre) is a substantial increase in production costs (from $31,300 to $105,900) and average annual flood damages (from $11,600 to $29,900). In absolute terms, an increase in out-of-pocket expenditures (production costs) of $74,600 are required to increase net revenue $69,000. In other words, net revenue is increased approximately one dollar for each additional dollar of production costs resulting from the land use adjustment. The increase in capital requirements and risk (flood damages) are a consequence of adjusting from a low to a high value crop; i.e., intensification of flood plain use [9].

Flood Protection Benefits

Benefits of flood protection are typically measured by the reduction in average annual flood damages and include a value for land enhancement. The authors contend this is a major pitfall of project evaluation because it overstates benefits by crediting the project with returns resulting solely from land use changes. Study of previously developed watersheds indicates that a more intensive use of flood plain does not always result [2]. An evaluation of a watershed in Texas found that less rather than more intensive land use patterns had developed—the opposite of the change projected by project planners [3]. It is not the intent here to outline the conditions under which increased returns resulting from land use adjustment should be included as benefits, but rather to indicate that the model being discussed provides a tool that can be used to separate the benefits of land use adjustment from those of flood protection.

One method of considering the effect of flood protection on an area is to assume that present land use does not change after the flood protection plan is put into effect. The effect of flood protection, assuming no change in land use, is shown for Nuyaka Creek by comparing average annual flood damages and expected net returns in columns 3 and 4 of Table 2. The flood protection plan reduces expected damages from $11,600 to $4,900 (or $6,700) and increases net returns from $11,700 to $18,400 (also $6,700). Thus the benefits of flood protection, assuming no land use changes, are $6,700.

However, land use adjustments may occur as a result of construction of a flood protection plan. The land use pattern that maximizes returns net of production costs and average annual flood damages for Nuyaka Creek is given in columns 5 and 6 of Table 2 without and with flood protection, respectively. The optimum land use with flood protection requires a cropping change on 1,405 acres. The changes indicated are primarily from alfalfa and pasture to soybeans. The flood protection and land use changes reduce expected flood damages $10,900 (from $29,900 to $19,000) and increase net returns $26,500 (from $80,700 to $107,200). In this case, the benefits of flood protection are $26,500.

The extent to which land use adjustment benefits are considered in evaluating a watershed project should probably be determined on a watershed by watershed basis. One interpretation of the above estimates of flood protection benefits is that the difference between net returns with and without flood protection for present land use ($6,700) is an estimate of the minimum benefits expected from flood protection, while the difference between net returns for the optimum land use with and without flood protection ($26,500) is an estimate of the maximum benefits expected from flood protection [9].

Assessing Beneficiaries for Flood Protection

In addition to estimating the benefits of a flood protection project, it is necessary to assess the flood plain beneficiaries for specified project costs not included in legislative appropriations. The assessment criterion is that each beneficiary be assessed in proportion to benefits received. That is, flood plain farmers are to pay specified flood protection costs in proportion to the total benefits received. The procedures reported in this bulletin can be utilized to assess farmers based on either of two methods: (1) the reduction in damages incurred or (2) the increase in net returns for an optimum (profit maximizing) flood plain land use pattern both with and without flood protection. These two methods have been compared in detail [7], but the issues can be illustrated by considering a few sample points.

First, consider assessments based on the reduction of flood damages. Table 3 lists present land use (1968 land use), average annual flood damages before and after flood protection, reduction in flood damages attributable to flood protection, and proportion of total Nuyaka Creek flood plain reduced damages (benefits) for each of six sample points. The final column of Table 3 gives the proportion of total Nuyaka Creek benefits by sample point. This proportion can be used to determine the percent of beneficiary project costs levied against each of the six sample points.

The assessment factor for a farmer is obtained by summing the assessment factors for the sample points that represent the farmer's land. The reduction in average annual flood damages over the aggregate Nuyaka Creek flood plain is $6,730, of which $128.35 is applicable to the six sample points of Table 3. In this case, 1.9071 percent of the total Nuyaka Creek assessment is allocated among the six sample points. Assuming the six sample points of Table 3 represent the flood plain of one farmer, the assessment levied against him for flood protection would be 1.9071 percent of the specified project costs.

A possible problem in basing assessments on the benefits for present land use can be noted. Sample points producing low-value crops (such as woodland pasture on sample point 1) tend to be characterized by smaller flood damage estimates than sample points producing higher value crops (such as alfalfa on sample point 2). Under the above procedure, two sample points with equal productivity, receiving the same reduction of flood frequency and inundation, might be assessed at quite different levels because their land use differs.

An alternative approach which avoids the above criticism bases assessments on the difference in net return for optimum land use before

Table 3. Present Land Use, Average Annual Flood Damages Assuming No Flood Protection and With Flood Protection, and the Reduction in Average Annual Flood Damages Attributable to Flood Protection for Six Selected Sample Points.[1]

Sample Point[2] (1)	Present Land Use (2)	Average Annual Flood Damages		Benefits of Flood Protection[3] (5)	Assessment Factor[4] (6)
		Without Flood Protection (3)	With Flood Protection (4)		
		Dollars	Dollars	Dollars	Percent
1	Woodland Pasture	4.03	2.93	1.12	0.0166
2	Alfalfa	55.23	10.43	44.80	0.6657
3	Woodland Pasture	3.79	2.00	1.79	0.0266
4	Woodland Pasture	1.58	0.61	0.97	0.0144
5	Alfalfa	60.65	21.45	39.20	0.5825
6	Corn	225.75	185.28	40.47	0.6013
	Total	351.03	222.68	128.35	1.9071

[1] Present Land Use refers to 1968 land use.

[2] Each sample point represents 5 acres; hence, the values given in the table refer to 5-acre units of flood plain.

[3] Benefits are measured by the rdeuction in average annual flood damages attributable to flood protection assuming present land use.

[4] Assessment Factor refers to the percent of total flood plain flood protection benefits received by each sample point.

and after flood protection. Table 4 lists the information used to compute the assessments based on optimum land use. The increase in potential net returns attributable to flood protection is given in column 6 for each of the six sample points. The percentage of total Nuyaka Creek flood plain benefits by sample point, the assessment factor, is listed in column 7.

The increase in estimated net returns resulting from flood protection and appropriate land use changes is $26,516, for the total Nuyaka Creek flood plain and $202.03 for the six sample points (Table 4). Benefits of flood protection are the same in Tables 3 and 4 for sample point 1 ($1.12). However, the assessment factor based on optimum land use is only one-fourth the assessment based on present land use (0.004 percent in Table 4 compared to 0.0166 percent in Table 3). The present land use, as well as the optimum land use on sample point 2, is a high value crop resulting in similar benefits of flood protection for sample point 2 in Tables 3 and 4. However, the assessment factor in Table 4 is only 0.180 compared with 0.6657 in Table 3. Sample points 1 and 2 indicate that locations characterized by approximately the same present and optimum land use tend to have a smaller assessment under the optimum land use procedure than under the reduced damages procedure.

Table 4. Optimum Land Use and Expected Net Returns Without Flood Protection and With Flood Protection and the Potential Increase in Net Returns Attributable to Flood Protection for Six Selected Sample Points.

	Without Flood Protection		With Flood Protection			
Sample Point[1] (1)	Optimum Land Use[2] (2)	Net Returns (3)	Optimum Land Use[2] (4)	Net Returns (5)	Benefits of Flood Protection[3] (6)	Assessment Factor[4] (7)
		Dollars		Dollars	Dollars	Percent
1	Woodland Pasture	4.72	Woodland Pasture	5.84	1.12	0.004
2	Alfalfa	166.37	Soybeans	214.09	47.72	0.180
3	Woodland Pasture	4.96	Native Hay	11.74	6.78	0.026
4	Alfalfa	33.84	Alfalfa	122.14	88.30	0.333
5	Soybeans	160.95	Soybeans	205.35	44.40	0.167
6	Native Pasture	18.42	Native Hay	32.13	13.71	0.052
	Total	389.26		591.29	202.03	0.762

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[1] Each sample point represents 5 acres; hence, the values given in the table refer to 5-acre units of flood plain.

[2] Land use that maximizes returns net of production costs and average annual flood damages.

[3] Benefits of flood protection are measured by the increase in estimated net returns assuming an optimum sample point land use before and after flood protection.

[4] The assessment factor is the percent of total flood plain flood protection benefits each sample point receives, with benefits measured as the potential increase in net returns.

The data of Tables 3 and 4 indicate the optimum land use procedure tends to assign larger assessments to sample points on which it is profitable to shift from a low to a high value crop. For example, the benefits of flood protection for sample point 4 are much larger in Table 4 ($88.30) than in Table 3 ($0.97). Consequently, the assessment factor for sample point 4 based on optimum land use is much larger than one based on reduced damages (0.333 percent compared with 0.0144 percent).

The assessment factor for the six sample points is 0.762 percent based on optimum land use, compared with 1.9071 percent based on reduced damages. This comparison indicates significant differences may result depending on which method is selected. The model discussed can be applied with either.[17]

Agricultural Flood Insurance

The final application of the model considered in this paper is in establishing annual flood insurance premiums. Insurance involves substituting a smaller but sure annual cost for a small probability of a larger loss. Considering flood damages over the very long run for a particular flood plain field, average annual flood damages are analogous to the smaller but sure annual cost. Therefore, the annual premium, not including administrative costs, is derived by computing average annual flood damages in a given field for a specific land use assuming the farmer insures at a level equal to the expected gross value of the crop in the absence of flooding.

Average annual flood damages for present land use without flood protection and with flood protection are given in Table 3 for the area represented by six sample points. The annual flood insurance premium for the five acres represented by each sample point without flood protection is presented in column 3 of Table 3. The annual premiums for the six sample points range from $1.58 to $225.75. The range in premiums for sample points with the same land use (for instance, $1.58 to $4.03 for woodland pasture) indicates the effect of flood plain location on the magnitude of average annual flood damages.

Assuming the six sample points represent the flood plain acreage one farmer will insure, the annual premium with no flood protection is $351.03. With flood protection and the same land use, it is $222.68 (column 4, Table 3) for the six sample points. If the farmer operates the six sample points as one 30-acre field, the model also can be used to

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[17] The authors recognize that basing assessments on optimum land use as well as on a preproject land use is subect to criticism. A third alternative is to base the annual assessment on the reduction in flood damages provided by the watershed project for the crops annually produced. Total assessments for the watershed would be constant from year to year, but the distribution among beneficiaries would change as land use changed. This approach can also be implemented with the model.

estimate the premium (average annual flood damages) when the six sample points are planted to the same crop.

Compulsory flood insurance or flood plain occupancy charges with indemnification for losses incurred is advocated by some to bring about desirable land use adjustments [12, p. 38 and 5, pp. 166-169]. The procedure involves collecting an annual levy from each flood plain farmer based on the average annual damages of the crops produced in the bottomland. The optimizing routine described may be used to compute average damages—the levy rates—for as many as 15 crops on each sample point.

Summary and Conclusions

An evaluation of potential development of agricultural flood plains should consider, conjunctively, alternative uses for the land and alternative methods of coping with flood losses. Procedures currently used to estimate flood losses are based on the composite acre—a general specification of land use. These procedures do not provide accurate flood damage estimates by tract of land for a specific land use. Reliable flood damage estimates by tract of flood plain, land use and type of protection are needed to determine the desired development strategy. The major objective of this study was to develop a methodology and computer programs that can be used to more accurately estimate flood damages for a specific field with respect to the particular characteristics of that field, i.e., land use, productivity, depth of inundation and location.

The model developed to make these estimates uses the frequency method of estimating flood damage and is based on the point sample. The sample used in this model is a uniform assignment of sample points throughout the flood plain with each sample point representing a specified number of flood plain acres. The model computes flood damages for each of the sample points assigned throughout the flood plain.

The computational procedure uses data readily available in flood damage studies, i.e., crop damage factors, cross section data, and hydrology through which flood elevation data are determined. Crop damage factors typically used in discrete form are converted to approximations of continuous functions increasing the sensitivity of flood damages to depth of inundation.

The computational procedure is composed of six major steps. The first step relates sample points to the appropriate cross section and estimates the elevation of each sample point using measured elevations on the cross sections and linear interpolation procedures. The second step determines the depth of inundation at each sample point by subtracting the flood elevation from the calculated land elevation. The depth of inundation is computed for each sample point and flood size considered in the analysis. In the third step, damage factors are converted to a continuous function of inundation depth and weighted by the seasonal probability of flooding. The fourth step utilizes these crop damage factors to compute average annual flood damages for each sample point. The damages are aggregated to provide estimates of average annual damages for any part of the flood plain. The fifth step involves the computation of average annual flood damages as a percent of gross value of production with no flooding. The final step subtracts from gross returns by sample point the production costs and average annual flood damages. This provides an expected net return value at each sample point considering flood damages.

A computer program to apply the six steps to actual watershed situations is referred to as the General Routine and is listed in Appendix B of this bulletin. Applying the General Routine with alternative structure systems provides estimates of: (1) acres inundated by specific flood sizes with alternative systems of structures, (2) flood damages for specific storm sizes and average annual damages on any selected area within the flood plain of the watershed, (3) average annual benefits for proposed systems of structures for a specific field and/or land owner, and (4) flood damages for each land use pattern specified.

A modification of the model adds a seventh step to determine the land use that maximizes returns net of production costs and average annual flood damages by sample point. A second computer program, referred to as the Optimizing Routine, is used to apply the modified model. The Optimizing Routine estimates flood damages for each crop by sample point. The Optimizing Routine estimates, for all crops considered, net returns and flood damages by sample point for the specified flood protection plan and selects the optimum (profit maximizing) land use at each sample point. The routine also selects the second most profitable land use at each sample point and computes the product price decline required to make net returns for the optimum land use equal to net returns for the second most profitable land use. This information is an indication of the stability of the optimum plan.

With the General and Optimizing Routines, a more complete and detailed evaluation can be made of alternative methods for coping with flood losses and more meaningful flood plain development plans can be devised. An application of the two routines to the Nuyaka Creek watershed in Eastern Oklahoma illustrates some of the uses of the routines in watershed planning and evaluation. The models were utilized to (1) evaluate alternative land use patterns, (2) estimate benefits of flood protection, (3) calculate assessments of beneficiaries for flood protection and (4) establish annual flood insurance premiums.

Operators can be helped with land use decisions by using sample point estimates of gross returns, production costs, flood damages, and net returns for both current and optimum land use. This application suggests that operators can significantly increase net returns from flood plain land by shifting to higher value crops even though there may be a substantial increase in production costs and average annual flood damages. Thus farm management extension workers may find the general and optimizing routines useful planning tools regardless of whether flood prevention structures are planned or not.

One problem in using the procedure to advise farmers is that land use is the only resource constraint considered by the model in selecting optimum land use. The profit maximizing use of flood plain land on farms may differ somewhat from the model optimum because the amount of upland, labor, capital, and allotments available may influence the intensity of flood plain use. However, the model can be used to estimate the repercussions of alternative land uses at each flood plain location. In this way the farm operator can make a better selection of the combination of risk and expected returns he desires. Those watersheds justifying a more complete specification of the farm organization framework can use linear programming procedures with the model described to select optimum land use. Expected returns net of production costs and average annual flood damages can be estimated for alternative crops on each sample point (or field) in the flood plain with the model discussed in this bulletin. These net return estimates can be used in developing a linear programming model for each farm having land in the flood plain. The land use specified by the linear programming solutions can be used by the model as a basis for educational programs, assessment rate computation, and other analyses.

The estimated aggregate flood protection benefits for proposed projects typically include both a measured reduction in average annual flood damages and a value for land enhancement. A second use of the model is to apply the two computer routines to separate the benefits into the two parts. The two routines can be used to estimate the aggregate net returns for the flood plain (1) for present land use under current flood plain conditions, (2) for present land use with the proposed protection plan and (3) for the proposed protection plan with a specified land use or the optimum land use. A comparison of the three net return figures indicates the portion of increased net returns resulting from flood protection and the portion occurring from land use adjustments.

Applying the model to the Nuyaka Creek flood plain indicates that the increase in expected net returns for appropriate land use changes exceeds the benefits of flood protection. This suggests that government agencies involved in watershed planning may want to apply the model discussed in this bulletin as the basis for a flood plain development strategy. The strategy would require an initial effort to inform farmers of the profit maximizing land use perhaps through cooperation of the planning agencies and the State Extension Service. This work should be done before approval or construction of a flood protection plan. After farmers have indicated the extent to which they are willing to make adjustments in their farming operations, flood protection alternatives could be evaluated. Farmers could then be informed again of the profit maximizing land use in conjunction with installation of flood protection.

With the installation of flood retention structures, beneficiaries are assessed for specified project costs. A third use of the procedures discussed in this bulletin is to determine a watershed farmer's assessment for flood protection costs in relation to the proportion of benefits received. The procedures can be used to assess farmers either on the basis of (1) the reduction in damages incurred or (2) the increased net returns for an optimum (profit-maximizing) flood plain land use pattern both with and without flood protection. Although institutional constraints currently require that the former be used, the application to the Nuyaka Creek watershed suggests that it is more appropriate to base assessments on the computed optimum or profit maximizing land use.

Although retention structures are the common method of managing flood losses, flood insurance is one alternative that can be considered. A fourth use of the model is to develop estimates of the average annual flood damages by sample point and land use which provide a basis for establishing flood insurance premiums for farm operators in the flood plain. The appropriate administrative costs can be added to the estimates of average annual flood damages to develop the appropriate insurance premium by field and land use. The model discussed could be used to provide the basis for such an insurance program.

Current experience with the model is limited to the four types of application discussed above. However, it appears the model estimates of the frequency of flooding and the depth of inundation information may also aid in developing both flood zones and the assessed value of flood plain land. Thus, tax assessment and zoning studies are two additional areas of potential application for the general and optimizing routines.

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APPENDIX A

A Numerical Illustration of the Computational Procedure

This example illustrates the computational procedure using a single point since the method followed is identical for all points in a watershed. It is assumed a flood plain has been chosen for evaluation and the process of gathering, organizing, and utilizing the input data is in motion.

After studying the flood plain, aerial photos, and available data, it is concluded that allowing each sample point to represent 5 acres will provide the desired level of accuracy. Sample points are then assigned throughout the flood plain at the rate of 1 per 5 acres. Assuming Appendix Figure I represents an aerial photo of a portion of the flood plain, note that the cross section is located and the part of the flood plain it represents is contained within the flood plain and section boundaries.[18] Each of the dots located throughout the flood plain is one

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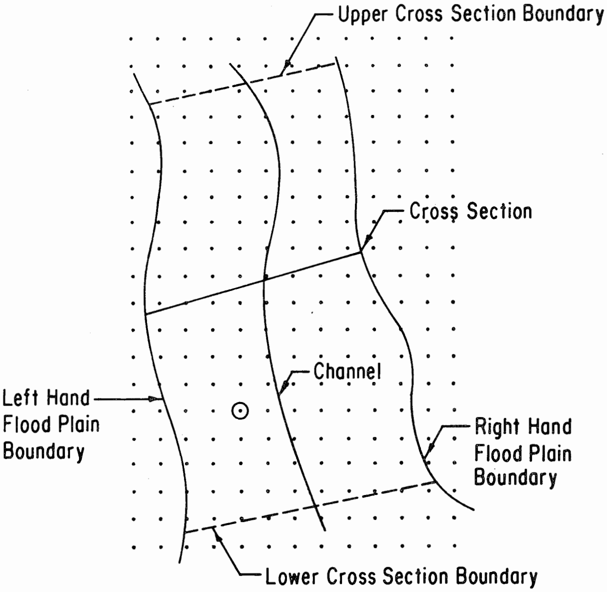
[18] The hypothetical cross section area illustrated in Appendix Figure I is also used as an example in Appendix C.



APPENDIX FIGURE I. Hypothetical Representation of a Portion of Flood Plain With Cross Section, Cross Section Boundaries, Flood Plain Boundaries, Channel and Assigned Sample Points.

sample point and represents 5 acres. The circled sample point is the one for which flood damages are to be calculated.

Input data required for the sample point in further calculations are:

1. The sample point is 35.9 percent of the distance from the channel to the flood plain boundary. Hence, XOCATE = .359.
2. The land use is wheat.
3. The productivity or land capability class is such that 28 bushels is the expected yield with no flooding.

Sample Point Evaluation

The first step is to calculate the elevation of the sample point based on the station elevations of the cross section to the left of the channel. There are 18 stations to the left of the channel (LSTA=18) and 10 feet between stations (LINTER=10). Applying equation (1), the total feet of flood plain from channel to the left boundary (LDIST) is 180 feet. Appendix Table I gives the elevation at each of the stations beginning with the one nearest the channel. The elevation of the station nearest the channel is 851.3 feet while the last station or flood plain boundary has an elevation of 872.6 feet. Hydrologists have determined that any sample point with an elevation exceeding 872.6 feet is not subject to flooding at this point along the channel and hence is outside the flood plain boundary.

The elevation of the sample point under analysis is calculated using equations (2) and (3). The number of feet from the channel bottom that the sample point lies (Dp) is computed using (2). It is the percent of the distance from the channel to the flood plain boundary the sample point lies (XOCATE) times the feet of flood plain from the channel to the flood plain boundary at the cross section (LDIST). For the example, this is computed as $Dp=0.359 \bullet 180=64.62$, and, therefore, the sample

APPENDIX TABLE I. Left Bank Cross Section Station Evaluations[1]

Station	Elevation	Station	Elevation
	Feet		Feet
1	851.3	10	865.3
2	853.6	11	866.0
3	855.9	12	866.7
4	858.3	13	867.4
5	860.6	14	868.1
6	861.5	15	869.2
7	863.8	16	870.4
8	864.1	17	871.5
9	864.7	18	872.6

[1] The interval between stations is assumed to be 10 feet.

point is assumed to lie 64.62 feet from the channel. The number of stations the sample point lies from the channel bottom (SSTA) is computed by equation (3). In the example this is:

$$\text{SSTA} = \frac{64.62}{10} = 6.462.$$

In this case, the sample point is located between cross section stations six and seven, and more specifically it is 46.2 percent of the distance from station six to station seven. The elevations of stations six and seven are 861.5 and 863.8 feet, respectively (Appendix Table I). The increase in elevation from station six to seven is 863.8 less 861.5, or 2.3 feet. Using linear interpolation between stations six and seven, the estimated increase in elevation from station six to the sample point is 2.3 • 0.462, or 1.0626 feet. Thus, the estimated elevation of the sample point (ELV) is the elevation at station six (861.5 feet) plus the increase just determined (1.0626) or 862.5626 feet.[19]

Depth of Inundation

The next step is to determine depth of inundation at the sample point (DEPTH) for all floods considered. For this example, assume eight alternative floods are selected to represent the distribution of floods in the study area. Appendix Table II shows the elevation at the cross section, frequency of occurrence, and annual probability of occurrence for each of the eight floods.

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[19] One possible shortcoming of the procedure for relating a sample point to a cross section in order to establish elevation should be noted. The reliability depends on the distance between cross sections and how well the cross section does, in fact, represent changes in elevation across the flood plain for the designated area. For some erratic flood plains it may be necessary to obtain topography maps and read the elevation of sample points. In these cases, a procedure for adjusting flood elevation in relation to how far the sample point lies between two cross sections may also be required. The difference in peak elevation at the two cross sections indicates whether it is necessary to adjust the peak elevation for intermediate sample points.

APPENDIX TABLE II. Elevation, Frequency and Probability of Occurrence of Eight Alternative Floods

Frequency	Probability of Occurrence in Any Specific Year	Elevation
Year		Feet
1	1.00	855.4
2	.50	858.3
3	.33	861.8
5	.20	862.9
10	.10	863.4
25	.04	864.5
50	.02	865.4
100	.01	866.1

A comparison of the sample point elevation with the flood elevation indicates that the first three floods do not inundate the sample point. However, the remaining five floods do result in varying depths on inundation at the sample point. Subtracting the elevation of the sample point (ELV) from the flood elevation (FELV) results in depths of inundation for the sample point of 0.3374, 0.8374, 1.9374, 2.8374, and 3.5374 feet for flood frequencies of 5, 10, 25, 50, and 100 years, respectively.

Damage Factors

Seasonal crop damage factors, used as input in the model, represent the reduction in gross returns that results if the depth of inundation is experienced in this season. Assume the damage factors shown in Appendix Table III are applicable for wheat in the watershed that includes the hypothetical sample point. Only three inundation depths and four seasons are considered in order to simplify the example.

The first step in applying the seasonal damage factors is to weight them by the frequency of flooding in each season using equation (5). Weighting the damage factors in this manner accounts for the probability of flooding in each season. The frequency of flooding in each season is computed from the historical record of floods. Assume the historical record of floods, grouped by the season in which they occurred, applies to the hypothetical watershed. Dividing the floods in each season by the total floods that occurred during the historical period results in the seasonal probability of flooding (Appendix Table IV). These are the probability factors ($SWAIT_i$) used in developing weighted damage factors.

The weighted damage factors for season i and inundation increment j ($SDAMA_{ij}$) are obtained by multiplying the damage factors of each season ($FACTOR_{ij}$ given in Appendix Table III) by the probability of occurrence of any flood in that season ($SWAIT_i$ given in Appendix Table IV). For example, the spring damage factors of 0.272, 0.324 and

APPENDIX TABLE III. Proportionate Reduction in Gross Returns for Wheat From Flooding by Depth of Inundation and Season

Depth of Inundation in feet	Season			
	Spring	Summer	Fall	Winter
0-1	.272	.243	.204	.052
1-3	.324	.416	.472	.081
3 and over	.453	.498	.577	.107

0.453 are multiplied by 0.359, which is the probability of any flood occurring in the spring. Extending this same procedure to other seasons' damage factors results in the weighted damage factors shown in Appendix Table V. Note that the weighted damage factors in Table V are much lower than those in Appendix Table III because the probability of a flood occurring in each season has been taken into consideration.[20]

One other modification of the damage factors is required before flood damages can be estimated. Rather than having one damage factor apply to a depth of inundation increment such as 1 to 3 feet, the model converts the weighted damage factors presented in Appendix Table V to a continuous function of depth of inundation. This is accomplished by assuming that the weighted damage factor for increments of inundation less than the maximum considered applies to the median of the interval it represents. For instance, consider the fall damage factors in Appendix Table V. Following this procedure, the 0.05 damage factor for the 0 to 1-foot inundation depth interval now applies to only a depth

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[20] The purpose of the model is to estimate damages from anticipated flooding. Hence, the values in Table V are appropriate. However, the same procedure is used to compute damages for a flood that actually occurs in a given season. In this case, a probability of 1.0 is assigned to the season in which the flood occurs and a zero to other seasons. The remaining computations are completed as discussed above.

APPENDIX TABLE IV. Historical Record of All Floods in Flood Plain by Season of Occurrence.

Season	Floods	Seasonal Probability of Flooding
	Number	
Spring	28	.359
Summer	16	.205
Fall	19	.244
Winter	15	.192
Total	78	1.000

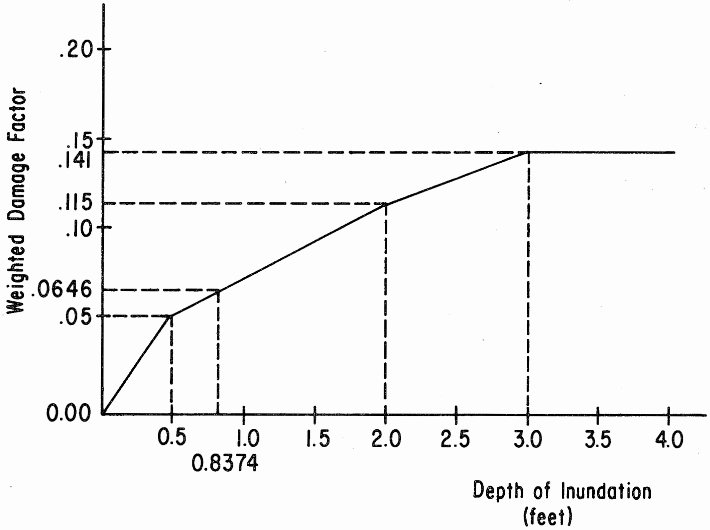
APPENDIX TABLE V. Weighted Damage Factors for Wheat for the Hypothetical Sample Point.

Depth of Inundation in feet	Season			
	Spring	Summer	Fall	Winter
0-1	.098	.050	.050	.010
1-3	.116	.085	.115	.016
3 and over	.162	.102	.141	.021

of inundation of 0.5 foot, the 0.115 value to 2 feet of inundation, but the 0.141 factor still applies to all inundation depths of 3 feet or more. These damage factors for given inundation depths are then connected by straight line segments and result in a unique damage factor for each depth of inundation. Appendix Figure II illustrates the functional relationship between damages and depth of inundation for the fall damage factor data.

The weighted damage factor ($SDAMA_{i\mu}$) can also be calculated directly using equation (6). Assume $DEPTH_{\mu}=.8374$ and the weighted damage factor for season i at the start of the interval within which $DEPTH_{\mu}$ is located ($SDAMA_{ij}$) is 0.05. The depth of inundation at the beginning of the interval in which $DEPTH_{\mu}$ is contained (DE) is 0.5 foot. The slope of the functional relationship over the interval containing $DEPTH_{\mu}$ is b_i. In this example, b_i equals the difference in the damage factors at the beginning and end of the interval depth within which $DEPTH_{\mu}$ is located divided by the difference in inundation depth at the beginning and end of the same interval. Hence, $b_i=(0.115—0.050)/(2.0—0.5)=0.0433$ and

$$\begin{aligned} SDAMA_{i\mu} &= 0.05 + 0.0433\ (0.8374—0.5) \\ &= 0.0646 \end{aligned}$$



APPENDIX FIGURE II. Weighted Wheat Damage Factors for the Fall Season as a Function of Depth of Inundation.

Weighted damage factors for other seasons are converted to a continuous function of depth of inundation following the same procedure. The weighted damage factor read for a specific depth of inundation replaces the arbitrary damage factor for an inundation depth interval in calculating expected flood damage.

Calculating Flood Damages

Having calculated the depth of inundation for each storm size and converted weighted damage factors to a continuous function of inundation depth, the next step is to calculate expected damages for each storm size. Of the eight storm sizes considered, only five resulted in flooding at the sample point being considered. Consider the task of computing flood damages for one of the floods that results in flooding, say the ten-year flood. The depth of inundation is calculated at 0.8374 foot. The weighted damage factor applicable to the fall season for the 10-year flood was computed above using equation (6) and it can also be read from Appendix Figure II.

Appendix Table VI shows the inundation depths and resulting damage factors by season for each of the five damaging floods. The 100-year flood has the same weighted damage factors as Table V for the inundation interval of 3 feet or more since this flood results in an excess of 3 feet of flood water at the sample point.

The expected damages per acre from each flood at a sample point ($DAMA_{kr}$) are computed using equation (7). This figure equals the summation of the product of the expected gross value per acre ($GVAL_r$) and the weighted seasonal damage factors ($SDAMA_{i\mu}$). For example, damages from the 10-year flood are computed in the following manner. Assume the price of wheat (PRICE) is \$2.00 per bushel and the yield of wheat ($YIELD_r$) is 28 bushels per acre. Gross value ($GVAL_r$) is \$56 per acre at the sample point. Expected per acre flood damages at the

APPENDIX TABLE VI. Proportionate Reduction in Gross Returns for Five Flood Frequencies at One Sample Point

Flood		Season			
Frequency	Depth of Inundation	Spring	Summer	Fall	Winter
Year	Feet	Proportion			
5	0.3374	0.0661	0.0337	0.0337	0.0067
10	0.8374	0.1020	0.0579	0.0646	0.0114
25	1.9374	0.1152	0.835	0.1122	0.0157
50	2.8374	0.1545	0.0992	0.1368	0.0177
100	3.5374	0.1620	0.1020	0.1410	0.0210

sample point from the 10-year flood size ($DAMA_{kr}$) are computed as

$$DAMA_{kr} = \sum_{i=1}^{n} [(GVAL_r)\ (SDAM_{i\mu})]$$

In this case

$$DAMA_{kr} = (56.00 \bullet 0.1020)+(56.00 \bullet 0.0579)+(56.00 \bullet 0.0646) + (56.00 \bullet 0.0114) = \$13.21.$$

Therefore, expected damages from the 10-year flood are $13.21 per acre at the sample point. Expected damages per acre from each of the other four damaging floods can be similarly estimated. The results shown in Appendix Table VII indicate, as would be anticipated, that damages increase as the size of flood increases. Damages from the 5-year flood are only $7.85 per acre, but increase to $23.86 per acre for the 100-year flood.

To compute expected average annual damages per acre in any given year, all floods and associated damages must be considered. A simple addition of the total damages from each flood would be inaccurate for this would imply all flood sizes occur every year. The estimate of average annual flood requires that the damages associated with each flood size ($DAMA_{kr}$) be considered in view of all storm sizes, probability of occurrence and in such a way as to avoid double-counting. This is done according to equation (8). For example, considering the 3 and 5-year flood size relationship, their part of average annual flood damages are cal-

APPENDIX TABLE VII. Estimated Per Acre Damages and Damages Adjusted for Probability of Occurrence for Specific Flood Sizes at a Sample Point

Flood		Damages	
Frequency (1)	Probability of Occurrence[1] (2)	Total (3)	Adjusted (4)
Year		Dollars	
3	.33	0.00	
5	.20	7.85	0.51
10	.10	13.21	1.05
25	.04	18.29	0.95
50	.02	22.86	0.41
100	.01	23.86	0.23
∞	.00	23.86	0.24
		Average Annual Damages =	3.39

[1] Refers to probability of each flood size occurring in a specific year (Appendix Table III).

culated as $[\frac{0+7.85}{2}] \bullet (.33—.20)$, or \$0.51 (Appendix Table VII). For the 5 and 10-year floods, the calculation in $[\frac{7.85+13.21}{2}] \bullet (.20 — .10)$, or \$1.05. The largest flood size (100-year flood in the example) is considered with the 50-year flood and, in addition another larger flood size is assumed that is of infinite size, equal damages (\$23.86) and a probability of occurrence of zero. This last calculation is, therefore, $[\frac{23.86+23.86}{2}] \bullet (.01 — 0)$, or \$0.24.

Average annual flood damages are the summation of the values calculated as above, over all flood sizes. For this particular sample point, under the assumption made, per acre average annual damages are estimated as \$3.39 (Appendix Table VII.)

The expected average annual damages of \$3.39 at the sample point is for only 1 acre. Total average annual damages for the acreage represented by the sample point ($TDAMA_r$) are calculated by using the expansion factor, SPA, which equals 5 acres in this case. Hence, \$16.95 is the expected average annual damage for the area represented by this sample point. Having completed this computation, average annual damages can be obtained for any field by adding the expanded average annual damages for each sample point in the field.

Proportion of Gross Value Lost to Flooding

The extent of average annual damage relative to gross returns with no flooding is calculated by dividing average annual damages by the gross return value. Illustrating for the sample point, average annual flood damages are 6.1 percent of gross returns (3.39/56.00=0.077 or 7.7 percent). This can be extended to the entire flood plain by summing gross returns and average annual damages for the acreage represented by every sample point and making the division.

Returns net of production costs and average annual flood damages are calculated using equation (12). Assuming a set of production budgets are available and a production cost of \$32.73 is indicated for wheat, net returns ($PROFIT_r$) are:

$$PROFIT_r = 280.00 — [(32.73 \times 5) + 16.95] = \$99.40.$$

Expected returns net of production costs and average annual flood damages for the illustrative sample point are \$99.40 or \$19.88 per acre.

Optimizing Routine

Extending the example to the optimizing routine, the only change in input data is that land use is not specified. The optimizing routine can consider up to 15 land uses. Assume only four crops, wheat, alfalfa, soybeans, and grain sorghum, are considered feasible alternatives for the above hypothetical sample point. The optimizing routine computes average annual flood damages for each of the crops on the sample point in the same way as illustrated above for wheat. For this example, the following per acre yields and price per unit are assumed: (1) wheat, 28 bu. @ $2.00 bu., (2) alfalfa, 4.5 tons @ $22.00 ton, (3) soybeans, 29 bu. @ $2.40 bu., and (4) grain sorghum, 30 cwt. @ $1.90 cwt.[21]

Presented in Appendix Table VIII are gross returns, production costs, average annual flood damages, and expected net returns by crop for the 5 acres represented by the sample point. Gross returns are yield multiplied by price with the result expanded to the area represented by a sample point. Production costs must be developed for the specific area to reflect the alternative production requirements and associated costs. Assume the costs in Table VIII are from published budgets and apply to the above sample point.

Average annual flood damages for wheat are the same as computed above. Using the same procedure with data applicable to each specific crop, average annual flood damages are estimated for alfalfa, soybeans, and grain sorghum at the sample point. Production costs and average annual flood damages are deleted from gross returns to obtain estimated net returns (column 5, Appendix Table VIII).

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[21] In this example, different commodity prices are used than were used in the discussion of model results presented in the text.

APPENDIX TABLE VIII. Gross Value, Production Costs, Average Annual Flood Damages and Expected Net Returns For Alternative Land Uses on the Area Represented by An Illustrative Sample Point[1]

Crop (1)	Gross Value (2)	Production Costs (3)	Average Annual Flood Damages (4)	Net Returns[2] (5)
Wheat	280.00	163.65	16.95	99.40
Alfalfa	495.00	273.40	46.78	174.82
Soybeans	348.00	130.05	48.25	169.71
Grain Sorghum	285.00	144.30	33.98	106.72

[1] It is assumed a sample point represents 5 acres; therefore, the values refer to a 5-acre tract of flood plain.

[2] Returns net of production costs and average annual flood damages.

The optimizing routine selects the crop having the greatest returns net of production costs and average annual flood damages, as the optimum or profit maximizing land use. For the illustrative sample point, the optimum crop is alfalfa because it has the largest expected net return ($174.82). With the optimum crop identified, the model continues by selecting the second most profitable crop at the sample point. In this case, the second best crop is soybeans with expected net returns $5.11 less than the optimum (alfalfa) or $169.71.

An indication of the optimum solution stability is provided by using equation (16) to compute the product price for the optimum land use that gives net returns equal to the second best land use. For the illustrative sample point, with all values expanded to a five-acre tract of land, this is:

$$CPRICE_h = \frac{169.71 + 273.40}{22.5 - (\frac{46.78}{495.00} \bullet 22.5)} = \$21.75.$$

This means that a decrease in the price of alfalfa from $22.00 a ton to $21.75 a ton results in equalization of net returns for alfalfa and soybeans ($169.71). A 1.14 percent decline in the price of alfalfa invalidates the optimum solution, which indicates there is very little difference in alfalfa and soybeans for this sample point and it can be concluded that the optimum is not characterized by a high degree of stability.

The optimizing routine identifies the optimum and second best land use at each sample point and provides a measure of the stability of the optimum. In addition, the optimizing routine estimates and provides as output expected net returns, average annual flood damages, production costs, and gross returns for all considered crops.

APPENDIX B

The Computer Programs

The source programs for both the General Routine and the Optimizing Routine are presented in this appendix. Both programs are in FORTRAN IV language.

The General Routine

```
C                      SIMULATING AGRICULTURAL FLOOD DAMAGES
C
C
C  A3      DESIGNATES WHEITHER INPUT DATA FOLLOWS FOR ANOTHER MATRIX
C  AINUND DESIGNATES ACRES INUNDATED BY CROSS-SECTION AND FLOOD SIZE
C  AVDAM   DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR MATRIX UNDER CONSIDERATION
C  AXSEC   DESIGNATES PARTICULAR CROSS-SECTION BEING EVALUATED
C  CDAMPE DESIGNATES PERCENTAGE ACCUMULATED AVERAGE ANNUAL DAMAGES ARE
C                     OF ACCUMULATED GROSS RETURNS ASSUMING NO FLOODING
C  CELV    DESIGNATES ELEVATION OF CHANNEL BOTTOM
C  COMRET DESIGNATES GROSS RETURNS WITH NO FLOODING FOR THIS AND ALL PRECEDING
C                     CROSS-SECTIONS
C  COST    DESIGNATES PER ACRE PRODUCTION COSTS BY CROP AND PRODUCTIVITY GROUP
C CPVAL DESIGNATES GROSS VALUE OF EACH CROP ON EACH PRODUCTIVITY CLASS
C  D1      DESIGNATES DEPTH DIVIDING INTERVALS ONE AND TWO
C  D2      DESIGNATES DEPTH DIVIDING INTERVALS TWO AND THREE
C  D3      DESIGNATES DEPTH DIVIDING INTERVALS THREE AND FOUR
C THE FOURTH INTERVAL IS ALL DEPTHS EXCEEDING D3
C IF ONLY TWO INTERVALS ARE USED THEN THERE WILL BE ONLY ONE DIVIDING DEPTH
C  DAMA    DESIGNATES TOTAL DAMAGES FOR EACH FLOOD ON A PER ACRE BASIS
C  DEPTH   DESIGNATES DEPTH OF INUNDATION FOR EACH FLOOD AT EACH SAMPLE POINT
C  EXELV   DESIGNATES ELEVATION EXCEEDING LARGEST FLOOD
C  FACTOR DESIGNATES DAMAGE FACTORS IN RELATION TO INUNDATION
C  FELV    DESIGNATES ELEVATION OF SPECIFIC FLOODS
C  GCVAL   DESIGNATES GROSS RETURNS ON ACRES REPRESENTED BY EACH SAMPLE POINT
C                     WITH NO FLOODING
C  KDIST   DESIGNATES DISTANCE OF RIGHT CROSS-SECTION BANK
C  KEYP    DESIGNATES IF DATA FOR SYSTEM COMPARISONS MODEL IS TO BE PUNCHED
C                     ON CARDS (1 = NO PUNCH, 2 = PUNCH)
C  KINTER DESIGNATES INTERVAL BETWEEN EACH CROSS-SECTION STATION ON RIGHT
C  KLASS DESIGNATS LAND PRODUCTIVITY GROUP OF EACH SAMPLE POINT
C  KROP    DESIGNATES LAND-USE
C  KSTA    DESIGNATES CROSS-SECTION STATION ELEVATIONS ON THE RIGHT
C  L       DESIGNATES NUMBER OF FLOODS CONSIDERED
C  LD      DESIGNATES DEPTH INCREMENTS CONSIDERED
C  LDIST   DESIGNATES DISTANCE OF LEFT CROSS-SECTION BANK
C  LINTER DESIGNATES INTERVAL BETWEEN EACH CROSS-SECTION STATION ON LEFT
C  LP     DESIGNATES NUMBER OF PRODUCTIVITY GROUPS
C  LS      DESIGNATES TOTAL SEASONS CONSIDERED
C  LSTA    DESIGNATES CROSS-SECTION STATION ELEVATIONS ON THE LEFT
C  M       DESIGNATES ROWS OF MATRIX
C  MA      DESIGNATES NUMBER OF CROPS CONSIDERED
C  MORE    DESIGNATES WHETHER NET RETURNS ARE TO BE COMPUTED (1=YES,2=NO)
C  N       DESIGNATES COLUMNS OF MATRIX
C  NCOSRE DESIGNATES SPECIFIC SETS OF DATA TO BE PRINTED
C  PDAMA   DESIGNATES FLOODING DAMAGES FROM EACH SPECIFIC FLOOD IN THE YEAR IT
C                     OCCURS FOR THE ACRES REPRESENTED BY EACH SAMPLE POINT
C  PERDAM DESIGNATES PERCENT AVERAGE ANNUAL FLOODING DAMAGES OF ENTIRE CROSS-
C                     SECTION ARE OF TOTAL GROSS RETURNS WITH NO FLOODING
C  PRICE DESIGNATES PRICE PER UNIT OF EACH CROP
C  PROFIT DESIGNATES NET RETURN AFTER FLOODING AND PRODUCTION COSTS
C                     ON EACH SAMPLE POINT
C  R       DESIGNATES STATION ELEVATION ON RIGHT SIDE OF CROSS-SECTION
C  RETURN DESIGNATES ACCUMULATED ACREAGE DISTRIBUTION BY NET RETURN INTERVALS
C  SDAMA   DESIGNATES DAMAGE FACTORS WEIGHTED BY SWAIT FOR EACH SEASON
C  SNUND   DESIGNATES NUMBER OF SAMPLE POINTS INUNDATED BY EACH FLOOD SIZE
C  SPA     DESIGNATES ACRES REPRESENTED BY EACH SAMPLE POINT
C  SWAIT   DESIGNATES PERCENT CHANCE OF OCCURANCE OF ANY FLOOD BY SEASON
C  SWEIGH DESIGNATES PERCENT CHANCE OF OCCURANCE OF SPECIFIC FLOOD IN ANY YEAR
C  TAIND DESIGNATES ACCUMULATED ACRES INUNDATED BY FLOOD SIZE
C  TDAMA   DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR THE AREA REPRESENTED BY
C                     EACH SAMPLE POINT (WEIGHT DAMAGES FROM EACH FLOOD AND SUM
C                     FOR EACH SAMPLE POINT)
C  TCVAL   DESIGNATES GROSS RETURNS FOR ENTIRE CROSS-SECTION WITH NO FLOODING
C  TPROF   DESIGNATES ACCUMULATED NET RETURNS FOR ALL ANALYZED CORSS-SECTIONS
C  X       DESIGNATES STATION ELEVATION ON LEFT SIDE OF CROSS-SECTION
C  XDAMA DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR ALL MATRICES COMPUTED
C  XOCATE DESIGNATES LOCATION OF EACH SAMPLE POINT
C  YIELD DESIGNATES YIELD OF EACH CROP ON EACH PRODUCTIVITY GROUP
C  PROVIDING STORAGE SPACE FOR DATA THAT IS CONSIDERED IN BLOCKS OR ARRAYS
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      DIMENSION X(500),R(500)
      DIMENSION XOCATE(14,14), ELV(14,14)
      DIMENSION FELV(8),DEPTH(8,14,14),SWEIGH(8)
      DIMENSION FACTOR(60,12), SDAMA(60,12), SWAIT(12)
      DIMENSION PRICE(15), YIELD(10,15), CPVAL(10,15)
      DIMENSION KLASS(14,14), KROP(14,14), DAMA(8,14,14)
      DIMENSION TDAMA(14,14)
      DIMENSION GCVAL(14,14),PDAMA(8,14,14)
      DIMENSION SNUND(8),AINUND(8),TAIND(8)
      DIMENSION CROP(15,2),AXSEC(2)
      DIMENSION COST(10,15),PROFIT(14,14)
      DIMENSION RETURN(30)
C   SETTING FLOOD-PLAIN DATA STORAGE AREA TO ZERO
      DO 600 I=1,30
  600 RETURN(I)=0.0
      TPROF=0.0
      XDAMA = 0.0
      PERDAM = 0.0
      COMRET = 0.0
      DO 650 I=1,60
      DO 650 J=1,12
      FACTOR(I,J) = 0.0
      SDAMA(I,J) = 0.0
      SWAIT(J) = 0.0
  650 CONTINUE
      DO 651 I=1,10
      DO 651 J=1,15
      COST(I,J)=0.0
      YIELD(I,J) = 0.0
      CPVAL(I,J) = 0.0
      PRICE(J) = 0.0
  651 CONTINUE
      DO 652 I=1,8
      SWEIGH(I) = 0.0
      TAIND(I) = 0.0
  652 CONTINUE
      DO 653 I=1,15
      DO 653 J=1,2
      CROP(I,J) = 0.0
  653 CONTINUE
C   READING DATA THAT APPLIES TO THE ENTIRE FLOODPLAIN UNDER ANALYSIS
      READ (5,120) MA
      READ(5,580) ((CROP(I,J),J=1,2),I=1,MA)
      READ (5,120) L
      READ (5,120) LP
      READ (5,120) LS
      READ (5,120) LD
      READ (5,200) D1,D2,D3
      READ (5,13) (SWEIGH(I),I=1,L)
      LG = MA *LD
      READ (5,13) ((FACTOR(I,J),J=1,12),I=1,LG)
      READ (5,13) (SWAIT(I),I=1,LS)
      READ (5,20) (PRICE(I),I=1,MA)
      READ (5,21) ((YIELD(I,J),J=1,15),I=1,LP)
      READ(5,11) MORE
      IF(MORE.EQ.1)GO TO 400
      GO TO 401
  400 READ(5,20) ((COST(I,J),I=1,10),J=1,MA)
  401 READ(5,11) KFYP
      DATA A1,A2/4HDATA, 3HALL/
  148 READ (5,149) A3
  149 FORMAT (2A4)
      IF (A3.EQ.A1) GO TO 150
      CALL EXIT
C   SETTING STORAGE EQUAL TO ZERO
  150 DO 1 I=1,14
      DO 1 J=1,14
      PROFIT(I,J)=0.0
      GCVAL(I,J) = 0.0
      TDAMA(I,J) = 0.0
      KLASS(I,J) = 0
      KROP(I,J) = 0
      XOCATE(I,J) = 0.0
      ELV(I,J) = 0.0
    1 CONTINUE
      DO 2 I = 1,8
      DO 2 J = 1,14
      DO 2 K = 1,14
      PDAMA(I,J,K) = 0.0
      DAMA(I,J,K) = 0.0
      DEPTH(I,J,K) = 0.0
      FELV(I) = 0.0
      SNUND(I) = 0.0
      AINUND(I) = 0.0
    2 CONTINUE
      DO 5 NA = 1,500
      X(NA) = 0.0
    5 R(NA) = 0.0
C   READING INPUT DATA FOR A PARTICULAR CROSS-SECTION WITHIN THE FLOODPLAIN
      READ (5,105) AXSEC
      READ(5,20) SPA
      READ (5,120) M,N
      READ (5,120) LSTA, KSTA
      READ (5,120) LINTER, KINTER
      READ (5,121) CELV
      READ (5,121) EXELV
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      READ (5,121) (X(I),I=1,LSTA)
      READ (5,121) (R(I),I=1,KSTA)
      READ (5,121) (FELV(I),I=1,L)
      READ (5,121) ((XOCATE(I,J),I=1,M),J=1,N)
      READ (5,11) ((KROP(I,J),I=1,M),J=1,N)
C  A CHECK TO DETERMINE IF MORE THAN ONE PRODUCTIVITY GROUP IS CONSIDERED
      IF(LP.GT.1) GO TO 350
      DO 351 I=1,M
      DO 351 J=1,N
      KLASS(I,J)=1
  351 CONTINUE
      GO TO 352
  350 READ (5,11) ((KLASS(I,J),I=1,M),J=1,N)
  352 READ(5,11) NCOSRE
  105 FORMAT (2A4)
  200 FORMAT (20F4.1)
  580 FORMAT (20A4)
   20 FORMAT (10F8.3)
   21 FORMAT (15F5.1)
   13 FORMAT (12F5.3)
  120 FORMAT (20I4)
  121 FORMAT (10F8.1)
   11 FORMAT (40I2)
C  FILLING BLANKS ON LINEAR SEGMENTS OF CROSS-SECTION
      KE = 0
  122 DO 124 I=1,LSTA
      IF (X(I))126,125,126
  125 IF (KE) 128,127,128
  127 KE = I
  128 GO TO 124
  126 IF (KE) 129,124,129
  129 LE = KE - 1
      ME = I - LE
      SE = ME
      TE = (X(I) - X(LE)) / SE
      ID = I - 1
      FMULT = 0.0
      DO 130 II = KE,ID
      FMULT = FMULT + 1.0
      X(II) = X(LE) + (TE * FMULT)
  130 CONTINUE
      KE = 0
  124 CONTINUE
  131 DO 132 I=1,KSTA
      IF (R(I)) 134,133,134
  133 IF (KE) 136,135,136
  135 KE = I
  136 GO TO 132
  134 IF (KE) 137,132,137
  137 LE = KE - 1
      ME = I - LE
      SE = ME
      TE = (R(I) - R(LE)) / SE
      ID = I - 1
      FMULT = 0.0
      DO 138 II = KE,ID
      FMULT = FMULT + 1.0
      R(II) = R(LE) + (TE * FMULT)
  138 CONTINUE
      KE = 0
  132 CONTINUE
      LDIST = LINTER * LSTA
      KDIST = KINTER * KSTA
C COMPUTING ELEVATION FOR EACH SAMPLE POINT
  160 DO 163 I=1,M
      DO 163 J=1,N
      IF (XOCATE(I,J).GT.100.0.AND.XOCATE(I,J).LT.200.0) GO TO 161
      IF (XOCATE(I,J).GT.200.0.AND.XOCATE(I,J).LT.300.0) GO TO 162
      IF (XOCATE(I,J).EQ.0.0) FLV(I,J) = CELV
      IF (XOCATE(I,J).EQ.1.0) ELV(I,J) = X(LSTA)
      IF (XOCATE(I,J).EQ.2.0) ELV(I,J) = EXELV
      GO TO 163
  161 XINTER = LINTER
      XDIST = LDIST
      SSTA = (XDIST * ((XOCATE(I,J) - 100.0) / 100.0)) / XINTER
      IF (SSTA.LT.1.0) GO TO 166
      ISTA = SSTA
      JSTA = ISTA + 1
      CHELV = X(JSTA) - X(ISTA)
      TSTA = ISTA
      HIL = (SSTA - TSTA) * CHELV
      MSTA = TSTA
      ELV(I,J) = X(MSTA) + HIL
      GO TO 163
  166 CHELV = X(1) - CELV
      HIL = SSTA * CHELV
      ELV(I,J) = CELV + HIL
      GO TO 163
  162 RINTER = KINTER
      RDIST = KDIST
      SSTA = (RDIST * ((XOCATE(I,J) - 200.0) / 100.0)) / RINTER
      IF (SSTA.LT.1.0) GO TO 167
      ISTA = SSTA
      JSTA = ISTA + 1
      CHELV = R(JSTA) - R(ISTA)
      TSTA = ISTA
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      HIL = (SSTA - TSTA) * CHELV
      MSTA = TSTA
      ELV(I,J) = R(MSTA) + HIL
      GO TO 163
  167 CHELV = R(1) - CELV
      HIL = SSTA * CHELV
      ELV(I,J) = CELV + HIL
  163 CONTINUE
C  COMPUTING DEPTH OF INUNDATION FOR EACH POINT
      DO 17 I=1,L
      DO 17 J=1,M
      DO 17 K=1,N
      DEPTH(I,J,K) = FELV(I) - ELV(J,K)
   17 CONTINUE
C  COUNTING NUMBER OF SAMPLE POINTS INUNDATED BY EACH FLOOD SIZE ON THIS
C  CROSS-SECTION
      DO 550 I =1,L
      IE = 0
      DO 550 J =1,M
      DO 550 K =1,N
      IF(DEPTH(I,J,K).GT.0.0) GO TO 551
      GO TO 550
  551 IE = IE + 1
      SNUND(I) = IE
  550 CONTINUE
C  EXPANDING SAMPLE POINTS INUNDATED BY FLOOD SIZE TO ACRES INUNDATED BY FLOOD
C  SIZE FOR THE PARTICULAR CROSS-SECTION UNDER ANALYSIS
      DO 553 I=1,L
  553 AINUND(I) = SNUND(I) * SPA
C  ACCUMULATING ACRES INUNDATED BY EACH FLOOD SIZE FOR THIS AND ALL PREVIOUSLY
C  ANALYZED CROSS-SECTIONS
      DO 554 I=1,L
  554 TAIND(I) = TAIND(I) + AINUND(I)
C  WEIGHTING DAMAGE FACTORS BY SEASONAL PROBABILITY OF FLOODING
      DO 19 I=1,LG
      DO 19 J=1,LS
      SDAMA(I,J) = FACTOR(I,J) * SWAIT(J)
   19 CONTINUE
C  CALCULATING GROSS VALUE OF EACH CROP ON EACH PRODUCTIVITY GROUP
      DO 22 I=1,10
      DO 22 J = 1,15
      CPVAL(I,J) = PRICE(J) * YIELD(I,J)
   22 CONTINUE
C CALCULATING FLOOD DAMAGES ON EACH POINT FOR EACH FLOOD
      IF (LD.EQ.1) GO TO 201
      IF (LD.EQ.2) GO TO 203
      IF (LD.EQ.3) GO TO 205
      IF (LD.EQ.4) GO TO 207
C ONLY ONE DEPTH INCREMENT CONSIDERED
  201 DO 202 I=1,L
      DO 202 J=1,M
      DO 202 K=1,N
      DO 202 IE=1,MA
      DO 202 KD=1,LP
      DO 202 IT=1,LS
      IF (DEPTH(I,J,K).LE.0.) DAMA(I,J,K)=0.0
      IF (DEPTH(I,J,K).GT.0..AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IE,IT))
  202 CONTINUE
      GO TO 208
C TWO DEPTH INCREMENTS CONSIDERED-ZERO TO X1 FEET, X1 FEET AND GREATER
  203 DO 204 I=1,L
      DO 204 J=1,M
      DO 204 K=1,N
      DO 204 IE=1,MA
      DO 204 KD=1,LP
      DO 204 IT=1,LS
      IG =(IE * 2) - 1
      IH = (IE * 2)
      D1N = D1 / 2.
      IF (DEPTH(I,J,K).LE.0.)  DAMA(I,J,K) = 0.0
      IF (DEPTH(I,J,K).GT.0..AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT) / D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) =DAMA(I,J,K)+(CPVAL(KD,IE)*((S
     2DAMA(IH,IT)-(((SDAMA(IH,IT)-SDAMA(IG,IT))/ (D2 - D1N))* D2)) +(((S
     3DAMA(IH,IT)-SDAMA(IG,IT))/(D2-D1N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2.AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IH,IT))
      D1N = 0.0
  204 CONTINUE
      GO TO 208
C THREE DEPTH INCREMENTS CONSIDERED- 0 TO X1, X1 TO X2, X2 AND GREATER
  205 DO 206 I=1,L
      DO 206 J=1,M
      DO 206 K=1,N
      DO 206 IE=1,MA
      DO 206 KD=1,LP
      DO 206 IT=1,LS
      D1N = D1 / 2.
      D2N =(D1+D2) / 2.
      IG = (IE * 3) - 2
      IH = (IE * 3) - 1
      IK = (IE * 3)
      IF (DEPTH(I,J,K).LE.0.) DAMA(I,J,K) = 0.0
```

```
      IF (DEPTH(I,J,K).GT.0..AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT)/ D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD) DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *(
     2(SDAMA(IH,IT) - (((SDAMA(IH,IT) - SDAMA(IG,IT)) / (D2N - D1N)) * D
     32N)) +(((SDAMA(IH,IT)-SDAMA(IG,IT))/(D2N-D1N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2N.AND.DEPTH(I,J,K).LT.D2.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD) DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*  (
     2(SDAMA(IK,IT)-(((SDAMA(IK,IT)-SDAMA(IH,IT))/(D2-D2N))*D2)) +(((SDA
     3MA(IK,IT)-SDAMA(IH,IT))/ (D2-D2N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2.AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IK,IT))
      D1N = 0.0
      D2N = 0.0
  206 CONTINUE
      GO TO 208
C FOUR DEPTH ENCREMENTS CONSIDERED - 0 TO X1, X1 TO X2, X2 TO X3, X3 AND GREATER
  207 DO 208 I=1,L
      DO 208 J=1,M
      DO 208 K=1,N
      DO 208 IE=1,MA
      DO 208 KD=1,LP
      DO 208 IT=1,LS
      D1N = D1 / 2.
      D2N =(D1+D2) / 2.
      D3N = (D2+D3) / 2.
      IG = (IE * 4) - 3
      IH = (IE * 4) - 2
      IK = (IE * 4) - 1
      IL = (IE * 4)
      IF (DEPTH(I,J,K).LE.0.0) DAMA(I,J,K) = 0.0
      IF (DEPTH(I,J,K).GT.0.0.AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT) / D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2N.AND.KROP(J,K).EQ.I
     1F.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*(
     2(SDAMA(IH,IT)-(((SDAMA(IH,IT) -SDAMA(IG,IT))/ (D2N-D1N))* D2N))+((
     3(SDAMA(IH,IT)-SDAMA(IG,IT))/(D2N-D1N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2N.AND.DEPTH(I,J,K).LT.D3N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*(
     2(SDAMA(IK,IT)- (((SDAMA(IK,IT) -SDAMA(IH,IT))/ (D3N-D2N)) *D3N))+(
     3((SDAMA(IK,IT)-SDAMA(IH,IT))/(D3N-D2N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D3N.AND.DEPTH(I,J,K).LT.D3.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*((
     2SDAMA(IL,IT)-(((SDAMA(IL,IT)- SDAMA(IK,IT))/ (D3-D3N))* D3))+(((SD
     3AMA(IL,IT)- SDAMA(IK,IT))/ (D3-D3N)) *DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D3.AND.KROP(J,K).EQ.IF.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IL,IT))
      D1N = 0.0
      D2N = 0.0
      D3N = 0.0
  208 CONTINUF
C EXPANDING FLOOD DAMAGES TO EACH SAMPLE POINT FROM EACH FLOOD TO THE ACRES
C REPRESENTED BY EACH SAMPLE POINT
      DO 224 I=1,L
      DO 224 J=1,M
      DO 224 K=1,N
      PDAMA(I,J,K) = DAMA(I,J,K)* SPA
  224 CONTINUE
C COMPUTING AVERAGE ANNUAL FLOODING DAMAGES TO THE AREA REPRESENTED BY EACH
C SAMPLE POINT (WEIGHT EACH FLOODS DAMAGES BY PROBABILITY OF OCCURANCE OF THE
C FLOOD AND SUM THE RESULT FOR EACH FLOOD ON EACH POINT)
      LAA = L - 1.
      DO 225 I=1,LAA
      DO 225 J=1,M
      DO 225 K=1,N
      TDAMA(J,K) = TDAMA(J,K) + ((PDAMA(I,J,K) + PDAMA((I+1),J,K)) /2)
     1* (SWEIGH(I) - SWEIGH(I+1))
  225 CONTINUE
      DO 984 J=1,M
      DO 984 K=1,N
  984 TDAMA(J,K) = TDAMA(J,K) + (PDAMA(L,J,K) * SWEIGH(L))
C COMPUTING GROSS RETURNS ON AREA REPRESENTED BY EACH SAMPLE POINT WITH NO
C FLOODING
  236 DO 226 I=1,M
      DO 226 J=1,N
      DO 226 K=1,MA
      DO 226 IE=1,LP
      IF (KROP(I,J).EQ.K.AND.KLASS(I,J).EQ.IE) GCVAL(I,J) = CPVAL(IE,K)
     1* SPA
  226 CONTINUE
C COMPUTING GROSS RETURNS FOR ENTIRE CROSS-SECTION WITH NO FLOODING
      TCVAL =0.0
      DO 227 I=1,M
      DO 227 J=1,N
      TCVAL =TCVAL + GCVAL(I,J)
  227 CONTINUE
      DO 315  I=1,M
      DO 315  J=1,N
      IF (TDAMA(I,J).GT.GCVAL(I,J)) TDAMA(I,J) = GCVAL(I,J)
  315 CONTINUE
C SUMMING AVERAGE ANNUAL DAMAGES FOR ENTIRE CROSS-SECTION AND ACCUMULATING
C DAMAGES FOR THIS AND ALL PREVIOUSLY COMPUTED CROSS-SECTIONS
C  SUMMING AVERAGE ANNUAL DAMAGES FOR ENTIRE CROSS-SECTION
      AVDAM = 0.0
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      DO 63 I=1,M
      DO 63 J=1,N
   63 AVDAM = AVDAM + TDAMA(I,J)
      XDAMA = XDAMA + AVDAM
C COMPUTING PERCENT AVERAGE ANNUAL FLOOD DAMAGES ARE OF TOTAL GROSS RETURNS WITH
C NO FLOODING FOR ENTIRE CROSS-SECTION
      PERDAM = (AVDAM / TCVAL) * 100.0
C ACCUMULATING GROSS RETURNS WITH NO FLOODING FOR THIS PLUS ALL PREVIOUS CROSS-
C SECTIONS
      COMRET = COMRET + TCVAL
C COMPUTING PERCENTAGE ACCUMULATED AVERAGE ANNUAL DAMAGES ARE OF ACCUMULATED
C GROSS RETURNS WITH NO FLOODING
      CDAMPE = (XDAMA/ COMRET) * 100.0
      IF(MORE.EQ.1) GO TO 402
      GO TO 405
  402 DO 403 I=1,M
      DO 403 J=1,N
      DO 403 IE=1,MA
      DO 403 KD=1,LP
      IF(KROP(I,J).EQ.IE.AND.KLASS(I,J).EQ.KD) PROFIT(I,J) = (GCVAL(I,J)
     1- ((COST(KD,IE) * SPA) + TDAMA(I,J)))
  403 CONTINUE
      DO 635 I=1,M
      DO 635 J=1,N
      IF (PROFIT(I,J).LE.(-50.00)) RETURN(1)=RETURN(1)+SPA
      IF (PROFIT(I,J).GT.(-50.00).AND.PROFIT(I,J).LE.(-25.00))RETURN(2)
     1= RETURN(2) + SPA
      IF (PROFIT(I,J).GT.(-25.00).AND.PROFIT(I,J).LE.(-10.00))RETURN(3)
     1= RETURN(3) + SPA
      IF (PROFIT(I,J).GT.(-10.00).AND.PROFIT(I,J).LE.(-5.00)) RETURN(4)
     1= RETURN(4) + SPA
      IF (PROFIT(I,J).GT.(-5.00).AND.PROFIT(I,J).LT.0.0) RETURN(5)
     1= RETURN(5) + SPA
      IF (PROFIT(I,J).EQ.0.0.AND.KROP(I,J).GT.0.0) RETURN(6) = RETURN(6)
     1 + SPA
      IF (PROFIT(I,J).GT.  0.0.AND.PROFIT(I,J).LE.  1.00) RETURN(7) =
     1RETURN(7)  + SPA
      IF (PROFIT(I,J).GT.  1.0.AND.PROFIT(I,J).LE.  2.00) RETURN(8) =
     1RETURN(8)  + SPA
      IF (PROFIT(I,J).GT.  2.0.AND.PROFIT(I,J).LE.  3.00) RETURN(9) =
     1RETURN(9)  + SPA
      IF (PROFIT(I,J).GT.  3.0.AND.PROFIT(I,J).LE.  4.00) RETURN(10)=
     1RETURN(10) + SPA
      IF (PROFIT(I,J).GT.  4.0.AND.PROFIT(I,J).LE.  5.00) RETURN(11)=
     1RETURN(11) + SPA
      IF (PROFIT(I,J).GT.  5.0.AND.PROFIT(I,J).LE.  7.50) RETURN(12)=
     1RETURN(12) + SPA
      IF (PROFIT(I,J).GT.  7.50.AND.PROFIT(I,J).LE. 10.00) RETURN(13)=
     1RETURN(13) + SPA
      IF (PROFIT(I,J).GT. 10.00.AND.PROFIT(I,J).LE. 15.00) RETURN(14)=
     1RETURN(14) + SPA
      IF (PROFIT(I,J).GT. 15.00.AND.PROFIT(I,J).LE. 20.00) RETURN(15)=
     1RETURN(15) + SPA
      IF (PROFIT(I,J).GT. 20.00.AND.PROFIT(I,J).LE. 30.00) RETURN(16)=
     1RETURN(16) + SPA
      IF (PROFIT(I,J).GT. 30.00.AND.PROFIT(I,J).LE. 40.00) RETURN(17)=
     1RETURN(17) + SPA
      IF (PROFIT(I,J).GT. 40.00.AND.PROFIT(I,J).LE. 50.00) RETURN(18)=
     1RETURN(18) + SPA
      IF (PROFIT(I,J).GT. 50.00.AND.PROFIT(I,J).LE. 75.00) RETURN(19)=
     1RETURN(19) + SPA
      IF (PROFIT(I,J).GT. 75.00.AND.PROFIT(I,J).LE.100.00) RETURN(20)=
     1RETURN(20) + SPA
      IF (PROFIT(I,J).GT.100.00.AND.PROFIT(I,J).LE.125.00) RETURN(21)=
     1RETURN(21) + SPA
      IF (PROFIT(I,J).GT.125.00.AND.PROFIT(I,J).LE.150.00) RETURN(22)=
     1RETURN(22) + SPA
      IF (PROFIT(I,J).GT.150.00.AND.PROFIT(I,J).LE.175.00) RETURN(23)=
     1RETURN(23) + SPA
      IF (PROFIT(I,J).GT.175.00.AND.PROFIT(I,J).LE.200.00) RETURN(24)=
     1RETURN(24) + SPA
      IF (PROFIT(I,J).GT.200.00.AND.PROFIT(I,J).LE.250.00) RETURN(25)=
     1RETURN(25) + SPA
      IF (PROFIT(I,J).GT.250.00.AND.PROFIT(I,J).LE.300.00) RETURN(26)=
     1RETURN(26) + SPA
      IF (PROFIT(I,J).GT.300.00.AND.PROFIT(I,J).LE.350.00) RETURN(27)=
     1RETURN(27) + SPA
      IF (PROFIT(I,J).GT.350.00.AND.PROFIT(I,J).LE.400.00) RETURN(28)=
     1RETURN(28) + SPA
      IF (PROFIT(I,J).GT.400.00.AND.PROFIT(I,J).LE.500.00) RETURN(29)=
     1RETURN(29) + SPA
      IF (PROFIT(I,J).GT.500) RETURN(30) = RETURN(30) +SPA
  635 CONTINUE
      DO 404 I=1,M
      DO 404 J=1,N
      TPROF=TPROF+PROFIT(I,J)
  404 CONTINUE
  405 WRITE(6,151)
  151 FORMAT (1H1,34X,48H NAME OF AND BEGINNING OF NEW CROSS-SECTION ARE
     1A)
      WRITE (6,106) AXSEC
  106 FORMAT (58X,2A4)
      WRITE (6,64)
      WRITE (6,64)
      IF (NCOSRE.EQ.1) GO TO 305
      IF (NCOSRE.EQ.2) GO TO 309
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      IF (NCOSRE.EQ.3) GO TO 307
      IF (NCOSRE.EQ.4) GO TO 308
      IF (NCOSRE.EQ.5) GO TO 309
      IF (NCOSRE.EQ.6) GO TO 310
      IF (NCOSRE.EQ.7) GO TO 311
      IF (NCOSRE.EQ.8) GO TO 312
      IF (NCOSRE.EQ.9) GO TO 313
      IF (NCOSRE.EQ.10) GO TO 314
  305 WRITE (6,300)
  300 FORMAT (2X,36H DATA APPLICABLE TO ENTIRE WATERSHED)
  240  WRITE (6,64)
      WRITE (6,72)
   72 FORMAT (29X,28H CROP DAMAGE FACTORS APPLIED)
      WRITE (6,210)
  210 FORMAT (35X,7H SEASON)
      WRITE (6,73)
   73 FORMAT (4X,95H  FIRST  SECOND   THIRD  FOURTH   FIFTH   SIXTH  SEV
     1ENTH EIGHTH   NINTH   TENTH ELEVENTH TWELTH)
      WRITE (6,74) ((FACTOR(I,J),J=1,12),I=1,LG)
   74 FORMAT (2X,12F8.3)
      WRITE (6,64)
      WRITE (6,91)
   91 FORMAT (1H1,17X,66H CROP DAMAGE FACTORS WEIGHTED FOR SEASONAL PROB
     1ABILITY OF FLOODING)
      WRITE (6,210)
      WRITE (6,73)
      WRITE (6,74) ((SDAMA(I,J),J=1,12),I=1,LG)
      WRITE (6,64)
      WRITE (6,211) LD
  211 FORMAT (1H1,5X,58H NUMBER OF INUNDATION DEPTH INTERVALS FOR DAMAGE
     1 FACTORS =,I2)
      WRITE (6,64)
      WRITE (6,212)
  212 FORMAT (4X,28H INUNDATION INCREMENTS(FEET))
      IF (LD.EQ.1) GO TO 213
      IF (LD.EQ.2) GO TO 214
      IF (LD.EQ.3) GO TO 215
      IF (LD.EQ.4) GO TO 216
  213 WRITE (6,221)
  221 FORMAT (2X,22H NO INTERVAL BREAKDOWN)
      GO TO 220
  214 WRITE (6,217) D1
  217 FORMAT (10X,7H 0.0  -,1X,F4.1)
      WRITE (6,218) D1
  218 FORMAT (10X,F4.1,12H AND GREATER)
      GO TO 220
  215 WRITE (6,217) D1
      WRITE (6,219) D1,D2
  219 FORMAT (10X,F4.1,3H  -,1X,F4.1)
      WRITE (6,218) D2
      GO TO 220
  216 WRITE (6,217) D1
      WRITE (6,219) D1,D2
      WRITE (6,219) D2,D3
      WRITE (6,218) D3
      GO TO 220
  220 CONTINUE
      WRITE (6,64)
      WRITE (6,176)
  176 FORMAT (8X,58H PRODUCTIVITY GROUPS CONSIDERED      TOTAL CROPS CONS
     1IDERED)
      WRITE (6,177) LP,MA
  177 FORMAT (23X,I4,21X,I4)
      WRITE (6,64)
      WRITE (6,178)
  178 FORMAT (49X,30H PRICE PER UNIT OF CROPS GROWN)
      WRITE (6,179) ((CROP(I,J),J=1,2),I=1,15)
  179 FORMAT(3X,30A4)
      WRITE (6,180) (PRICE(I),I=1,15)
  180 FORMAT (2X,15F8.2)
      WRITE (6,64)
      WRITE (6,181)
  181 FORMAT (43X,38H CROP YIELD ON EACH PRODUCTIVITY GROUP)
      WRITE(6,7)
    7 FORMAT (2X,6H GROUP,36X,5H CROP)
      WRITE (6,8) ((CROP(I,J),J=1,2),I=1,15)
    8 FORMAT(8X,30A4)
      WRITE (6,184) (I,(YIELD(I,J),J=1,15),I=1,10)
  184 FORMAT (5X,I2,1X,15F8.2)
      WRITE (6,64)
      WRITE (6,182)
  182 FORMAT (35X,47H GROSS VALUE BY CROP IN EACH PRODUCTIVITY GROUP)
      WRITE(6,7)
      WRITE(6,8) ((CROP(I,J),J=1,2),I=1,15)
      WRITE (6,184) (I,(CPVAL(I,J),J=1,15),I=1,10)
      WRITE (6,64)
  306 WRITE (6,82)
   82 FORMAT (1H1,2X,43H COMPUTED DEPTH OF INUNDATION BY EACH FLOOD)
      WRITE (6,64)
      WRITE (6,83)
   83 FORMAT (40X,10H FLOOD ONE)
      WRITE (6,81) ((DEPTH(1,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,84)
   84 FORMAT (40X,10H FLOOD TWO)
      WRITE (6,81) ((DEPTH(2,J,K),K=1,14),J=1,14)
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      WRITE (6,64)
      WRITE (6,85)
 85   FORMAT (40X,12H FLOOD THREE)
      WRITE (6,81) ((DEPTH(3,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,86)
 86   FORMAT (1H1,40X,11H FLOOD FOUR)
      WRITE (6,81) ((DEPTH(4,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,87)
 87   FORMAT (40X,11H FLOOD FIVE)
      WRITE (6,81) ((DEPTH(5,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,88)
 88   FORMAT (40X,10H FLOOD SIX)
      WRITE (6,81) ((DEPTH(6,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,89)
 89   FORMAT (1H1,40X,12H FLOOD SEVEN)
      WRITE (6,81) ((DEPTH(7,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,90)
 90   FORMAT (40X,12H FLOOD EIGHT)
      WRITE (6,81) ((DEPTH(8,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE(6,555)
555   FORMAT(2X,58H ACRES INUNDATED BY EACH FLOOD FOR THIS CROSS-SECTION
     1 AREA)
      WRITE(6,64)
      WRITE(6,556)
556   FORMAT( 6X,27H FLOOD       ACRES INUNDATED)
      WRITE(6,557) (I,AINUND(I),I=1,L)
557   FORMAT (9X,I2,10X,F9.1)
      WRITE(6,64)
      WRITE(6,558)
558   FORMAT (1H1,2X,70H ACCUMULATED ACRES INUNDATED FOR THIS AND PREVIO
     1US CROSS-SECTION AREAS)
      WRITE(6,64)
      WRITE(6,556)
      WRITE(6,557) (I,TAIND(I),I=1,L)
      WRITE(6,64)
307   WRITE (6,301)
301   FORMAT (41X,27H GENERAL CROSS-SFCTION DATA)
      WRITE (6,174)
174   FORMAT (7X,98H   ROWS       COLUMNS     FLOODS     LSTATIONS  RSTATIO
     1NS CELEVATION  XELFVATION LINTERVAL  RINTERVAL)
      WRITE (6,175) M,N,L,LSTA,KSTA,CELV,EXELV,LINTER,KINTER
175   FORMAT (2X,5I11,2F11.1,2I11)
      WRITE (6,64)
      IF(LSTA.LE.KSTA) LSTA = KSTA
      WRITE(6,250)
250   FORMAT (2X,33H CROSS SECTION STATION ELEVATIONS)
      WRITE(6,168)
168   FORMAT (6X,48H STATION NUMBER   LEFT STATIONS   RIGHT STATIONS)
      WRITE(6,139) (I,X(I),R(I),I=1,LSTA)
      WRITE (6,64)
      WRITE(6,170)
170   FORMAT (1H1,5X,58H FEET FROM CHANNEL TO FLOODPLAIN BOUNDARY AT CRO
     1SS-SECTION)
      WRITE(6,171)
171   FORMAT(21X,23H LEFT BANK   RIGHT BANK)
      WRITE (6,141) XDIST, RDIST
      WRITE (6,64)
      WRITE (6,75)
 75   FORMAT (6X,50H FLOOD NUMBER     FLOOD ELEVATION     FLOOD WEIGHT)
      WRITE (6,76) (I,FELV(I),SWEIGH(I),I=1,L)
      WRITE (6,64)
308   WRITE (6,302)
302   FORMAT(2X,37H CHARACTERISTICS OF EACH SAMPLE POINT)
      WRITF(6,64)
      WRITE(6,172)
172   FORMAT(40X,33H SAMPLE POINT COORDINANT LOCATION)
      WRITE (6,165) ((XOCATE(I,J),J=1,14),I=1,14)
      WRITE (6,64)
      WRITE(6,173)
173   FORMAT (1H1,46X,23H SAMPLE POINT ELEVATION)
      WRITE (6,165) ((ELV(I,J),J=1,14),I=1,14)
      WRITE (6,64)
      WRITE (6,71)
 71   FORMAT (4X,35H CROP PROCUCED ON EACH SAMPLE POINT)
      WRITF (6,70) ((KROP(I,J),J=1,14),I=1,14)
 70   FORMAT(2X,14I4)
      WRITE (6,64)
      WRITE (6,6)
  6   FORMAT (4X,40H PRODUCTIVITY GROUP OF EACH SAMPLE POINT)
      WRITE (6,70) ((KLASS(I,J),J=1,14),I=1,14)
      WRITE (6,64)
309   WRITE (6,238)
238   FORMAT (1H1,2X,78H GROSS RETURNS ON ACRES REPRESENTED BY EACH SAMP
     1LE POINT WITH A GIVEN LAND USE)
      WRITE (6,95) ((GCVAL(I,J),J=1,14),I=1,14)
 95   FORMAT (2X,14F9.2)
      WRITE(6,64)
      WRITE(6,231)
231   FORMAT (3X,68H GROSS RETURNS FOR ENTIRE CROSS-SECTION ASSUMING NO
     1FLOODING DAMAGES)
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      WRITE (6,98) TCVAL
      WRITE (6,64)
      WRITE (6,239)
  239 FORMAT (2X,63H ACCUMULATED GROSS RETURNS FOR THIS AND PREVIOUS CRO
     1SS-SECTIONS)
      WRITE (6,98) COMRET
      WRITE(6,64)
      WRITE(6,233)
  233 FORMAT( 3X,96H PERCENT AVERAGE ANNUAL FLOODING DAMAGES ARE OF GROSS
     1 RETURNS WITH NO FLOODING FOR CROSS-SECTION)
      WRITE(6,98) PERDAM
      WRITE(6,64)
      WRITE(6,235)
  235 FORMAT( 3X,93H PERCENT ACCUMULATED AVERAGE ANNUAL DAMAGES ARE OF AC
     1CUMULATED GROSS RETURNS WITH NO FLOODING)
      WRITE(6,98) CDAMPE
      WRITE(6,64)
  310 WRITE(6,94)
   94 FORMAT (1H1,4X,65H DAMAGES FROM EACH FLOOD ON EACH SAMPLE POINT ON
     1 A PER ACRE BASIS)
      WRITE (6,64)
      WRITE (6,83)
      WRITE (6,81) ((DAMA(1,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,84)
      WRITE (6,81) ((DAMA(2,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,85)
      WRITE (6,81) ((DAMA(3,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,86)
      WRITE (6,81) ((DAMA(4,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,87)
      WRITE (6,81) ((DAMA(5,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,88)
      WRITE (6,81) ((DAMA(6,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,89)
      WRITE (6,81) ((DAMA(7,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,90)
      WRITE (6,81) ((DAMA(8,J,K),K=1,14),J=1,14)
      WRITE (6,64)
  311 WRITE(6,229)
  229 FORMAT (1H1,3X,71H FLOOD DAMAGES ON ACRES REPRESENTED BY EACH SAMP
     1LE POINT FOR EACH FLOOD)
      WRITE (6,64)
      WRITE (6,83)
      WRITE (6,81) ((PDAMA(1,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,84)
      WRITE (6,81) ((PDAMA(2,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,85)
      WRITE (6,81) ((PDAMA(3,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,86)
      WRITE (6,81) ((PDAMA(4,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,87)
      WRITE (6,81) ((PDAMA(5,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,88)
      WRITE (6,81) ((PDAMA(6,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,89)
      WRITE (6,81) ((PDAMA(7,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,90)
      WRITE (6,81) ((PDAMA(8,J,K),K=1,14),J=1,14)
      WRITE(6,64)
  312 WRITE (6,96)
   96 FORMAT (6X,65H AVERAGE ANNUAL DAMAGES ON ACRES REPRESENTED BY EACH
     1 SAMPLE POINT)
      WRITE (6,95) ((TDAMA(I,J),J=1,14),I=1,14)
      WRITE (6,64)
  313 WRITE (6,97)
   97 FORMAT (1H1,2X,46H AVERAGE ANNUAL DAMAGES FOR CROSS-SECTION AREA)
      WRITE (6,98) AVDAM
   98 FORMAT (6X,F12.2)
      WRITE (6,64)
  314 WRITE(6,222)
  222 FORMAT (5X,68H ACCUMULATED FLOOD DAMAGES, THIS CROSS-SECTION AREA
     1AND ALL PREVIOUS)
      WRITE (6,223) XDAMA
  223 FORMAT (25X,F11.2)
      WRITE(6,64)
      WRITE(6,581)
  581 FORMAT(20X,12H CROP LEGEND)
      WRITE(6,582)
  582 FORMAT(4X,38H   CROP NUMBER     CROP IDENTIFICATION)
      WRITE(6,583) (I,(CROP(I,J),J=1,2),I=1,MA)
  583 FORMAT(13X,I2,12X,2A4)
      IF(MORE.EQ.1) GO TO 406
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      GO TO 407
  406 WRITE(6,64)
      WRITE(6,410)
  410 FORMAT(5X,'NET RETURNS BY SAMPLE POINT CONSIDERING AVERAGE ANNUAL
     1FLOODING')
      WRITE(6,95) ((PROFIT(I,J),J=1,14),I=1,14)
      WRITE(6,64)
      WRITE(6,411)
  411 FORMAT(5X,'ACCUMULATED NET RETURNS FOR ALL ANALYZED CROSS-SECTION
     1AREAS')
      WRITE(6,223) TPROF
      WRITE(6,64)
      WRITE(6,601)
  601 FORMAT(T6,'DISTRIBUTION OF ANALYZED FLOODPLAIN ACREAGE BY NET RETU
     1RN INCREMENTS')
      WRITE(6,602)
  602 FORMAT(T11,'NET RETURNS INCREMENT',5X,'FLOODPLAIN ACRES')
      WRITE(6,603)  RETURN(1)
  603 FORMAT(T15,'-50.00 OR LESS',13X,F8.1)
      WRITE(6,604)  RETURN(2)
  604 FORMAT(T13,'-49.99 TO -25.00',13X,F8.1)
      WRITE(6,605)  RETURN(3)
  605 FORMAT(T13,'-24.99 TO -10.00',13X,F8.1)
      WRITE(6,606)  RETURN(4)
  606 FORMAT(T13,'- 9.99 TO - 5.00',13X,F8.1)
      WRITE(6,607)  RETURN(5)
  607 FORMAT(T13,'- 4.99 TO - 0.01',13X,F8.1)
      WRITE(6,608)  RETURN(6)
  608 FORMAT(T20,'0.0',19X,F8.1)
      WRITE(6,609)  RETURN(7)
  609 FORMAT(T13,'  0.01 TO   1.00',13X,F8.1)
      WRITE(6,610)  RETURN(8)
  610 FORMAT(T13,'  1.01 TO   2.00',13X,F8.1)
      WRITE(6,611)  RETURN(9)
  611 FORMAT(T13,'  2.01 TO   3.00',13X,F8.1)
      WRITE(6,612)  RETURN(10)
  612 FORMAT(T13,'  3.01 TO   4.00',13X,F8.1)
      WRITE(6,613)  RETURN(11)
  613 FORMAT(T13,'  4.01 TO   5.00',13X,F8.1)
      WRITE(6,614)  RETURN(12)
  614 FORMAT(T13,'  5.01 TO   7.50',13X,F8.1)
      WRITE(6,615)  RETURN(13)
  615 FORMAT(T13,'  7.51 TO  10.00',13X,F8.1)
      WRITE(6,616)  RETURN(14)
  616 FORMAT(T13,' 10.01 TO  15.00',13X,F8.1)
      WRITE(6,617)  RETURN(15)
  617 FORMAT(T13,' 15.01 TO  20.00',13X,F8.1)
      WRITE(6,618)  RETURN(16)
  618 FORMAT(T13,' 20.01 TO  30.00',13X,F8.1)
      WRITE(6,619)  RETURN(17)
  619 FORMAT(T13,' 30.01 TO  40.00',13X,F8.1)
      WRITE(6,620)  RETURN(18)
  620 FORMAT(T13,' 40.01 TO  50.00',13X,F8.1)
      WRITE(6,621)  RETURN(19)
  621 FORMAT(T13,' 50.01 TO  75.00',13X,F8.1)
      WRITE(6,622)  RETURN(20)
  622 FORMAT(T13,' 75.01 TO 100.00',13X,F8.1)
      WRITE(6,623)  RETURN(21)
  623 FORMAT(T13,'100.01 TO 125.00',13X,F8.1)
      WRITE(6,624)  RETURN(22)
  624 FORMAT(T13,'125.01 TO 150.00',13X,F8.1)
      WRITE(6,625)  RETURN(23)
  625 FORMAT(T13,'150.01 TO 175.00',13X,F8.1)
      WRITE(6,626)  RETURN(24)
  626 FORMAT(T13,'175.01 TO 200.00',13X,F8.1)
      WRITE(6,627)  RETURN(25)
  627 FORMAT(T13,'200.01 TO 250.00',13X,F8.1)
      WRITE(6,628)  RETURN(26)
  628 FORMAT(T13,'250.01 TO 300.00',13X,F8.1)
      WRITE(6,629)  RETURN(27)
  629 FORMAT(T13,'300.01 TO 350.00',13X,F8.1)
      WRITE(6,630)  RETURN(28)
  630 FORMAT(T13,'350.01 TO 400.00',13X,F8.1)
      WRITE(6,631)  RETURN(29)
  631 FORMAT(T13,'400.01 TO 500.00',13X,F8.1)
      WRITE(6,632)  RETURN(30)
  632 FORMAT(T13,'500.01 OR GREATER',12X,F8.1)
  407 IF(KEYP.EQ.1) GO TO 700
      WRITE(7,585) M,N
  585 FORMAT(2I4)
      WRITE(7,587) AXSEC
  587 FORMAT(2A4)
      WRITE(7,586) ((TDAMA(I,J),J=1,N),I=1,M)
  586 FORMAT(10F8.2)
  700 CONTINUE
   64 FORMAT (//)
   81 FORMAT (4X,14F8.2)
  139 FORMAT (13X,I3,10X,F8.1,9X,F8.1)
  141 FORMAT (22X,F8.1,5X,F8.1)
  165 FORMAT (5X,14F8.1)
   76 FORMAT (12X,I2,12X,F7.1,16X,F4.2)
      GO TO 148
      STOP
```

The Optimizing Routine

Modification of the general routine to include the optimizing procedure has been referred to throughout this bulletin. The extent of the modifications can be determined by comparing the source programs. The same methodology for estimating the incidence of flood damages is adhered to in both routines and large parts of the two source programs are identical. Although the source program is the only form in which the optimizing routine is presented, the detailed explanation provided for the general routine can be used to trace through the optimizing source program.

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C                    OPTIMUM CR PROFIT MAXIMIZING FLOOD PLAIN LAND USE
C  A3     DESIGNATES WHEITHER INPUT DATA FOLLOWS FOR ANOTHER MATRIX
C  AVDAM  DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR MATRIX UNDER CONSIDERATION
C  AXSEC  DESIGNATES PARTICULAR CROSS-SECTION BEING EVALUATED
C  CDAM   DESIGNATES AVERAGE ANNUAL DAMAGES ON EACH SAMPLE POINT FOR EACH CROP
C                    IN THE STUDY AREA
C  CDAMPE DESIGNATES PERCENTAGE ACCUMULATED AVERAGE ANNUAL DAMAGES ARE
C                    OF ACCUMULATED GROSS RETURNS ASSUMING NO FLOODING
C  CELV   DESIGNATES ELEVATION OF CHANNEL BOTTOM
C  COMRET DESIGNATES GROSS RETURNS WITH NO FLOODING FOR THIS AND ALL PRECEDING
C                    CROSS-SECTIONS
C  COPTUM DESIGNATES NET RETURNS WITH OPTIMUM LAND-USE FOR THIS CROSS-SECTION
C  COST   DESIGNATES PER ACRE COSTS TO PRODUCE ONE ACRE OF EACH CROP
C  CPRICE DESIGNATES PRICE OF OPTIMUM THAT EQUATES OPTIMUM AND SECOND BEST CROP
C  COPTU2 DESIGNATES NET RETURNS WITH SECOND BEST LAND-USE FOR CROSS-SECTION
C CPVAL DESIGNATES GROSS VALUE OF EACH CROP ON EACH PRODUCTIVITY CLASS
C  D1     DESIGNATES DEPTH DIVIDING INTERVALS ONE AND TWO
C  D2     DESIGNATES DEPTH DIVIDING INTERVALS TWO AND THREE
C  D3     DESIGNATES DEPTH DIVIDING INTERVALS THREE AND FOUR
C IF ONLY TWO INTERVALS ARE USED THEN THERE WILL BE ONLY ONE DIVIDING DEPTH
C THE FOURTH INTERVAL IS ALL DEPTHS EXCEEDING D3
C  DAMA   DESIGNATES TOTAL DAMAGES FOR EACH FLOOD ON A PER ACRE BASIS
C  DEPTH  DESIGNATES DEPTH OF INUNDATION FOR EACH FLOOD AT EACH SAMPLE POINT
C  DTRTN  DESIGNATES NET RETURNS AS INPUT DATA RATHER THAN COMPUTED
C  EXELV  DESIGNATES ELEVATION EXCEEDING LARGEST FLOOD
C  FACTOR DESIGNATES DAMAGE FACTORS IN RELATION TO INUNDATION
C  FELV   DESIGNATES ELEVATION OF SPECIFIC FLOODS
C  FLD    DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES WITH OPTIMUM LAND-USE FOR THIS
C                    CROSS-SECTION
C  FLD2   DESIGNATES CROSS-SECTION AVERAGE ANNUAL DAMAGES WITH SECOND BEST
C                    LAND-USE
C  KDIST  DESIGNATES DISTANCE OF RIGHT CROSS-SECTION BANK
C  KEYP   DESIGNATES IF OPTIMUM LAND-USE IS TO BE PUNCH ON DATA CARDS
C  KINTER DESIGNATES INTERVAL BETWEEN EACH CROSS-SECTION STATION ON RIGHT
C  KLASS DESIGNATS LAND PRODUCTIVITY GROUP OF EACH SAMPLE POINT
C  KROP   DESIGNATES LAND-USE
C  KSTA   DESIGNATES CROSS-SECTION STATION ELEVATIONS ON THE RIGHT
C  L      DESIGNATES NUMBER OF FLOODS CONSIDERED
C  LAND   DESIGNATES ACCUMULATED ACREAGE OF EACH CROP OVER THE FLOOD-
C                    PLAIN WITH OPTIMUM LAND-USE
C  LAND2  DESIGNATES ACCUMULATED ACREAGE OF EACH CROP OVER THE FLOODPLAIN WITH
C                    SECOND BEST LAND-USE
C  LD     DESIGNATES DEPTH INCREMENTS CONSIDERED
C  LDIST  DESIGNATES DISTANCE OF LEFT CROSS-SECTION BANK
C  LDUSE2 DESIGNATES SECOND BEST LAND-USE AT EACH SAMPLE POINT CONSIDERING FLOOD
C  LINTER DESIGNATES INTERVAL BETWEEN EACH CROSS-SECTION STATION ON LEFT
C  LP    DESIGNATES NUMBER OF PRODUCTIVITY GROUPS
C  LS     DESIGNATES TOTAL SEASONS CONSIDERED
C  LSTA   DESIGNATES CROSS-SECTION STATION ELEVATIONS ON THE LEFT
C  LDUSE  DESIGNATES OPTIMUM LAND-USE AT EACH SAMPLE POINT CONSIDERING FLOODING
C  M      DESIGNATES ROWS OF MATRIX
C  MA     DESIGNATES NUMBER OF CROPS CONSIDERED
C  N      DESIGNATES COLUMNS OF MATRIX
C  NCOSRE DESIGNATES SPECIFIC SETS OF DATA TO BE PRINTED
C  OPTUM  DESIGNATES LAND-USE AT EACH SAMPLE POINT YIELDING LARGEST NET RETURNS
C         CONSIDERING AVERAGE ANNUAL FLOODING DAMAGES
C  OPTUM2 DESIGNATES NET RETURNS AT EACH SAMPLE POINT WITH SECOND BEST LAND-USE
C  PCOST  DESIGNATES PRODUCTION COSTS WITH OPTIMUM LAND-USE FOR THIS CROSS-
C                    SECTION
C  PCOST2 DESIGNATES CROSS-SECTION PRODUCTION COSTS WITH SECOND BEST LAND-USE
C  PDAMA  DESIGNATES FLOODING DAMAGES FROM EACH SPECIFIC FLOOD IN THE YEAR IT
C                    OCCURS FOR THE ACRES REPRESENTED BY EACH SAMPLE POINT
C  PERDAM DESIGNATES PERCENT AVERAGE ANNUAL FLOODING DAMAGES OF ENTIRE CROSS-
C                    SECTION ARE OF TOTAL GROSS RETURNS WITH NO FLOODING
C  PRICE DESIGNATES PRICE PER UNIT OF EACH CROP
C PRICE1 DESIGNATES DISTRIBUTION OF ACRES OF XPRICE FOR A CROSS-SECTION AREA
C PRICE2 DESIGNATES DISTRIBUTION OF ACRES OF XPRICE OVER ANALYZED CROSS-SECTIONS
C  PROFIT DESIGNATES NET RETURNS ON EACH SAMPLE POINT AREA CONSIDERING AVERAGE
C                    ANNUAL DAMAGES
C  R      DESIGNATES STATION ELEVATION ON RIGHT SIDE OF CROSS-SECTION
C  RETURN DESIGNATES NET RETURN BY CROP AND PRODUCTIVITY GROUP ASSUMING NO
C                    FLOODING OCCURS
C  SDAMA  DESIGNATES DAMAGE FACTORS WEIGHTED BY SWAIT FOR EACH SEASON
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C   SPA    DESIGNATES ACRES REPRESENTED BY EACH SAMPLE POINT
C   SWAIT  DESIGNATES PERCENT CHANCE OF OCCURANCE OF ANY FLOOD BY SEASON
C   SWEIGH DESIGNATES PERCENT CHANCE OF OCCURANCE OF SPECIFIC FLOOD IN ANY YEAR
C   TCVAL2 DESIGNATES CROSS-SECTION GROSS RETURNS WITH SECOND BEST LAND-USE
C   TCVAL  DESIGNATES GROSS RETURNS FOR ENTIRE CROSS-SECTION WITH NO FLOODING
C   TDAMA  DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR THE AREA REPRESENTED BY
C                     EACH SAMPLE POINT (WEIGHT DAMAGES FROM EACH FLOOD AND SUM
C                     FOR EACH SAMPLE POINT)
C   TFLD   DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES WITH OPTIMUM LAND-USE FOR ALL
C                     CROSS-SECTIONS ANALYZED
C   TFLD2  DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES WITH SECOND BEST LAND-USE OVER
C                     ALL CROSS-SECTIONS
C   TOPTUM DESIGNATES NET RETURNS WITH OPTIMUM LAND-USE FOR ALL CROSS-SECTIONS
C   TPCOST DESIGNATES PRODUCTION COSTS WITH OPTIMUM LAND-USE FOR ALL CROSS-
C                     SECTIONS ANALYZED
C   TOPTU2 DESIGNATES NET RETURNS WITH SECOND BEST LAND-USE OVER ALL CROSS-
C                     SECTIONS
C   TPCOS2 DESIGNATES PRODUCTION COSTS FOR SECOND BEST LAND-USE OVER ALL CROSS-
C                     SECTIONS
C   TTCVAL DESIGNATES GROSS RETURNS WITH OPTIMUM LAND-USE FOR ALL CROSS-SECTIONS
C   TTCVA2 DESIGNATES ACCUMULATED GROSS RETURNS, ALL CROSS-SECTIONS, SECOND BEST
C                     LAND-USE
C   TVAL  DESIGNATES GROSS VALUE OF EACH CROP ON EACH SAMPLE POINT
C   X      DESIGNATES STATION ELEVATION ON LEFT SIDE OF CROSS-SECTION
C   XDAMA DESIGNATES AVERAGE ANNUAL FLOOD DAMAGES FOR ALL MATRICES COMPUTED
C   XOCATE DESIGNATES LOCATION OF EACH SAMPLE POINT
C  XPRICE DESIGNATES PERCENT DECREASE IN PRICE REQUIRED FOR OPTIMUM LAND USE NET
C                    RETURNS TO EQUAL SECOND BEST LAND USE NET RETURNS
C   YIELD DESIGNATES YIELD OF EACH CROP ON EACH PRODUCTIVITY GROUP
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```
      DIMENSION X(500),R(500)
      DIMENSION XOCATE(14,14), ELV(14,14)
      DIMENSION FELV(8),DEPTH(8,14,14),SWEIGH(8)
      DIMENSION FACTOR(60,12), SDAMA(60,12), SWAIT(12)
      DIMENSION PRICE(15), YIELD(10,15), CPVAL(10,15)
      DIMENSION KLASS(14,14), KROP(14,14), DAMA(8,14,14)
      DIMENSION TDAMA(14,14)
      DIMENSION PDAMA(8,14,14)
      DIMENSION TVAL(15,14,14),COST(10,15),PROFIT(15,14,14)
      DIMENSION LAND2(15,2),LDUSE2(14,14),OPTUM2(14,14),CPRICE(14,14)
      DIMENSION CDAM(15,14,14)
      DIMENSION OPTUM(14,14),LDUSE(14,14)
      DIMENSION DTRTN(10,15)
      DIMENSION AXSEC(2),CROP(15,2)
      DIMENSION LAND(15,2)
      DIMENSION XPRICE(14,14),PRICE1(13),PRICE2(13)
      DO 400 I=1,8
      DO 400 J=1,14
      DO 400 K=1,14
      FELV(I) = 0.0
      DEPTH(I,J,K) = 0.0
      SWEIGH(I) = 0.0
      DAMA(I,J,K) = 0.0
      PDAMA(I,J,K) = 0.0
  400 CONTINUE
      DO 401 I=1,60
      DO 401 J=1,12
      FACTOR(I,J) = 0.0
      SDAMA(I,J) = 0.0
      SWAIT(J) = 0.0
  401 CONTINUE
      DO 402 I=1,10
      DO 402 J=1,15
      PRICE(J) = 0.0
      YIELD(I,J) = 0.0
      CPVAL(I,J)=0.0
      DTRTN(I,J) = 0.0
      COST(I,J) = 0.0
  402 CONTINUE
      DO 403 I = 1,15
      DO 403 J = 1,2
      CROP(I,J)=0.0
      LAND(I,J) = 0.0
      LAND2(I,J) = 0.0
  403 CONTINUE
      DO 801 I=1,13
  801 PRICE2(I)=0.0
      TOPTUM = 0.0
      TTCVAL = 0.0
      TFLD = 0.0
      TPCOST = 0.0
      TPCOS2 = 0.0
      TFLD2 = 0.0
      TTCVA2 =0.0
      TOPTU2 =0.0
      READ (5,120) MA
      READ(5,580) ((CROP(I,J),J=1,2),I=1,MA)
      READ (5,120) L
      READ (5,120) LP
      READ (5,120) LS
      READ (5,120) LD
      READ (5,200) D1,D2,D3
      READ (5,13) (SWEIGH(I),I=1,L)
      LG = MA *LD
      READ (5,13) ((FACTOR(I,J),J=1,12),I=1,LG)
      READ (5,13) (SWAIT(I),I=1,LS)
      READ (5,20) (PRICE(I),I=1,MA)
      READ (5,21) ((YIELD(I,J),J=1,15),I=1,LP)
      READ (5,11) KEYP
      READ(5,20) ((COST(I,J),I=1,10),J=1,MA)
      DATA A1,A2/4HDATA,4HALL /
  148 READ (5,149) A3
  580 FORMAT(20A4)
  149 FORMAT (A4)
      IF (A3.EQ.A1) GO TO 150
      CALL EXIT
C  SETTING STORAGE EQUAL TO ZERO
  150 DO 1 I=1,14
      DO 1 J=1,14
      CPRICE(I,J)=0.0
      OPTUM2(I,J)=0.0
      LDUSE2(I,J)=0.0
      OPTUM(I,J) = 0.0
      LDUSE(I,J) = 0
      TDAMA(I,J) = 0.0
      KLASS(I,J) = 0
      KROP(I,J) = 0
      XOCATE(I,J) = 0.0
      ELV(I,J) = 0.0
    1 CONTINUE
      DO 2 I = 1,8
      DO 2 J = 1,14
      DO 2 K = 1,14
      PDAMA(I,J,K) = 0.0
      DAMA(I,J,K) = 0.0
      DEPTH(I,J,K) = 0.0
```

```
      FELV(I) = 0.0
      XPRICE(J,K)=0.0
    2 CONTINUE
      DO 800 I=1,13
  800 PRICE1(I)=0.0
      DO 5 NA = 1,500
      X(NA) = 0.0
    5 R(NA) = 0.0
      DO 540 IE=1,15
      DO 540 J=1,14
      DO 540 K=1,14
      CDAM(IE,J,K) =0.0
      TVAL(IE,J,K) =0.0
      PROFIT(IE,J,K) = 0.0
  540 CONTINUE
      COPTUM = 0.0
      TCVAL = 0.0
      FLD = 0.0
      PCOST = 0.0
      PCOST2 = 0.0
      FLD2 =0.0
      TCVAL2 = 0.0
      COPTU2 =0.0
      READ (5,105) AXSEC
      READ(5,20) SPA
      READ (5,120) M,N
      READ (5,120) LSTA, KSTA
      READ (5,120) LINTER, KINTER
      READ (5,121) CELV
      READ (5,121) EXELV
      READ (5,121) (X(I),I=1,LSTA)
      READ (5,121) (R(I),I=1,KSTA)
      READ (5,121) (FELV(I),I=1,L)
      READ (5,121) ((XOCATE(I,J),I=1,M),J=1,N)
      IF(LP.GT.1) GO TO 350
      DO 351 I=1,M
      DO 351 J=1,N
      KLASS(I,J)=1
      IF (XOCATE(I,J).EQ.2.0) KLASS(I,J) = 0
  351 CONTINUE
      GO TO 352
  350 READ (5,11) ((KLASS(I,J),I=1,M),J=1,N)
  352 READ(5,11) NCOSRE
  105 FORMAT (2A4)
  200 FORMAT (20F4.1)
   20 FORMAT (10F8.3)
   21 FORMAT (15F5.1)
   13 FORMAT (12F5.3)
  120 FORMAT (20I4)
  121 FORMAT (10F8.1)
   11 FORMAT (40I2)
C  FILLING BLANKS ON LINEAR SEGMENTS OF CROSS-SECTION
      KE = 0
  122 DO 124 I=1,LSTA
      IF (X(I))126,125,126
  125 IF (KE) 128,127,128
  127 KE = I
  128 GO TO 124
  126 IF (KE) 129,124,129
  129 LE = KE - 1
      ME = I - LE
      SE = ME
      TE = (X(I) - X(LE)) / SE
      ID = I - 1
      FMULT = 0.0
      DO 130 II = KE,ID
      FMULT = FMULT + 1.0
      X(II) = X(LE) + (TE * FMULT)
  130 CONTINUE
      KE = 0
  124 CONTINUE
  131 DO 132 I=1,KSTA
      IF (R(I)) 134,133,134
  133 IF (KE) 136,135,136
  135 KE = I
  136 GO TO 132
  134 IF (KE) 137,132,137
  137 LE = KE - 1
      ME = I - LE
      SE = ME
      TE = (R(I) - R(LE)) / SE
      ID = I - 1
      FMULT = 0.0
      DO 138 II = KE,ID
      FMULT = FMULT + 1.0
      R(II) = R(LE) + (TE * FMULT)
  138 CONTINUE
      KE = 0
  132 CONTINUE
      LDIST = LINTER * LSTA
      KDIST = KINTER * KSTA
C COMPUTING ELEVATION FOR EACH SAMPLE POINT
  160 DO 163 I=1,M
      DO 163 J=1,N
      IF (XOCATE(I,J).GT.100.0.AND.XOCATE(I,J).LT.200.0) GO TO 161
      IF (XOCATE(I,J).GT.200.0.AND.XOCATE(I,J).LT.300.0) GO TO 162
```

```
      IF (XOCATE(I,J).EQ.0.0) ELV(I,J) = CELV
      IF (XOCATE(I,J).EQ.1.0) ELV(I,J) = X(LSTA)
      IF (XOCATE(I,J).EQ.2.0) ELV(I,J) = EXELV
      GO TO 163
  161 XINTER = LINTER
      XDIST = LDIST
      SSTA = (XDIST * ((XOCATE(I,J) - 100.0) / 100.0)) / XINTER
      IF (SSTA.LT.1.0) GO TO 166
      ISTA = SSTA
      JSTA = ISTA + 1
      CHELV = X(JSTA) - X(ISTA)
      TSTA = ISTA
      HIL = (SSTA - TSTA) * CHELV
      MSTA = TSTA
      ELV(I,J) = X(MSTA) + HIL
      GO TO 163
  166 CHELV = X(1) - CELV
      HIL = SSTA * CHELV
      ELV(I,J) = CELV + HIL
      GO TO 163
  162 RINTER = KINTER
      RDIST = KDIST
      SSTA = (RDIST * ((XOCATE(I,J) - 200.0) / 100.0)) / RINTER
      IF (SSTA.LT.1.0) GO TO 167
      ISTA = SSTA
      JSTA = ISTA + 1
      CHELV = R(JSTA) - R(ISTA)
      TSTA = ISTA
      HIL = (SSTA - TSTA) * CHELV
      MSTA = TSTA
      ELV(I,J) = R(MSTA) + HIL
      GO TO 163
  167 CHELV = R(1) - CELV
      HIL = SSTA * CHELV
      ELV(I,J) = CELV + HIL
  163 CONTINUE
C COMPUTING DEPTH OF INUNDATION FOR EACH POINT
      DO 17 I=1,L
      DO 17 J=1,M
      DO 17 K=1,N
      DEPTH(I,J,K) = FELV(I) - ELV(J,K)
   17 CONTINUE
C  WEIGHTING DAMAGE FACTORS BY SEASONAL PROBABILITY OF FLOODING
      DO 19 I=1,LG
      DO 19 J=1,LS
      SDAMA(I,J) = FACTOR(I,J) * SWAIT(J)
   19 CONTINUE
C  CALCULATING GROSS VALUE OF EACH CROP ON EACH PRODUCTIVITY GROUP
      DO 22 I=1,10
      DO 22 J = 1,15
      CPVAL(I,J) = PRICE(J) * YIELD(I,J)
   22 CONTINUE
      DO 700 I=1,LP
      DO 700 J=1,MA
  700 DTRTN(I,J) = CPVAL(I,J) - COST(I,J)
C CALCULATING FLOOD DAMAGES ON EACH POINT FOR EACH FLOOD
      DO 500 IE = 1,MA
      DO 501 I = 1,L
      DO 501 J = 1,M
      DO 501 K = 1,N
      PDAMA(I,J,K) =0.0
      DAMA(I,J,K) = 0.0
      KROP(J,K) = IE
  501 CONTINUE
      IF (LD.EQ.1) GO TO 201
      IF (LD.EQ.2) GO TO 203
      IF (LD.EQ.3) GO TO 205
      IF (LD.EQ.4) GO TO 207
C ONLY ONE DEPTH INCREMENT CONSIDERED
  201 DO 202 I=1,L
      DO 202 J=1,M
      DO 202 K=1,N
      DO 202 KD=1,LP
      DO 202 IT=1,LS
      IF (DEPTH(I,J,K).LE.0.) DAMA(I,J,K)=0.0
      IF (DEPTH(I,J,K).GT.0..AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IE,IT))
  202 CONTINUE
      GO TO 208
C TWO DEPTH INCREMENTS CONSIDERED-ZERO TO X1 FEET, X1 FEET AND GREATER
  203 DO 204 I=1,L
      DO 204 J=1,M
      DO 204 K=1,N
      DO 204 KD=1,LP
      DO 204 IT=1,LS
      IG =(IE * 2) - 1
      IH = (IE * 2)
      D1N = D1 / 2.
      IF (DEPTH(I,J,K).LE.0.)  DAMA(I,J,K) = 0.0
      IF (DEPTH(I,J,K).GT.0..AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT) / D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) =DAMA(I,J,K)+(CPVAL(KD,IE)*((S
     2DAMA(IH,IT)-(((SDAMA(IH,IT)-SDAMA(IG,IT))/ (D2 - D1N))* D2)) +(((S
     3DAMA(IH,IT)-SDAMA(IG,IT))/(D2-D1N))*DEPTH(I,J,K))))
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      IF (DEPTH(I,J,K).GE.D2.AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IH,IT))
      D1N = 0.0
  204 CONTINUE
      GO TO 208
C THREE DEPTH INCREMENTS CONSIDERED- 0 TO X1, X1 TO X2, X2 AND GREATER
  205 DO 206 I=1,L
      DO 206 J=1,M
      DO 206 K=1,N
      DO 206 KD=1,LP
      DO 206 IT=1,LS
      D1N = D1 / 2.
      D2N =(D1+D2) / 2.
      IG = (IE * 3) - 2
      IH = (IE * 3) - 1
      IK = (IE * 3)
      IF (DEPTH(I,J,K).LE.0.) DAMA(I,J,K) = 0.0
      IF (DEPTH(I,J,K).GT.0..AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT)/ D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD) DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *(
     2(SDAMA(IH,IT) - (((SDAMA(IH,IT) - SDAMA(IG,IT)) / (D2N - D1N)) * D
     32N)) +(((SDAMA(IH,IT)-SDAMA(IG,IT))/(D2N-D1N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2N.AND.DEPTH(I,J,K).LT.D2.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD) DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*  (
     2(SDAMA(IK,IT)-(((SDAMA(IK,IT)-SDAMA(IH,IT))/(D2-D2N))*D2)) +(((SDA
     3MA(IK,IT)-SDAMA(IH,IT))/ (D2-D2N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2.AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IK,IT))
      D1N = 0.0
      D2N = 0.0
  206 CONTINUE
      GO TO 208
C FOUR DEPTH ENCREMENTS CONSIDERED - 0 TO X1, X1 TO X2, X2 TO X3, X3 AND GREATER
  207 DO 208 I=1,L
      DO 208 J=1,M
      DO 208 K=1,N
      DO 208 KD=1,LP
      DO 208 IT=1,LS
      D1N = D1 / 2.
      D2N =(D1+D2) / 2.
      D3N = (D2+D3) / 2.
      IG = (IE * 4) - 3
      IH = (IE * 4) - 2
      IK = (IE * 4) - 1
      IL = (IE * 4)
      IF (DEPTH(I,J,K).LE.0.0) DAMA(I,J,K) = 0.0
      IF (DEPTH(I,J,K).GT.0.0.AND.DEPTH(I,J,K).LT.D1N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) *
     2((SDAMA(IG,IT) / D1N) * DEPTH(I,J,K)))
      IF (DEPTH(I,J,K).GE.D1N.AND.DEPTH(I,J,K).LT.D2N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*(
     2(SDAMA(IH,IT)-(((SDAMA(IH,IT) -SDAMA(IG,IT))/ (D2N-D1N))* D2N))+((
     3(SDAMA(IH,IT)-SDAMA(IG,IT))/(D2N-D1N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D2N.AND.DEPTH(I,J,K).LT.D3N.AND.KROP(J,K).EQ.I
     1E.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*(
     2(SDAMA(IK,IT)- (((SDAMA(IK,IT) -SDAMA(IH,IT))/ (D3N-D2N)) *D3N))+(
     3((SDAMA(IK,IT)-SDAMA(IH,IT))/(D3N-D2N))*DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D3N.AND.DEPTH(I,J,K).LT.D3.AND.KROP(J,K).EQ.IE
     1.AND.KLASS(J,K).EQ.KD)  DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE)*((
     2SDAMA(IL,IT)-(((SDAMA(IL,IT)- SDAMA(IK,IT))/ (D3-D3N))* D3))+(((SD
     3AMA(IL,IT)- SDAMA(IK,IT))/ (D3-D3N)) *DEPTH(I,J,K))))
      IF (DEPTH(I,J,K).GE.D3.AND.KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.KD)
     1DAMA(I,J,K) = DAMA(I,J,K)+(CPVAL(KD,IE) * SDAMA(IL,IT))
      D1N = 0.0
      D2N = 0.0
      D3N = 0.0
  208 CONTINUE
C EXPANDING FLOOD DAMAGES TO EACH SAMPLE POINT FROM EACH FLOOD TO THE ACRES
C REPRESENTED BY EACH SAMPLE POINT
      DO 224 I=1,L
      DO 224 J=1,M
      DO 224 K=1,N
      PDAMA(I,J,K) = DAMA(I,J,K)* SPA
  224 CONTINUE
C COMPUTING AVERAGE ANNUAL FLOODING DAMAGES TO THE AREA REPRESENTED BY EACH
C SAMPLE POINT (WEIGHT EACH FLOODS DAMAGES BY PROBABILITY OF OCCURANCE OF THE
C FLOOD AND SUM THE RESULT FOR EACH FLOOD ON EACH POINT)
      LAA = L-1.
      DO 225 I=1,LAA
      DO 225 J=1,M
      DO 225 K=1,N
  225 CDAM(IE,J,K) = CDAM(IE,J,K) + ((PDAMA(I,J,K) + PDAMA((I+1),J,K)) /
     12) * (SWEIGH(I) - SWEIGH(I+1))
      DO 984 J=1,M
      DO 984 K=1,N
  984 CDAM(IE,J,K) = CDAM(IE,J,K) + (PDAMA(L,J,K) * SWEIGH(L))
  500 CONTINUE
      DO 519 I=1,14
      DO 519 J=1,14
  519 KROP(I,J)=0
      DO 520 IE = 1,MA
      DO 520 J =1,M
      DO 520 K =1,N
      DO 520 I = 1,LP
```

```
      KROP(J,K) = IE
      IF(KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.I) TVAL(IE,J,K) = CPVAL(I,IE)
     1*SPA
  520 CONTINUE
      DO 730 IE =1,MA
      DO 730 J=1,M
      DO 730 K=1,N
  730 IF (CDAM(IE,J,K).GT.TVAL(IE,J,K)) CDAM(IE,J,K) = TVAL(IE,J,K)
C CONPUTING SAMPLE POINT AREA NET RETURNS WITH AVERAGE ANNUAL FLOODING
C  DAMAGES SUBTRACTED
  562 DO 564 IE = 1,MA
      DO 564 I = 1,LP
      DO 564 J = 1,M
      DO 564 K = 1,N
      KROP(J,K) = IE
      IF(KROP(J,K).EQ.IE.AND.KLASS(J,K).EQ.I) GO TO 652
      GO TO 564
  652 IF (TVAL(IE,J,K)) 653,653,654
  653 PROFIT(IE,J,K) = 0.0
      GO TO 564
  654 PROFIT(IE,J,K) = (DTRTN(I,IE) * SPA) - CDAM(IE,J,K)
  564 CONTINUE
  563 DO 530 J = 1,M
      DO 530 K = 1,N
      DO 530 IE = 1,MA
      IF(OPTUM(J,K).LT.PROFIT(IE,J,K)) GO TO 531
      GO TO 530
  531 OPTUM(J,K) = PROFIT(IE,J,K)
      LDUSE(J,K) = IE
  530 CONTINUE
      KOUNT= SPA
      DO 600 I=1,15
  600 LAND(I,1) = I
      DO 601 I = 1,15
      DO 601 J= 1,M
      DO 601 K= 1,N
      IF(LAND(I,1).EQ.LDUSE(J,K)) GO TO 602
      GO TO 601
  602 LAND(I,2) = LAND(I,2) + KOUNT
  601 CONTINUE
      SPA = KOUNT
C  ACCUMULATING NET RETURNS WITH OPTIMUM LAND-USE
      DO 610 I=1,M
      DO 610 J=1,N
      COPTUM = COPTUM + OPTUM(I,J)
  610 CONTINUE
      TOPTUM = TOPTUM + COPTUM
C  ACCUMULATING GROSS RETURNS WITH OPTIMUM LAND-USE
      DO 611 I=1,M
      DO 611 J=1,N
      DO 611 IE=1,MA
      DO 611 KD=1,LP
      IF (LDUSE(I,J).EQ.IE.AND.KLASS(I,J).EQ.KD)  TCVAL = TCVAL +(CPVAL(
     1KD,IE) * SPA)
  611 CONTINUE
      TTCVAL = TTCVAL + TCVAL
C  ACCUMULATING AVERAGE ANNUAL FLOOD DAMAGES WITH OPTIMUM LAND-USE
      DO 612 I=1,M
      DO 612 J=1,N
      DO 612 IE=1,MA
      IF  (LDUSE(I,J).EQ.IE) FLD = FLD + CDAM(IE,I,J)
  612 CONTINUE
      TFLD = TFLD + FLD
C  ACCUMALATING PRODUCTION COSTS WITH OPTIMUM LAND-USE
      PCOST = TCVAL -(COPTUM + FLD)
      TPCOST = TPCOST + PCOST
C  COMPUTING STATISTICS FOR SECOND BEST LAND USE
      DO 702 J=1,M
      DO 702 K=1,N
      DO 702 IE=1,MA
      IF (OPTUM2(J,K).LT.PROFIT(IE,J,K).AND.PROFIT(IE,J,K).LT.OPTUM(J,K)
     1) GO TO 703
      GO TO 702
  703 OPTUM2(J,K) = PROFIT(IE,J,K)
      LDUSE2(J,K) = IE
  702 CONTINUE
      KOUNT = SPA
      DO 705 I=1,15
  705 LAND2(I,1)=I
      DO 706 I=1,15
      DO 706 J=1,M
      DO 706 K=1,N
      IF (LAND2(I,1).EQ.LDUSE2(J,K)) GO TO 707
      GO TO 706
  707 LAND2(I,2) = LAND2(I,2) + KOUNT
  706 CONTINUE
      SPA = KOUNT
C  ACCUMULATING NET RETURNS WITH SECOND BEST LAND USE
      DO 708 I=1,M
      DO 708 J=1,N
```

```
  708 COPTU2 = COPTU2 + OPTUM2(I,J)
      TOPTU2 = TOPTU2 + COPTU2
C  ACCUMULATING GROSS RETURNS WITH SECOND BEST LAND-USE
      DO 709 I=1,M
      DO 709 J=1,N
      DO 709 IE=1,MA
      DO 709 KD=1,LP
  709 IF (LDUSE2(I,J).EQ.IE.AND.KLASS(I,J).EQ.KD) TCVAL2 = TCVAL2 + (CPV
     1AL(KD,IE) * SPA)
      TTCVA2 = TTCVA2 + TCVAL2
C  ACCUMULATING AVERAGE ANNUAL FLOOD DAMAGES WITH SECOND BEST LAND-USE
      DO 710 I=1,M
      DO 710 J=1,N
      DO 710 IE=1,MA
  710 IF (LDUSE2(I,J).EQ.IE) FLD2 = FLD2 + CDAM(IE,I,J)
      TFLD2 = TFLD2 + FLD2
C  ACCUMULATING PRODUCTION COSTS WITH SECOND BEST LAND-USE
      PCOST2 = TCVAL2 -(COPTU2 + FLD2)
      TPCOS2 = TPCOS2 + PCOST2
      DO 716 J=1,M
      DO 716 K=1,N
      DO 716 IE=1,LP
      IF (KLASS(J,K).EQ.IE) GO TO 717
      GO TO 716
  717 CPRICE(J,K) = ((OPTUM2(J,K) + (TVAL(LDUSE(J,K),J,K) - CDAM(LDUSE(J
     1,K),J,K) - OPTUM(J,K))) / ((YIELD(IE,LDUSE(J,K)) * SPA) - ((YIELD(
     2IE,LDUSE(J,K))      * SPA) * (CDAM(LDUSE(J,K),J,K) / TVAL(LDUSE(J,K
     3),J,K)))))
  716 CONTINUE
      DO 802 I=1,M
      DO 802 J=1,N
      DO 802 IE=1,MA
      IF(LDUSE(I,J).EQ.IE.AND.CPRICE(I,J).GT.0.0) GO TO 803
      IF(LDUSE(I,J).EQ.IE.AND.CPRICE(I,J).EQ.0.0) XPRICE(I,J)=100.0
      GO TO 802
  803 XPRICE(I,J)=100.0-((CPRICE(I,J)/PRICE(IE))*100.0)
      IF (XPRICE(I,J).GT. 0.0.AND.XPRICE(I,J).LE. 0.5) PRICE1(1) =PRICE1
     1(1) + SPA
      IF (XPRICE(I,J).GT. 0.5.AND.XPRICE(I,J).LE. 1.0) PRICE1(2) =PRICE1
     1(2) + SPA
      IF (XPRICE(I,J).GT. 1.0.AND.XPRICE(I,J).LE. 2.0) PRICE1(3) =PRICE1
     1(3) + SPA
      IF (XPRICE(I,J).GT. 2.0.AND.XPRICE(I,J).LE. 3.0) PRICE1(4) =PRICE1
     1(4)+SPA
      IF (XPRICE(I,J).GT. 3.0.AND.XPRICE(I,J).LE. 4.0) PRICE1(5) =PRICE1
     1(5)+SPA
      IF (XPRICE(I,J).GT. 4.0.AND.XPRICE(I,J).LE. 5.0) PRICE1(6) =PRICE1
     1(6)+SPA
      IF (XPRICE(I,J).GT. 5.0.AND.XPRICE(I,J).LE.10.0) PRICE1(7) =PRICE1
     1(7)+SPA
      IF (XPRICE(I,J).GT.10.0.AND.XPRICE(I,J).LE.15.0) PRICE1(8) =PRICE1
     1(8)+SPA
      IF (XPRICE(I,J).GT.15.0.AND.XPRICE(I,J).LE.20.0) PRICE1(9) =PRICE1
     1(9)+SPA
      IF (XPRICE(I,J).GT.20.0.AND.XPRICE(I,J).LE.25.0) PRICE1(10)=PRICE1
     1(10)+SPA
      IF (XPRICE(I,J).GT.25.0.AND.XPRICE(I,J).LE.50.0) PRICE1(11)=PRICE1
     1(11)+SPA
      IF (XPRICE(I,J).GT.50.0.AND.XPRICE(I,J).LE.99.9) PRICE1(12)=PRICE1
     1(12) + SPA
  802 CONTINUE
      DO 820 I=1,M
      DO 820 J=1,N
  820 IF (XPRICE(I,J).EQ.100.0) PRICE1(13) = PRICE1(13) + SPA
      DO 822 I=1,13
  822 PRICE2(I)=PRICE2(I)+PRICE1(I)
      WRITE (6,151)
  151 FORMAT (1H1,20X,45H NAME OF AND BEGINNING OF NEW EVALUATION AREA)
      WRITE (6,106) AXSEC
  106 FORMAT (58X,2A4)
      WRITE (6,64)
      WRITE (6,64)
      IF (NCOSRE.EQ.1) GO TO 305
      IF (NCOSRE.EQ.2) GO TO 306
      IF (NCOSRE.EQ.3) GO TO 307
      IF (NCOSRE.EQ.4) GO TO 308
      IF (NCOSRE.EQ.5) GO TO 825
  305 WRITE (6,300)
  300 FORMAT (2X,36H DATA APPLICABLE TO ENTIRE WATERSHED)
  240  WRITE (6,64)
      WRITE (6,72)
   72 FORMAT (6X,23H DAMAGE FACTORS APPLIED)
      WRITE (6,210)
  210 FORMAT (12X,7H SEASON)
      WRITE (6,73)
   73 FORMAT (4X,95H  FIRST  SECOND   THIRD  FOURTH   FIFTH   SIXTH  SEV
     1ENTH EIGHTH   NINTH   TENTH ELEVENTH TWELTH)
      WRITE (6,74) ((FACTOR(I,J),J=1,12),I=1,LG)
   74 FORMAT (2X,12F8.3)
      WRITE (6,64)
      WRITE (6,91)
   91 FORMAT (1H1,10X,24H DAMAGE FACTORS WEIGHTED)
      WRITE (6,210)
      WRITE (6,73)
      WRITE (6,74) ((SDAMA(I,J),J=1,12),I=1,LG)
      WRITE (6,64)
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      WRITE (6,211) LD
  211 FORMAT(5X,58H NUMBER OF INUNDATION DEPTH INTERVALS FOR DAMAGE FACT
     1ORS =,I2)
      WRITE (6,64)
      WRITE (6,212)
  212 FORMAT (4X,21H INUNDATION INTERVALS)
      IF (LD.EQ.1) GO TO 213
      IF (LD.EQ.2) GO TO 214
      IF (LD.EQ.3) GO TO 215
      IF (LD.EQ.4) GO TO 216
  213 WRITE (6,221)
  221 FORMAT (2X,22H NO INTERVAL BREAKDOWN)
      GO TO 220
  214 WRITE (6,217) D1
  217 FORMAT (10X,7H 0.0  -,1X,F4.1)
      WRITE (6,218) D1
  218 FORMAT (10X,F4.1,12H AND GREATER)
      GO TO 220
  215 WRITE (6,217) D1
      WRITE (6,219) D1,D2
  219 FORMAT (10X,F4.1,3H  -,1X,F4.1)
      WRITE (6,218) D2
      GO TO 220
  216 WRITE (6,217) D1
      WRITE (6,219) D1,D2
      WRITE (6,219) D2,D3
      WRITE (6,218) D3
      GO TO 220
  220 CONTINUE
      WRITE (6,64)
      WRITE (6,176)
  176 FORMAT (8X,27H PRODUCTIVITY   TOTAL CROPS)
      WRITE (6,177) LP,MA
  177 FORMAT (13X,I4,11X,I4)
      WRITE (6,64)
      WRITE (6,178)
  178 FORMAT (1H1,18X,30H PRICE PER UNIT OF CROPS GROWN)
      WRITE(6,179) ((CROP(I,J),J=1,2),I=1,15)
  179 FORMAT(3X,30A4)
      WRITE (6,180) (PRICE(I),I=1,15)
  180 FORMAT (2X,15F8.2)
      WRITE (6,64)
      WRITE (6,181)
  181 FORMAT (10X,38H CROP YIELD ON EACH PRODUCTIVITY GROUP)
      WRITE(6,7)
    7 FORMAT (2X,6H GROUP,36X,5H CROP)
    8 FORMAT(8X,30A4)
      WRITE(6,8) ((CROP(I,J),J=1,2),I=1,15)
      WRITE (6,184) (I,(YIELD(I,J),J=1,15),I=1,LP)
  184 FORMAT (5X,I2,1X,15F8.2)
      WRITE (6,64)
      WRITE (6,182)
  182 FORMAT (10X,47H GROSS VALUE BY CROP IN EACH PRODUCTIVITY GROUP)
      WRITE(6,7)
      WRITE(6,8) ((CROP(I,J),J=1,2),I=1,15)
      WRITE (6,184) (I,(CPVAL(I,J),J=1,15),I=1,LP)
      WRITE(6,64)
      WRITE(6,701)
  701 FORMAT (6X,50H COST OF PRODUCTION BY CROP AND PRODUCTIVITY GROUP)
      WRITE(6,7)
      WRITE(6,8) ((CROP(I,J),J=1,2),I=1,15)
      WRITE(6,184) (I,(COST(I,J),J=1,15),I=1,LP)
      WRITE (6,64)
  573 WRITE(6,565)
  565 FORMAT(4X,71H NET RETURNS BY CROP AND PRODUCTIVITY GROUP ASSUMING
     1NO FLOODING OCCURS)
      WRITE(6,7)
      WRITE(6,8) ((CROP(I,J),J=1,2),I=1,15)
      WRITE(6,184) (I,(DTRTN(I,J),J=1,15),I=1,LP)
      WRITE(6,64)
  306 WRITE (6,82)
   82 FORMAT (1H1,2X,43H COMPUTED DEPTH OF INUNDATION BY EACH FLOOD)
      WRITE (6,64)
      WRITE (6,83)
   83 FORMAT (40X,10H FLOOD ONE)
      WRITE (6,81) ((DEPTH(1,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,84)
   84 FORMAT (40X,10H FLOOD TWO)
      WRITE (6,81) ((DEPTH(2,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,85)
   85 FORMAT (40X,12H FLOOD THREE)
      WRITE (6,81) ((DEPTH(3,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,86)
   86 FORMAT (1H1,40X,11H FLOOD FOUR)
      WRITE (6,81) ((DEPTH(4,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,87)
   87 FORMAT (40X,11H FLOOD FIVE)
      WRITE (6,81) ((DEPTH(5,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,88)
   88 FORMAT (40X,10H FLOOD SIX)
      WRITE (6,81) ((DEPTH(6,J,K),K=1,14),J=1,14)
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86

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      WRITE (6,64)
      WRITE (6,89)
   89 FORMAT (1H1,40X,12H FLOOD SEVEN)
      WRITE (6,81) ((DEPTH(7,J,K),K=1,14),J=1,14)
      WRITE (6,64)
      WRITE (6,90)
   90 FORMAT (40X,12H FLOOD EIGHT)
      WRITE (6,81) ((DEPTH(8,J,K),K=1,14),J=1,14)
      WRITE (6,64)
  307 WRITE (6,301)
  301 FORMAT (2X,27H GENERAL CROSS-SECTION DATA)
      WRITE (6,174)
  174 FORMAT (7X,98H   ROWS       COLUMNS    FLOODS    LSTATIONS  RSTATIO
     1NS CELEVATION  XELEVATION LINTERVAL  RINTERVAL)
      WRITE (6,175) M,N,L,LSTA,KSTA,CELV,EXELV,LINTER,KINTER
  175 FORMAT (2X,5I11,2F11.1,2I11)
      WRITE (6,64)
      IF(LSTA.LE.KSTA) LSTA = KSTA
      WRITE(6,250)
  250 FORMAT (1H1,2X,33H CROSS SECTION STATION ELEVATIONS)
      WRITE(6,168)
  168 FORMAT (6X,31H LEFT STATIONS   RIGHT STATIONS)
      WRITE(6,139) (I,X(I),R(I),I=1,LSTA)
      WRITE (6,64)
      WRITE(6,170)
  170 FORMAT(1H1,5X,14H LEFT    RIGHT)
      WRITE(6,171)
  171 FORMAT(3X,18H DISTANCE DISTANCE)
      WRITE (6,141) XDIST, RDIST
      WRITE (6,64)
      WRITE (6,75)
   75 FORMAT (6X,34H FLOOD ELEVATIONS     FLOOD WEIGHT)
      WRITE (6,76) (FELV(I),SWEIGH(I),I=1,L)
      WRITE (6,64)
  308 WRITE (6,302)
  302 FORMAT(2X,37H CHARACTERISTICS OF EACH SAMPLE POINT)
      WRITE(6,64)
      WRITE(6,172)
  172 FORMAT(30X,22H SAMPLE POINT LOCATION)
      WRITE (6,165) ((XOCATE(I,J),J=1,14),I=1,14)
      WRITE (6,64)
      WRITE(6,173)
  173 FORMAT(29X,23H SAMPLE POINT ELEVATION)
      WRITE (6,165) ((ELV(I,J),J=1,14),I=1,14)
      WRITE (6,64)
      WRITE (6,6)
    6 FORMAT (1H1,4X,'PRODUCTIVITY GROUP OF EACH SAMPLE POINT')
      WRITE (6,70) ((KLASS(I,J),J=1,14),I=1,14)
   70 FORMAT(2X,14I4)
      WRITE (6,64)
   64 FORMAT (//)
   81 FORMAT (4X,14F8.2)
  141 FORMAT (3X,2F8.1)
  139 FORMAT (4X,I3,1X,F8.1,10X,F8.1)
  165 FORMAT (5X,14F8.1)
   76 FORMAT (12X,F7.1,14X,F4.2)
      WRITE(6,64)
      WRITE(6,503)
  503 FORMAT(1H1,2X,55H AVERAGE ANNUAL FLOOD DAMAGES BY CROP AND SAMPLE
     1 POINT)
      WRITE(6,64)
      WRITE(6,504) (CROP(1,J),J=1,2)
  504 FORMAT(40X,2A4)
      WRITE (6,81)((CDAM(1,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(2,J),J=1,2)
      WRITE (6,81) ((CDAM( 2,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(3,J),J=1,2)
      WRITE (6,81) ((CDAM( 3,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(4,J),J=1,2)
      WRITE (6,81) ((CDAM( 4,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(5,J),J=1,2)
      WRITE (6,81) ((CDAM( 5,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(6,J),J=1,2)
      WRITE (6,81) ((CDAM( 6,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(7,J),J=1,2)
      WRITE (6,81) ((CDAM( 7,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(8,J),J=1,2)
      WRITE (6,81) ((CDAM( 8,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(9,J),J=1,2)
      WRITE (6,81) ((CDAM( 9,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(10,J),J=1,2)
      WRITE (6,81) ((CDAM(10,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(11,J),J=1,2)
      WRITE (6,81) ((CDAM(11,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(12,J),J=1,2)
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```
      WRITE (6,81) ((CDAM(12,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(13,J),J=1,2)
      WRITE (6,81) ((CDAM(13,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(14,J),J=1,2)
      WRITE (6,81) ((CDAM(14,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(15,J),J=1,2)
      WRITE (6,81) ((CDAM(15,J,K),K=1,14),J=1,14)
      WRITE(6,64)
  901 FORMAT(1H1,40X,2A4)
      WRITE(6,524)
  524 FORMAT(1H1,2X,39H GROSS RETURNS BY SAMPLE POINT AND CROP)
      WRITE(6,64)
      WRITE(6,504) (CROP(1,J),J=1,2)
      WRITE(6,81) ((TVAL( 1,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(2,J),J=1,2)
      WRITE(6,81) ((TVAL( 2,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(3,J),J=1,2)
      WRITE(6,81) ((TVAL( 3,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(4,J),J=1,2)
      WRITE(6,81) ((TVAL( 4,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(5,J),J=1,2)
      WRITE(6,81) ((TVAL( 5,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(6,J),J=1,2)
      WRITE(6,81) ((TVAL( 6,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(7,J),J=1,2)
      WRITE(6,81) ((TVAL( 7,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(8,J),J=1,2)
      WRITE(6,81) ((TVAL( 8,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(9,J),J=1,2)
      WRITE(6,81) ((TVAL( 9,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(10,J),J=1,2)
      WRITE(6,81) ((TVAL(10,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(11,J),J=1,2)
      WRITE(6,81) ((TVAL(11,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(12,J),J=1,2)
      WRITE(6,81) ((TVAL(12,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(13,J),J=1,2)
      WRITE(6,81) ((TVAL(13,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(14,J),J=1,2)
      WRITE(6,81) ((TVAL(14,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(15,J),J=1,2)
      WRITE(6,81) ((TVAL(15,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,527)
  527 FORMAT(1H1,2X,99H NET RETURNS BY CROP ON EACH SAMPLE POINT AREA
     1WITH AVERAGE ANNUAL FLOODING DAMAGES ACCOUNTED FOR)
      WRITE(6,64)
      WRITE(6,504) (CROP(1,J),J=1,2)
      WRITE(6,81) ((PROFIT(1,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(2,J),J=1,2)
      WRITE(6,81) ((PROFIT(2,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(3,J),J=1,2)
      WRITE(6,81) ((PROFIT(3,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(4,J),J=1,2)
      WRITE(6,81) ((PROFIT(4,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(5,J),J=1,2)
      WRITE(6,81) ((PROFIT(5,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(6,J),J=1,2)
      WRITE(6,81) ((PROFIT(6,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(7,J),J=1,2)
      WRITE(6,81) ((PROFIT(7,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(8,J),J=1,2)
      WRITE(6,81) ((PROFIT(8,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(9,J),J=1,2)
      WRITE(6,81) ((PROFIT(9,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(10,J),J=1,2)
      WRITE(6,81) ((PROFIT(10,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(11,J),J=1,2)
      WRITE(6,81) ((PROFIT(11,J,K),K=1,14),J=1,14)
```

```
      WRITE(6,64)
      WRITE(6,504) (CROP(12,J),J=1,2)
      WRITE(6,81) ((PROFIT(12,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,901) (CROP(13,J),J=1,2)
      WRITE(6,81) ((PROFIT(13,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(14,J),J=1,2)
      WRITE(6,81) ((PROFIT(14,J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,504) (CROP(15,J),J=1,2)
      WRITE(6,81) ((PROFIT(15,J,K),K=1,14),J=1,14)
      WRITE(6,64)
  825 WRITE(6,532)
  532 FORMAT(1H1,6X,85H LAND-USE MAXIMIZING NET RETURN ON EACH SAMPLE
     1POINT CONSIDERING FLOODING POTENTIAL)
      WRITE(6,70)  ((LDUSE(J,K),K=1,14),J=1,14)
      WRITE(6,64)
      WRITE(6,533)
  533 FORMAT (6X,98H EXPECTED NET RETURNS ON EACH SAMPLE POINT AREA WITH
     1 OPTIMUM LAND-USE IN VIEW OF POSSIBLE FLOODING)
      WRITE(6,81) ((OPTUM(J,K),K=1,14),J=1,14)
C  PUNCHING OPTIMUM LAND-USE FOR EACH MATRIX TO USE AS CROP INPUT DATA IN
C  GENERAL FLOOD DAMAGE MODEL
      IF (KEYP.EQ.1) GO TO 575
      GO TO 576
  575 WRITE(7,11) ((LDUSE(I,J),I=1,M),J=1,N)
  576 CONTINUE
      WRITE(6,64)
      WRITE(6,603)
  603 FORMAT(T6,'ACCUMULATED ACRES OF EACH CROP UNDER OPTIMUM LAND USE')
      WRITE(6,604)
  604 FORMAT(T15,'CROP',8X,'ACRES')
      WRITE(6,605) ((CROP(I,J),J=1,2),LAND(I,2),I=1,15)
  605 FORMAT(13X,2A4,5X,I6)
      WRITE(6,64)
      WRITE(6,64)
      WRITE(6,613)
  613 FORMAT(1H1,5X,'VALUES FOR THIS CROSS-SECTION WITH OPTIMUM LAND USE
     1')
      WRITE(6,614)
  614 FORMAT(10X,'GROSS',8X,'PRODUCTION',3X,'AVERAGE ANNUAL',6X,'NET')
      WRITE(6,615)
  615 FORMAT (9X,'REVENUE',9X,'COSTS',6X,'FLOOD DAMAGES',5X,'RETURNS')
      WRITE(6,616) TCVAL,PCOST,FLD,COPTUM
  616 FORMAT(1X,4F15.2)
      WRITE(6,64)
      WRITE(6,64)
      WRITE(6,617)
  617 FORMAT(5X,'ACCUMULATED VALUES OVER ALL ANALYZED CROSS-SECTIONS WIT
     2H OPTIMUM LAND-USE')
      WRITE(6,614)
      WRITE(6,615)
      WRITE(6,616) TTCVAL,TPCOST,TFLD,TOPTUM
      WRITE(6,64)
      WRITE(6,711)
  711 FORMAT    (T6,'SECOND BEST LAND-USE ON EACH SAMPLE POINT CONSIDERI
     1NG FLOODING POTENTIAL')
      WRITE(6,70) ((LDUSE2(I,J),J=1,14),I=1,14)
      WRITE(6,64)
      WRITE(6,712)
  712 FORMAT(T6,'EXPECTED NET RETURNS ON EACH SAMPLE POINT WITH SECOND B
     1EST LAND-USE IN VIEW OF POSSIBLE FLOODING')
      WRITE(6,81) ((OPTUM2(I,J),J=1,14),I=1,14)
      WRITE(6,64)
      WRITE(6,715)
  715 FORMAT(1H1,T6,'ACCUMULATED ACRES OF EACH CROP WITH SECOND BEST
     1LAND-USE')
      WRITE(6,604)
      WRITE(6,605) ((CROP(I,J),J=1,2),LAND2(I,2),I=1,15)
      WRITE(6,64)
      WRITE(6,713)
  713 FORMAT(T6,'VALUES FOR THIS CROSS-SECTION WITH SECOND BEST LAND-USE
     1')
      WRITE(6,614)
      WRITE(6,615)
      WRITE(6,616) TCVAL2,PCOST2,FLD2,COPTU2
      WRITE(6,64)
      WRITE(6,714)
  714 FORMAT(T6,'ACCUMULATED VALUES OVER ALL ANALYZED CROSS-SECTIONS WIT
     1H SECOND BEST LAND-USE')
      WRITE(6,614)
      WRITE(6,615)
      WRITE(6,616) TTCVA2,TPCOS2,TFLD2,TOPTU2
      WRITE(6,64)
      WRITE(6,718)
  718 FORMAT(T6,'PRICE OF OPTIMUM LAND-USE THAT YIELDS NET RETURNS EQUAL
     1TO SECOND BEST LAND-USE')
      WRITE(6,719) ((CPRICE(I,J),J=1,14),I=1,14)
  719 FORMAT(4X,14F8.3)
      WRITE(6,64)
      WRITE(6,804)
  804 FORMAT (1H1,T5,'PERCENTAGE DECREASE IN PRICE OF OPTIMUM LAND USE
     1REQUIRED FOR SOLUTION TO BE INDIFFERENT BETWEEN OPTIMUM AND SECOND
     2 BEST')
      WRITE(6,81)  ((XPRICE(I,J),J=1,14),I=1,14)
```

```
      WRITE(6,64)
      WRITE(6,805)
  805 FORMAT(T4,'DISTRIBUTION BY CROSS SECTION ACREAGE OF PERCENT PRICE
     1DECLINE REQUIRED FOR OPTIMUM TO EQUAL SECOND BEST LAND USE NET RET
     2URNS')
      WRITE(6,806)
  806 FORMAT(T6,'PERCENTAGE PRICE DECLINE REQUIRED',9X,'ACREAGE')
      WRITE(6,807)
  807 FORMAT(T8,'TO AFFECT LAND USE SOLUTION',13X,'AFFECTED')
      WRITE(6,808) PRICE1(1)
  808 FORMAT(T18,' 0.0  -  0.50',16X,F8.1)
      WRITE(6,809) PRICE1(2)
  809 FORMAT(T18,' 0.56 -  1.00',16X,F8.1)
      WRITE(6,810) PRICE1(3)
  810 FORMAT(T18,' 1.01 -  2.00',16X,F8.1)
      WRITE(6,811) PRICE1(4)
  811 FORMAT(T18,' 2.01 -  3.00',16X,F8.1)
      WRITE(6,812) PRICE1(5)
  812 FORMAT(T18,' 3.01 -  4.00',16X,F8.1)
      WRITE(6,813) PRICE1(6)
  813 FORMAT(T18,' 4.01 -  5.00',16X,F8.1)
      WRITE(6,814) PRICE1(7)
  814 FORMAT(T18,' 5.01 - 10.00',16X,F8.1)
      WRITE(6,815) PRICE1(8)
  815 FORMAT(T18,'10.01 - 15.00',16X,F8.1)
      WRITE(6,816) PRICE1(9)
  816 FORMAT(T18,'15.01 - 20.00',16X,F8.1)
      WRITE(6,817) PRICE1(10)
  817 FORMAT(T18,'20.01 - 25.00',16X,F8.1)
      WRITE(6,818) PRICE1(11)
  818 FORMAT(T18,'25.01 - 50.00',16X,F8.1)
      WRITE(6,819) PRICE1(12)
  819 FORMAT(T18,'50.01 - 99.90',16X,F8.1)
      WRITE(6,824) PRICE1(13)
  824 FORMAT(T18,'     100     ',16X,F8.1)
      WRITE(6,64)
      WRITE(6,64)
      WRITE(6,821)
  821 FORMAT(T4,'ACCUMULATED DISTRIBUTION BY ACREAGE OF PERCENT PRICE DE
     1CLINE REQUIRED FOR OPTIMUM TO EQUAL SECOND BEST LAND USE NET RETUR
     2NS')
      WRITE(6,806)
      WRITE(6,807)
      WRITE(6,808) PRICE2(1)
      WRITE(6,809) PRICE2(2)
      WRITE(6,810) PRICE2(3)
      WRITE(6,811) PRICE2(4)
      WRITE(6,812) PRICE2(5)
      WRITE(6,813) PRICE2(6)
      WRITE(6,814) PRICE2(7)
      WRITE(6,815) PRICE2(8)
      WRITE(6,816) PRICE2(9)
      WRITE(6,817) PRICE2(10)
      WRITE(6,818) PRICE2(11)
      WRITE(6,819) PRICE2(12)
      WRITE(6,824) PRICE2(13)
      WRITE(6,64)
      WRITE(6,581)
  581 FORMAT(1H1,20X,12H CROP LEGEND)
      WRITE(6,582)
  582 FORMAT(4X,38H    CROP NUMBER      CROP IDENTIFICATION)
      WRITE(6,583) (I,(CROP(I,J),J=1,2),I=1,MA)
  583 FORMAT(13X,I2,12X,2A4)
      GO TO 148
      STOP
```

APPENDIX C

Preparing Input Data

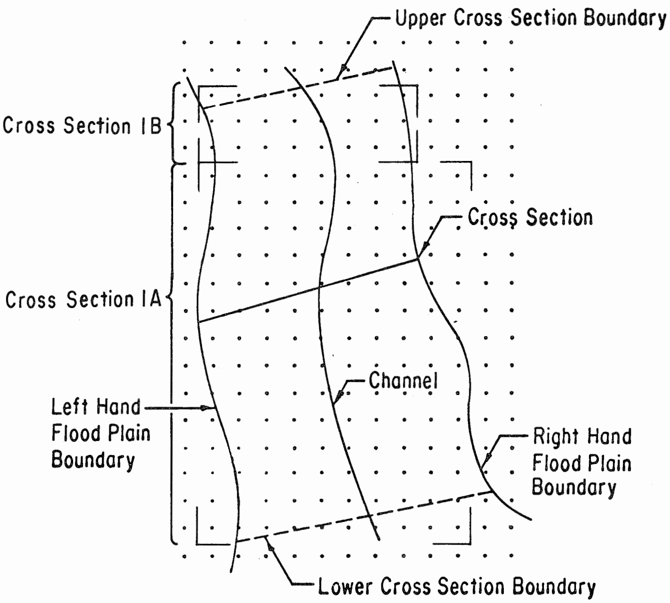
The two routines have similar data requirements. This section discusses the input data for the General Routine in detail and indicates the changes necessary for the Optimizing Routine.

Following a consistent organization of sample points enhances the preparation of sample point input data and reduces the likelihood of user error. The computational procedures use a matrix of sample points. This means that a sample point corresponds to a specific cell in a matrix and the different pieces of information applicable to the sample point, although entered in another matrix, must correspond to the same row and column (cell).

The matrix size is limited to 14 rows and 14 columns (14 x 14). If the number of sample points in the cross section area exceeds the number that can be accommodated, as it does in the hypothetical cross section shown in Appendix Figure III, the cross section area can be divided into two areas for analysis.

Cross Section 1A of Appendix Figure III is a matrix with 14 rows (the maximum number of rows programmed) and 10 columns (14 x 10). It is advantageous to impose a matrix over the flood plain in the form of matrix Cross Section 1A, i.e., consider one continuous section of the flood plain even though several sample points lie outside the flood plain. Flood plain sample points included in Cross Section 1B could be incorporated into the Cross Section 1A matrix by assigning them to non-flood plain point. This procedure is discouraged because it results in confusion of inputing data and reading the output. Therefore, the sample points in the top or first three rows of the aggregate cross section area are incorporated into a second matrix (Cross Section 1B) which has three rows and eight columns. In the analysis, Cross Section 1B is considered as a separate area from Cross Section 1A and, hence, requires re-entering the data applicable to the cross section. Sample point matrix delineation, as illustrated in Appendix Figure III is highly recommended and serves as a point of reference for the discussion later in this section on organizing input data.

Alternative land uses considered in the analysis should also be numbered consecutively. This sequential ordering of crops is useful in organizing yield, price, and other information applicable to each crop. The rationale of this ordering and organization becomes apparent in the discussion of input data form and specification.



APPENDIX FIGURE III. Hypothetical Representation of a Partion of Flood Plain with Cross Section Area, Assigned Sample Points and Matrix Division Suggested to Implement Analysis.

The General Routine

Input data for the General Routine can be divided into two groups. The first is general flood plain data, such as yield per acre, commodity price per unit, crop damage factors, and flood frequency. These general flood plain data are read one time only and applied to consecutive cross section areas.

The second data group is cross section area data (station elevations, flood elevations) and sample point data (land use, productivity and location). After analyzing a cross section area, the program returns to the beginning (it does not disturb general flood plain data) and reads data applicable to the next cross section area and associated sample points. This process continues until all cross section areas have been analyzed. Since the same data storage is used for consecutive cross section area analyses, this procedure permits analysis of all cross section areas (i.e., the total flood plain) in a single run and concurrently, several variables accumulated for the aggregate flood plain.

General Flood Plain Data Input Specifications

Data applicable to the total flood plain are entered first and do not have to be repeated for each cross section area. The data must follow the organization and form discussed below. The organization of the input data deck is shown in Appendix Figure IV. Information to be punched in each card is discussed below.

Number of Crops. The number of alternative agricultural land uses applicable to the flood plain is entered on the first data card in columns three and four (right justified.)[22] The number of crops to be considered

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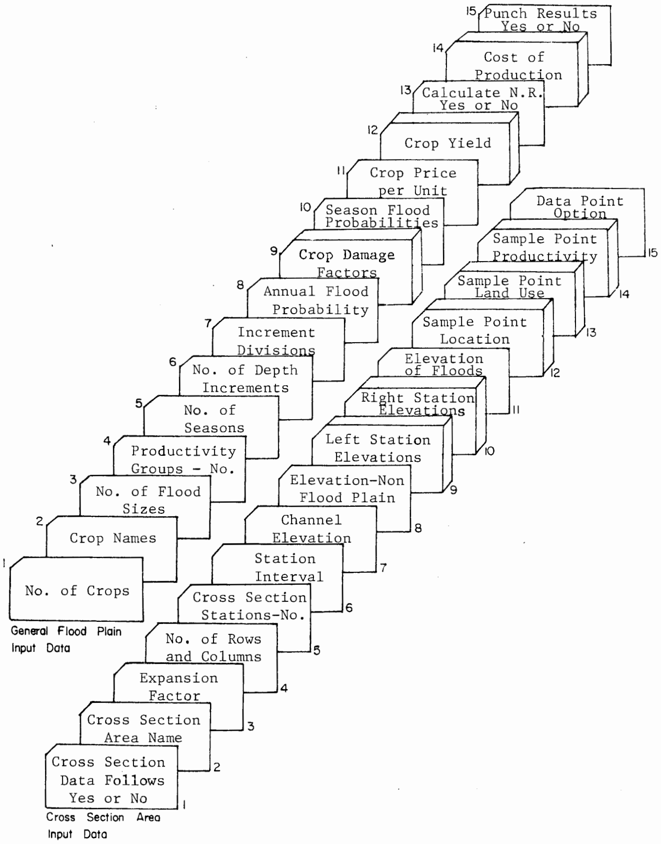
[22] Right justified indicates the variable value must be placed in the columns of the extreme right hand side of the data card columns reserved for the variable value. For example, a value for the number of crops considered of 1 through 9 must be placed in column 4 and for number of crops of 10 through 15 in columns 3 and 4. If a value such as 2 were placed in column 3, this would be read as 20 rather than 2.



APPENDIX FIGURE IV. Input Data Stream for the General Routine is limited to 15. For illustrative purposes, assume three crops are to be considered. The value 3 is punched in column 4 of the first card (see the example data code sheet at the end of this appendix).

Crop Names. The name of the alternative crops to be considered is the second data input. Eight columns are allocated for each group. Therefore, the name of a crop must be eight or less letters. Crop 1, wheat in the example, is placed in columns 1-8. The name cotton, crop 2, is placed in columns 9-16 and pasture, crop 3, is placed in columns 17-24. If eight or less crops are considered, only one data card for crop names is needed. For nine or more crops, a second card for crop names is used. The order in which the crops are named; i.e., wheat first, cotton second, and pasture third for the example, must be maintained for all other input data that applies to the crops, such as yield and price.

Number of Flood Sizes. This data card contains the number of floods to be considered as representative of the distribution of floods in the flood plain. The value is entered in column four and the number of flood sizes selected cannot exceed eight. Eight alternative flood sizes are indicated for the example. (See Appendix Table II and the example coding sheet.)

Number of Soil Productivity Groups. The number of soil productivity groups that are to be considered for the flood plain is entered in column 3 and 4 (right justified) of this data card. The number of productivity groups is limited to 10 and for the example is specified as 2.

Number of Seasons. The number of seasons to be considered in calculating flood damages is entered in columns 3 and 4 of the next card (right justified). This is generally determined by the seasonal division of available crop damage factors. From 1 to 12 seasons can be considered. For example, 4 seasons are used in Appendix Table III and the example.

Depth Increment Division. Crop damage factors typically apply to a specified inundation depth increment. In the example the increments are 0 to 1 foot, 1 to 3 feet, and 3 feet or more (see Appendix Table III). In this case there are 3 increments and 2 dividing points (1 foot and 3 feet). These dividing depths are entered on the next card, with the first division in columns 1 through 4, and the second in columns 5 through 8. A format of F4.1 is used, which indicates that of the four columns reserved for each division depth, a decimal goes in the third column; i.e., the increment-dividing inundation depths are entered to the first decimal place. (See the example coding sheet.) If four increments were used, there would be three increment-dividing inundation depths.

Annual Probability of Each Flood Size. A distribution of flood sizes is selected to represent the distribution of floods in the study area. This card is used to enter the probability of occurrence in any given year of each flood size selected (eight flood sizes were selected in the example). The flood sizes are placed in order according to size, beginning with the most frequent or smallest flood size. Five columns are allocated for each flood's probability of occurrence and the probability is recorded to the third decimal place, i.e., an F5.3 format is used. (See Appendix Table II and the example coding sheet.)

Crop Damage Factors. The next data cards are used for crop damage factors. The first card of this set is the damage factors applicable to crop one (wheat in the example) in the first inundation depth interval by season with the seasons conforming to a specified order (Spring, Summer, Fall, and Winter in the example). This seasonal ordering, once set, must be maintained. There will be as many damage factors on a card as there are seasons considered (four in the example). Five columns are allocated for each damage factor with three decimal places, or an F5.3 format. (See Appendix Table III and the example coding sheet.) The damage factors for crop one in the second inundation depth interval are recorded on the second card, etc. For the example there are 3 inundation depth intervals so there are 3 cards for each crop. Crop damage factors for succeeding crops, maintaining the previous ordering of crops, follows the same organization as for crop one. Since the example has 3 crops and 3 inundation depth intervals, nine cards are required to read all crop damage factors. (Only wheat is shown in the example coding sheet.)

Seasonal Probability of Flood Occurrence. The seasons to be considered in the analysis must be placed in order (as Spring, Summer, Fall, and Winter in the example) and this order maintained. For a flood that is to occur, there is some probability that it will occur in each of the designated seasons. (See Appendix Table IV.) The probability of a flood occurring in each season is entered on this card in the order that the seasons have been arranged. The probability of a flood in the first season (Spring for the example) is entered in columns 1 through 5, the second in columns 6 through 10, etc. The probability is entered to three decimal places (an F5.3 format).

Crop Price per Unit. The price per unit for each crop is entered in the same order as previously established for the crops (wheat, cotton, and pasture in the example). Eight columns are reserved for each crop's price with 3 decimal places (an F8.3 format). If more than 10 crops are considered, a second card is required for price data.

Crop Yield. Crop yield per acre, with yield conforming to the unit specification used for prices above, is entered next. The first card of this set is yield for each crop, with the crop order as previously established, on the first productivity group or group one. Five columns are allocated to the yield of each crop with yield given to 1 decimal place, i.e., an F5.1 format is used. (See the example.) The second card is each crop's expected yield on the second productivity group, etc. There will be as many cards in this section of the input as there are productivity groups established.

Computational Direction. Placing a 1 in column 2 of this card causes net returns to be calculated. Any other number in column 2 causes the program to omit the net returns calculation.

Cost of Production. If the previous card has a 1 in column 2, then cost of production for each crop on each productivity group must be included. Otherwise this data is *not* to be included. When net returns are to be calculated, production costs for crop one (wheat in the example) over each productivity group are punched in the first card. The production cost for crop one on the first productivity group is entered in columns 1 through 8 with 3 decimal places (an F8.3 format). Cost on productivity group two is entered in the next eight columns, etc. There will be as many cards as there are crops considered and each card will contain a crop's cost of production for each productivity group established. (See the example coding sheet.)

Computer Directions. The next card is used to indicate if average annual flood damages for each sample point are to be outputed on punch cards. A 2 in column 2 is used to obtain punched data. If any other number appears, these data are not punched.

Cross Section Area Data

These data must be developed and punched for each cross section area analyzed. The data decks for each cross section area may be stacked and an entire flood plain analyzed in a single run.

Check for Cross Section Area Data. The first card of the cross section area data indicates if data does follow. If the first 4 columns of this card have the word MORE then data does follow and is consequently read. If any word except MORE is on this card, this indicates no data follow and the computational procedure terminates.

Cross Section Area Name. The second card of the cross section area data is the name of the cross section. A name with up to 8 characters is permitted and is entered in the first 8 columns of the card. For example, in Appendix Figure III, two cross section areas are delineated. On the example coding sheet, the top cross section area, XSEC1B, is used for illustrative purposes.

Expansion Factor. The expansion factor or acres that each sample point represents is entered on this card in columns one through eight with three decimal places (an F8.3 format). In the example, the expansion factor is 5. Thus 5 is placed in column 4 and a decimal point in column 5.

Number of Rows and Columns. The number of rows, in the cross section area matrix of sample points, is entered in columns 1 through 4 (right justified) and the number of columns of the matrix is entered in columns 5 through 8. The example has 3 rows and 8 columns. (See Appendix Figure III and the example coding sheet.)

Number of Cross Section Stations. The number of cross section elevation stations from the channel to the left flood plain boundary is entered in columns 1 through 4, right justified. (The number is 18 for the example.) The number of stations for the right side of the channel is entered in columns 5 through 8, right justified. (The example coded assumes 12 cross section stations to the right of the channel.)

Cross Section Station Interval. The distance in feet between the cross section stations is entered on this card. Feet between stations on the left side is read in columns 1 through 4, right justified. The interval in feet for the right side is recorded in columns 5 through 8, right justified. (Ten feet is assumed for the left side and 5 feet for the right side on the hypothetical cross section.)

Channel Elevation. The elevation at the channel is recorded in columns 1 through 8 with one decimal place (an F8.1 format).

Non-Flood Plain Elevation. The elevation selected that exceeds all of the flood elevations and that will be assigned to sample points outside the flood plain is recorded in columns 1 through 8 of this card using an F8.1 format.

Station Elevations on Left Bank. This set of data is the elevation of each cross section station, beginning with the one nearest the channel. Eight columns are reserved for each station elevation with one decimal place (an F8.1 format). Ten station elevations can be entered on each card. Therefore, two data cards are required for the 18 stations in the example coded. (See Appendix Table I and example coding sheet.) If several stations fall on a linear segment of the cross section, only the elevation of the cross section stations at the beginning and end of the segment are required. The elevation of the intermediate stations may be left blank on the data cards and the program automatically calculates these blank station elevations.

Station Elevations on Right Bank. The above procedure used for the left bank elevations is followed for the right bank elevations (see the example coding sheet).

Elevation of Each Selected Flood Size. Elevation of the alternative flood sizes at the cross section are entered on one card, beginning with the elevation of the smallest flood size. Eight columns with one decimal place (an F8.1 format) are reserved for each elevation. (See Appendix Table II and the example coding sheet.)

Sample Point Location. The coordinate location, relative to the channel and flood plain boundary, of the sample points is entered by row from the cross section area matrix. Eight columns with one decimal place (an F8.1 format) are reserved for each coordinate location. Therefore, 10 sample point locations are entered on one card. For example, sample point locations for Cross Section 1B (XSEC1B) of Appendix Figure III are entered by beginning in the upper left hand corner and entering the location for the 8 sample points in row 1. Since 10 locations are read per card, the first 2 sample point locations of row 2 are also entered on card 1. The second card contains the last 6 points of row 2 and the first 4 of row 3. The last card needed in this example contains the last 4 points of row 3.

Consider Appendix Figure III and the task of coding the sample point locations in XSEC1B. The first point in the upper left corner of the matrix ($\text{Point}_{1,1}$) lies outside the upper cross section boundary. Therefore, this row and this point are included in the next cross section area analysis. $\text{Point}_{1,1}$ is given a value of 2.0 in the XSEC1B data which means an elevation that exceeds all the floods is assigned to the point (900.0 feet in the example). $\text{Point}_{1,3}$ is on the upper cross section boundary and can, therefore, be included in either the XSEC1B analysis or in the analysis of the next cross section beyond XSEC1B. $\text{Point}_{1,3}$ must be included once as a flood plain point, but not more than once. It will, therefore, be given a value of 2.0 for one cross section area and a coordinate location for the other applicable cross section area.

$\text{Point}_{1,8}$ lies outside the flood plain and is, therefore, given a value of 2.0 the same as $\text{Point}_{1,1}$. $\text{Point}_{3,1}$ lies on the flood plain boundary and is in turn given a value of 1.0, which means it is assigned the elevation of the flood plain boundary at the cross section.

The percent of the distance from the channel to the flood plain boundary must be determined for sample points in the flood plain. For example, $\text{Point}_{2,4}$ lies 22.3 percent of the distance from the channel to the flood plain boundary. Since $\text{Point}_{2,4}$ is left of the channel, this percentage value is preceded by a 1; i.e., a value of 122.3 is given to $\text{Point}_{2,4}$. (See the example coding sheet.) The percentage value for sample points on the right side of the channel is preceded by a 2. Thus the value for $\text{Point}_{2,6}$ is 230.6.

Sample Point Land Use. Land use of each sample point is read by row, similar to location. However, only those points in the flood plain of the cross section area being analyzed are given a land use designation with all others left blank. For example, $\text{Point}_{1,1}$ of XSEC1B is not included and is, therefore, zero or blank on the coding sheet.

The previous ordering of crops is used; i.e., a 1 refers to the first crop or wheat in the example, 2 to the second crop or cotton, 3 to the third land use or pasture, etc. Two columns are reserved for each sample point's land use. The entry must be right justified. On $\text{Point}_{1,4}$, a land use of 3 (pasture) is indicated on the example coding sheet. The land use for 40 sample points (in row order) is given on each card. For the example, XSEC1B matrix has 24 sample points, so only one card is needed for land use.

Sample Point Productivity Group. If only one productivity group is designated, this step is eliminated. For two or more productivity groups, however, the productivity group applicable to each sample point must be entered. The data are entered the same as for land use; i.e., by row order, 2 columns per sample point, with 40 sample points per card. Sample points not in the cross section area being analyzed are left blank or entered as a zero. ($\text{Point}_{1,1}$ is zero in the example coding sheet.) The productivity group designated will correspond to the group ordering established when entering crop yield data by productivity group. For example, $\text{Point}_{1,4}$ is in productivity group 2 and the land use pasture has an associated per acre yield of 3.0 AUM's.

Data Printout Direction. The last piece of information required for a cross section area is a code indicating the quantity of data to be printed. A 1 in column 2 of this card directs the printing of all general flood plain and cross section area input data as well as all model results. A 1 is recommended for the first cross section area of a flood plain that is analyzed. For successive cross section areas included in a single run, the general flood plain data printout serves no purpose.

A 3 in column 2 causes the program to skip the input data printout for the general flood plain and to go directly to a printing of the input data for the cross section area being analyzed as well as model results. Other printout alternatives are available. A 4 causes the program to print only sample point input data and model results. A 5 is used when only the model results are to be printed. For the second and succeeding cross section areas analyzed in a single run, a 3 or 4 for this card is recommended.

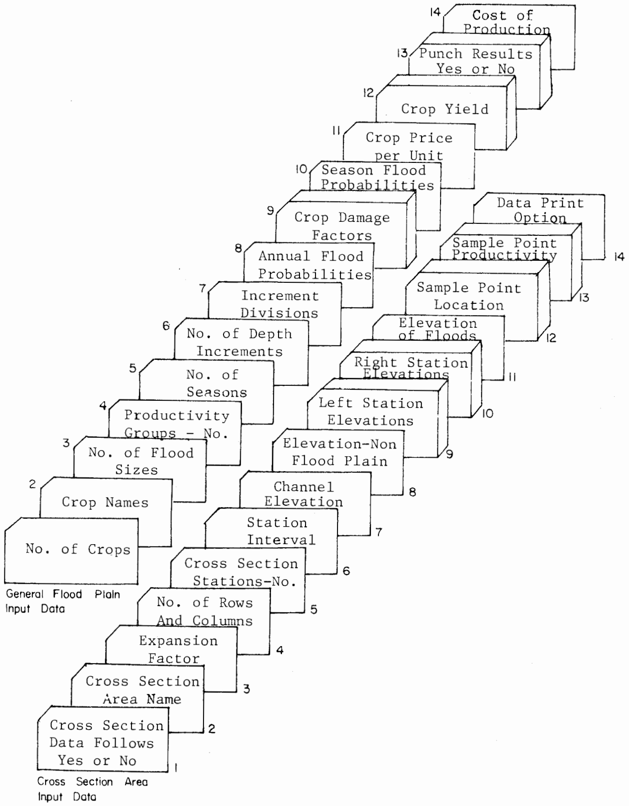
This concludes the input data required for a cross section area. The model continues by reading the next card. If it has MORE punched in columns 1 through 4, data for another cross section are entered in the sequence described above.

The Optimizing Routine

Data inputs are similar for the General Routine and the Optimizing Routine. The organization of the input data deck for the Optimizing Routine is shown in Appendix Figure V. The following discussion gives the changes in input data required to use this routine.

General Flood Plain Data

Data inputs are the same through yield by productivity group in both routines. The next card after yield in the Optimizing Routine contains a code indicating if optimum land use by sample point is to be punched in cards so that it may be used in the General Routine. A 1 in column 2 directs the computer to punch the cards. For the General



APPENDIX FIGURE V. Input Data Stream for the Optimizing Routine

Model, this card is used to indicate if sample point net returns are to be calculated.

The next card or cards in both routines refer to production cost per acre by crop and productivity group. In the General Routine, these cost data are optional, depending on whether or not net returns are estimated. For the Optimizing Routine, production costs must be included and are not optional.

The next card in the General Routine (whether or not to punch average annual flood damages by sample point) is deleted from the Optimizing Routine. Hence, production costs are the last input data applying to the general flood plain for the Optimizing Routine.

Cross Section Area Data

The only difference in cross section area input data between the two routines is that sample point land use is not specified in the Optimizing Routine. Hence, sample point land use data cards are deleted from the input deck when using the Optimizing Routine.

Coded Input Data Example

This section provides an illustration of example input data correctly organized and coded for application of the General Routine. The code sheets contain many of the data discussed earlier in this report and serve as an example for the discussion in this appendix. Code sheets normally contain 80 spaces, but have been cut to 60 columns for publication purposes. Hence, the data in columns 61 through 80 are not shown.

EXAMPLE CODING SHEET. General Routine General Flood Plain Data

1 5 6 7 10 20 30 40 50 60

3 — Number of Crops

WHEAT COTTON PASTURE — Name of Each Crop

8 — Number of Flood Sizes Selected

2 — Number of Soil Productivity Groups

4 — Number of Seasons

3 — Number of Inundation Depth Increments

1.0 3.0 — Depths Dividing Inundation Increments

1.0 .5 .33 .20 .10 .04 .02 .01 — Annual Probability of Each Flood

Crop Damage Factors:

Wheat Flood Damage Factors

.272	.243	.204	.052	0 - 1 foot inundation
.324	.416	.472	.081	1 - 3 feet inundation
.453	.498	.577	.107	3 + feet inundation

Cotton Flood Damage Factors
Pasture Flood Damage Factors
same organization as Crop 1 - Wheat

.359 .205 .244 .192 — Seasonal Probability of a Flood

2. .24 2.5 — Crop Price per Unit

Crop Yields by Productivity Group:

Wheat	Cotton	Pasture	
28.	265.	2.4	Productivity Group 1
34.	350.	3.0	Productivity Group 2

1 — Code for Calculating Net Revenue

Cost of Production by Productivity Group:

Group 1	Group 2	
32.73	35.92	Wheat
28.55	36.29	Cotton
1.48	2.26	Pasture

1 — Punch Sample Point Average Annual Damages Option

EXAMPLE CODING SHEET. General Routine Cross Section Area Data

1 5 6 7 10 20 30 4 60

MORE
Code Indicating if Cross Section Area Data Follows

XSEC1B
Cross Section Area Name

5.
Expansion Factor

3 8
Number of Cross Section Area Matrix Rows and Columns

18 12
Number of Cross Section Stations, Left - Right

10 5
Interval in Feet Between Stations, Left - Right

847.4
Channel Elevation

900.0
Elevation that Exceeds Any of the Floods

Left Flood Plain Cross Section Station Elevations

851.3 853.6 855.9 858.3 860.6 861.5 863.8 864.1
866.0 866.7 867.4 868.1 869.2 870.4 871.5 872.6

Right Flood Plain Cross Section Station Elevations

same form as for left bank

Elevation of Each Flood Size

855.4 858.3 861.8 862.9 863.4 864.5 865.4 866.1

Location of Each Sample Point

2.0 2.0 2.0 108.4 213.2 240.0 272.1 2.
145.7 122.3 101.8 230.6 264.1 299.5 1. 176.9
110.4 222.6 257.5 294.2

Land Use at Each Sample Point

0 0 0 3 3 2 2 0 1 1 1 3 3 3 2 2 1 1 1 3 3 3 2 2

Productivity Group for Each Sample Point

0 0 0 2 2 2 2 0 1 1 2 2 2 2 2 2 1 1 2 2 2 2 2 2

1
Option Indicating Data to be Printed

APPENDIX D

The General and Optimizing Routine Output

This appendix discusses the data that evolve from application of both the General and Optimizing Routines. The flood plain of a specific cross section area is used to illustrate the computer printout of the data. This printout begins on page 88.

The study area was a part of the Nuyaka Creek flood plain located in Oklahoma. The watershed has been planned by the Soil Conservation Service of the Department of Agriculture and the project has been approved by Congress for construction. Data developed for planning the watershed project were made available for this model through the courtesy of the Soil Conservation Service. Additional data required were the designation of sample points, determination of the present land use (for the general model), appropriate productivity group, and coordinate location of each designated sample point.

The computer printout of data used and some of the results are identical for both source programs. Therefore, discussion of only one printout, which is the same in both programs, is necessary. The sequence of data printout for the two programs is given below. An X indicates that the data are available from the specified program. In some cases (indicated by an X for both routines) the same information is available from both programs.

Sequence of Data Printout for the Two Programs

Data	General Routine	Optimizing Routine
Name of Study area	X	X
Crop damage factors	X	X
Damage factors weighted	X	X
Number of inundation depth intervals	X	X
Actual inundation increments	X	X
Number of productivity groups and crops	X	X
Price per unit (crops)	X	X
Yield by productivity group	X	X
Gross value by crop and productivity group	X	X
Production cost by crop and group		X
Net returns by crop and productivity group		X
Depth of inundation by flood size	X	X
Acres inundated by flood size	X	
General cross section data	X	X
Cross section station elevations	X	X
Feet of flood plain	X	X
Flood elevations and frequency	X	X
Sample point location	X	X
Land use by sample point	X	
Productivity group by sample point	X	X
Percent damages are of gross returns	X	

Continued—

Continued—

Data	General Routine	Optimizing Routine
Sample Point Land Use Specified		
Per acre damages by flood size	X	
Damages by flood for acres represented by each sample point	X	
Average annual damages by sample point	X	
Accumulate average annual damages	X	
Crop legend	X	
Returns net of production costs and average annual flooding	X	
Accumulated net returns	X	
Flood plain acreage by net return increments	X	
Sample Point Land Use Not Specified		
Damages by crop and sample point		X
Gross returns by crop and sample point		X
Returns net of production costs and average annual flooding by crop and sample point		X
Optimum land use by sample point		X
Optimum land use expected net returns by sample point		X
Acres of each optimum land use		X
Optimum land use cost and return values		X
Second best land use by sample point		X
Second best land use expected net returns by sample point		X
Acres of each second best land use		X
Second best land use cost and return values		X
Optimum land use price that nullifies the solution		X
Percentage price decrease that nullifies the solution		X
Acreage by percentage price decline increments that nullifies the solution		X
Crop legend		X

Computer Printout Common to Both Routines

This discussion emphasizes the data included in the printout of both routines (example of printout begins on page 88). Data printout, assuming all printout possible in the model is utilized (NCOSRE equals 1), begins with the name of the cross section area under analysis or, in this case, N-8. Data applicable to the entire watershed follows the name of the cross section. Crop damage factors are the first set of data to be printed. For this analysis, only 3 seasons are considered; hence, all other seasons (4 through 12) have a zero factor. The first 3 rows of the damage factor matrix apply to crop 1 or wheat. The first row is the first depth increment, the second row the second increment, and the third row the third increment. Rows 4, 5, and 6 apply to crop 2 or oats for the 3 successive depth increments. Each three rows in succession, therefore, apply in turn to each of the 13 crops being considered.

Crop damage factors, adjusted for seasonal probability of flooding, follow the crop damage factor matrix. The matrix contains a total of 39 rows, 3 rows for each of the 13 crops under consideration. The adjustment coefficient or probability of flooding in season 1 is 0.594, season 2 is 0.247 and season 3 is 0.159.

Below the matrix of adjusted crop damage factors is a statement specifying that crop damage factors are given for 3 inundation depth increments. The increments are then listed and are (1) 0.0 to 1.0 foot, (2) 1.0 to 3.0 feet, and (3) 3.00 feet and greater. Next are the number of alternative productivity groups (4) and crops considered (13), price per unit for each crop considered, yield of each crop on each productivity group, and gross value assuming no flooding by crop for each productivity group. The price per unit and yield by specific crop must be in the same measurement unit; i.e., bushel, pound, etc. Abbreviations for crop names apply to specific crops as follows:

G. SORG	Grain Sorghum
B. PAST	Bermudagrass Pasture
N. HAY	Native Hay
WOODPAST	Woodland Pasture
R. PAST	Native or Range Pasture

The depth of inundation at each sample point is given for each of the 8 floods considered. Each sample point represents a specific number of acres (5) at a specific location in the flood plain and, therefore, retains the same location in the cross section area matrix throughout the analysis. For example, flood plain represented by Sample Point 6,2 is not flooded by the first 2 flood sizes but for the third flood, depth of inundation for Sample Point 6,2 is 0.67 feet, fourth flood 1.07 feet, fifth flood 1.57 feet, sixth flood 2.07 feet, seventh flood 2.27 feet, and eighth flood 2.77 feet. For flood 1, only 7 sample points are inundated as shown by positive depth of inundation values. Negative values indicate the sample point elevation exceeds the flood elevation. As the size of flood increase, as shown in sequential matrices, additional sample points flood and the level of inundation increases at sample points previously flooded. There are 36 points with an entry of —3.00 for flood eight, indicating these points lie outside the flood plain. (The next two sections of printout, acres inundated by flood size for the cross section area and accumulated acres inundated for this and previous cross section areas, are only available as part of the output for the General Routine.

Data applying to the cross section that represents the flood plain in which the sample points lie are a part of the printout of both programs. The sample point matrix consists of 11 rows and 6 columns, eight floods are considered, the number of cross section stations in the flood plain on the left bank is 67 and on the right bank 53; the channel elevation is 703.2 feet, an elevation exceeding the largest flood and which is assigned to sample points lying out of the flood plain is 725.0 feet; and the interval between cross section stations is 20 feet on the left bank and 10 feet on the right bank.

A listing of each cross section station elevation on each bank is printed in sequence. Many of the station elevations printed were entered as zero since they fall on a linear cross section segment. The model, by interpolation, entered positive elevations for stations having zero elevations as input data. On the right channel, elevation for stations 54 through 67 are given as zero since there are only 53 cross section stations on the right bank. The feet of cross section in the flood plain on the left bank is 1,340 and on the right bank is 530. Next, the elevations of the 8 floods considered is printed along with the probability of occurrence of a specific flood in any given year (flood weight).

The next set of data printed is the characteristic of each sample point. First is the coordinate location of each sample point. A 2.0 indicates the sample point lies outside the flood plain. Sample points in the flood plain are given as percentage values 92.0, 92.5, 80.4, etc., but the percentage values are preceded by either a 1 or a 2 and read 192.0, 292.5, 180.4. When a 1 precedes the percentage value, the sample point lies on the left side of the channel and a 2 indicates the sample point lies on the right side of the channel. The value following the 1 or 2 is the percent of the distance the sample point lies from the channel to the flood plain edge. The next bit of output to be printed, sample point elevation, is derived from the sample point coordinate location and cross section station elevation data. The last sets of common data printed by both programs are the productivity group of each sample point and a crop legend. The crop legend indicates what crop the number code refers to; i.e., one to cotton, two to grain sorghum, etc.

Data other than that discussed above are unique to one of the two routines. The following section discusses output unique to the general routine. This is followed by a discussion of the additional computer printout unique to the Optimizing Routine.

Computer Printout Unique to the General Model

Reviewing the sequence of data printout, the General Routine follows the printout of inundation depth by flood size with a printing of acres inundated in the cross section area by each of the eight floods. Next, accumulated acres by each flood size for all cross section areas that have been analyzed are printed. (In the illustration only one cross section area, N-8, is analyzed so the accumulated acres of all cross section areas are the same as cross section area N-8.)

Since sample point land use is specified in the General Routine, the land use is presented following elevation of each sample point. A land use of zero indicates the sample point lies outside the flood plain. Considering sample point land use and productivity group, gross returns for the area represented by each sample point are printed. Next the summed returns for all sample point areas are printed; for N-8 it is $4,957.96. This is followed by the percent the average annual flood damages are of gross returns for the aggregate cross-section area (14.29 percent). Only one cross-section area is considered, so any aggregation over cross section areas will give the same results as cross section area N-8.

The next portion of the General Routine printout presents flood damages by sample point. Per acre flood damages at each sample point are presented by flood (eight matrices are required for this printout). These are followed by the flood damages on the acres represented by each sample point (3 in the example) for each flood considered. The values in these matrices present estimated damages by flood assuming the flood occurs.

An estimate of expected annual flood damages by sample point is presented in the following matrix. Average annual flood damages for the N-8 sample points range from $0.49 to $170.11. The crop, productivity group, and average annual flood damages can be related for a sample point. For example, Sample Point 10,1 has expected annual damages of $0.50, crop 12 (woodland pasture) is produced and the productivity group is 1. Alternatively, Sample Point 4,4 has average annual flood damages of $53.50, crop 4 (soybeans) is produced and the productivity group is 2.

The summed average annual flood damages over all sample points in the cross section area and for the study area ($708.73) are then printed. Since this is the only cross section area analyzed, the value for accumulated flood damages over all analyzed cross section areas is also $708.73.

If desired by the researcher, returns net of production costs and average annual flood damages can be computed and printed by sample point after the crop legend. Sample points in the cross section area N-8 have a net return ranging from a negative $110.63 to a positive $175.98. This provides additional information so that the researcher can consider land use, productivity group, associated average annual flood damages and expected net returns. The total picture is often misinterpreted and misleading without this relationship between damages and net returns. For example, on many sample points the larger average annual flood damages are associated with the larger expected net returns. However, there are exceptions which can readily be identified; i.e., Sample Point 6,4.

Expected net returns are accumulated over the sample points and for cross section area N-8 amounts to $1,603.16. The last set of data to be printed in the general model is the distribution of flood plain acreage by expected net return increments. Some 30 increments are presented, but in this illustration only 7 apply. The largest acreage for one increment is 55 acres for the $7.51 to $10.00 increment. The illustrative printout from the General Model which includes the data above, is presented below and is followed by the optimizing routine data discussion.

```
                                      NAME OF AND BEGINNING OF NEW CROSS-SECTION AREA
                                                            N-8



DATA APPLICABLE TO ENTIRE WATERSHED


                                 CROP DAMAGE FACTORS APPLIED
                                           SEASON
 FIRST    SECOND    THIRD   FOURTH    FIFTH     SIXTH   SEVENTH  EIGHTH     NINTH     TENTH  ELEVENTH  TWELTH
0.227    0.279    0.118    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.324    0.420    0.175    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.428    0.554    0.226    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.217    0.149    0.008    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.362    0.324    0.035    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.432    0.401    0.061    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.213    0.260    0.013    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.368    0.363    0.053    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.424    0.642    0.071    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.200    0.310    0.050    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.310    0.430    0.080    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.400    0.575    0.120    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.285    0.0      0.103    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.504    0.024    0.268    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.751    0.071    0.608    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.309    0.016    0.104    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.609    0.081    0.236    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.668    0.103    0.286    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.309    0.016    0.104    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.609    0.081    0.236    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.668    0.103    0.286    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.255    0.318    0.008    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.338    0.501    0.014    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.395    0.554    0.039    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.102    0.064    0.011    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.133    0.099    0.030    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.176    0.171    0.063    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.195    0.077    0.022    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.251    0.132    0.074    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.252    0.258    0.123    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.131    0.122    0.006    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.155    0.211    0.024    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.192    0.344    0.037    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.102    0.064    0.011    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.133    0.099    0.030    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.176    0.171    0.063    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.102    0.064    0.011    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.133    0.099    0.030    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.176    0.171    0.063    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
               CROP DAMAGE FACTORS WEIGHTED FOR SEASONAL PROBABILITY OF FLOODING
                                SEASON
  FIRST  SECOND   THIRD  FOURTH   FIFTH   SIXTH  SEVENTH EIGHTH   NINTH   TENTH ELEVENTH TWELTH
 0.135   0.069   0.019   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.192   0.103   0.028   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.254   0.136   0.036   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.129   0.037   0.001   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.215   0.080   0.006   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.257   0.099   0.010   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.127   0.064   0.002   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.219   0.089   0.008   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.252   0.158   0.011   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.119   0.076   0.008   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.184   0.106   0.013   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.238   0.141   0.019   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.169   0.0     0.016   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.299   0.006   0.043   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.446   0.017   0.097   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.184   0.004   0.017   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.362   0.020   0.038   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.397   0.025   0.046   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.184   0.004   0.017   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.362   0.020   0.038   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.397   0.025   0.046   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.151   0.078   0.001   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.201   0.123   0.002   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.235   0.136   0.006   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.061   0.016   0.002   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.079   0.024   0.005   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.105   0.042   0.010   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.116   0.019   0.004   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.149   0.032   0.012   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.150   0.063   0.020   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.078   0.030   0.001   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.092   0.052   0.004   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.114   0.085   0.006   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.061   0.016   0.002   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.079   0.024   0.005   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.105   0.042   0.010   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.061   0.016   0.002   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.079   0.024   0.005   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 0.105   0.042   0.010   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0




     NUMBER OF INUNDATION DEPTH INTERVALS FOR DAMAGE FACTORS = 3


   INUNDATION INCREMENTS(FEET)
         0.0  -  1.0
         1.0  -  3.0
         3.0 AND GREATER


       PRODUCTIVITY GROUPS CONSIDERED     TOTAL CROPS CONSIDERED
                        4                       13


                                                PRICE PER UNIT OF CROPS GROWN
 COTTON G. SORG.  CORN  SOYBEANS   WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
   0.29    1.69    1.05    2.45    1.30    0.60    0.85   10.00    2.50   22.00   22.00    2.50    2.50     0.0


                                         CROP YIELD ON EACH PRODUCTIVITY GROUP
GROUP                                     CROP
      COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS   BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
    1  450.00   30.00   43.00   29.00   29.00   50.00   40.00   15.00    7.20    4.50    1.50    0.70    2.70
    2  450.00   30.00   43.00   29.00   29.00   50.00   40.00     0.0    7.20    4.50    1.50    0.70    2.70
    3  360.00   25.00   36.00   26.00   26.00   48.00   38.00   18.00    7.20    3.50    1.20    0.60    2.20
    4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    3.20     0.0     0.0    0.30    0.80
    5     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    7     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    9     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   10     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                 GROSS VALUE BY CROP IN EACH PRODUCTIVITY GROUP
GROUP                                     CROP
      COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS   BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
    1  129.60   50.70   45.15   71.05   37.70   30.00   34.00  150.00   18.00   99.00   33.00    1.75    6.75
    2  129.60   50.70   45.15   71.05   37.70   30.00   34.00     0.0   18.00   99.00   33.00    1.75    6.75
    3  103.68   42.25   37.80   63.70   33.80   28.80   32.30  180.00   18.00   77.00   26.40    1.50    5.50
    4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    8.00     0.0     0.0    0.75    2.00
    5     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    7     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    9     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   10     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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COMPUTED DEPTH OF INUNDATION BY EACH FLOOD


                                       FLOOD ONE
   -8.00   -8.00   -8.00   -8.00   -8.00   -1.80    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -8.00   -8.00   -8.00   -2.54   -2.41    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -8.00   -8.00   -1.44    2.02   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -8.00   -1.26   -2.40   -1.59   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -8.00   -2.47    1.52   -1.77   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -2.23   -2.40    1.51   -1.80   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -2.43    1.28   -1.80   -2.03   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -8.00   -2.40   -0.53   -2.01   -8.00   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -2.07   -2.40    2.08   -8.00   -8.00   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -2.40    6.18   -8.00   -8.00   -8.00   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    1.59   -1.80   -2.24   -8.00   -8.00   -8.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                       FLOOD TWO
   -6.70   -6.70   -6.70   -6.70   -6.70   -0.50    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -6.70   -6.70   -6.70   -1.24   -1.11    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -6.70   -6.70   -0.14    3.32   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -6.70    0.04   -1.10   -0.29   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -6.70   -1.17    2.82   -0.47   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -0.93   -1.10    2.81   -0.50   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -1.13    2.58   -0.50   -0.73   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -6.70   -1.10    0.77   -0.71   -6.70   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -0.77   -1.10    3.38   -6.70   -6.70   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -1.10    7.48   -6.70   -6.70   -6.70   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.89   -0.50   -0.94   -6.70   -6.70   -6.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                       FLOOD THREE
   -5.10   -5.10   -5.10   -5.10   -5.10    1.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10   -5.10   -5.10   -5.10    0.36    0.49    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10   -5.10   -5.10    1.46    4.92   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10   -5.10    1.64    0.50    1.31   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10   -5.10    0.43    4.42    1.13   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10    0.67    0.50    4.41    1.10   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10    0.47    4.18    1.10    0.87   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -5.10    0.50    2.37    0.89   -5.10   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.83    0.50    4.98   -5.10   -5.10   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.50    9.08   -5.10   -5.10   -5.10   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    4.49    1.10    0.66   -5.10   -5.10   -5.10    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                        FLOOD FOUR
   -4.70   -4.70   -4.70   -4.70   -4.70    1.50    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70   -4.70   -4.70   -4.70    0.76    0.89    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70   -4.70   -4.70    1.86    5.32   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70   -4.70    2.04    0.90    1.71   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70   -4.70    0.83    4.82    1.53   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70    1.07    0.90    4.81    1.50   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70    0.87    4.58    1.50    1.27   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.70    0.90    2.77    1.29   -4.70   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    1.23    0.90    5.38   -4.70   -4.70   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.90    9.48   -4.70   -4.70   -4.70   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    4.89    1.50    1.06   -4.70   -4.70   -4.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                       FLOOD FIVE
   -4.20   -4.20   -4.20   -4.20   -4.20    2.00    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20   -4.20   -4.20   -4.20    1.26    1.39    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20   -4.20   -4.20    2.36    5.82   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20   -4.20    2.54    1.40    2.21   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20   -4.20    1.33    5.32    2.03   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20    1.57    1.40    5.31    2.00   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20    1.37    5.08    2.00    1.77   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -4.20    1.40    3.27    1.79   -4.20   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    1.73    1.40    5.88   -4.20   -4.20   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    1.40    9.98   -4.20   -4.20   -4.20   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    5.39    2.00    1.56   -4.20   -4.20   -4.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                       FLOOD SIX
   -3.70   -3.70   -3.70   -3.70   -3.70    2.50    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70   -3.70   -3.70   -3.70    1.76    1.89    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70   -3.70   -3.70    2.86    6.32   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70   -3.70    3.04    1.90    2.71   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70   -3.70    1.83    5.82    2.53   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70    2.07    1.90    5.81    2.50   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70    1.87    5.58    2.50    2.27   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.70    1.90    3.77    2.29   -3.70   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.23    1.90    6.38   -3.70   -3.70   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    1.90   10.48   -3.70   -3.70   -3.70   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    5.89    2.50    2.06   -3.70   -3.70   -3.70    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
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```
                                       FLOOD SEVEN
   -3.50   -3.50   -3.50   -3.50   -3.50    2.70     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50   -3.50   -3.50   -3.50    1.96    2.09     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50   -3.50   -3.50    3.06    6.52   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50   -3.50    3.24    2.10    2.91   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50   -3.50    2.03    6.02    2.73   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50    2.27    2.10    6.01    2.70   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50    2.07    5.78    2.70    2.47   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.50    2.10    3.97    2.49   -3.50   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.43    2.10    6.58   -3.50   -3.50   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.10   10.68   -3.50   -3.50   -3.50   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6.09    2.70    2.26   -3.50   -3.50   -3.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                      FLOOD EIGHT
   -3.00   -3.00   -3.00   -3.00   -3.00    3.20     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00   -3.00   -3.00   -3.00    2.46    2.59     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00   -3.00   -3.00    3.56    7.02   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00   -3.00    3.74    2.60    3.41   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00   -3.00    2.53    6.52    3.23   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00    2.77    2.60    6.51    3.20   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00    2.57    6.28    3.20    2.97   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   -3.00    2.60    4.47    2.99   -3.00   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.93    2.60    7.08   -3.00   -3.00   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.60   11.18   -3.00   -3.00   -3.00   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6.59    3.20    2.76   -3.00   -3.00   -3.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


ACRES INUNDATED BY EACH FLOOD FOR THIS CROSS-SECTION AREA


    FLOOD      ACRES INUNDATED
      1              35.0
      2              45.0
      3             150.0
      4             150.0
      5             150.0
      6             150.0
      7             150.0
      8             150.0

ACCUMULATED ACRES INUNDATED FOR THIS AND PREVIOUS CROSS-SECTION AREAS


   FLOOD      ACRES INUNDATED
     1              35.0
     2              45.0
     3             150.0
     4             150.0
     5             150.0
     6             150.0
     7             150.0
     8             150.0
                                      GENERAL CROSS-SECTION DATA
      ROWS      COLUMNS     FLOODS     LSTATIONS  RSTATIONS CELEVATION  XELEVATION LINTERVAL  RINTERVAL
       11          6           8          67         53       703.2      725.0         20         10

CROSS SECTION STATION ELEVATIONS
    STATION NUMBER    LEFT STATIONS    RIGHT STATIONS
             1            712.0             706.5
             2            715.4             711.0
             3            715.7             713.0
             4            715.7             716.3
             5            715.8             718.5
             6            715.6             718.9
             7            715.4             719.3
             8            715.2             719.1
             9            715.0             719.0
            10            714.8             718.8
            11            715.6             718.8
            12            716.5             718.8
            13            717.3             718.8
            14            718.2             718.8
            15            722.3             718.8
            16            719.4             718.8
            17            719.4             718.8
            18            719.4             718.8
            19            719.4             718.8
            20            719.4             718.8
            21            719.4             718.7
            22            719.4             718.6
            23            719.4             718.6
            24            719.4             718.5
            25            719.4             718.4
            26            719.4             718.3
            27            719.4             718.3
            28            719.4             718.2
            29            719.4             718.1
            30            719.4             718.7
            31            719.4             718.7
            32            719.5             718.8
            33            719.5             718.8
            34            719.6             718.9
            35            719.6             718.9
            36            719.5             718.9
            37            719.5             719.0
```

```
   38          719.4          719.0
   39          719.4          719.1
   40          719.3          719.1
   41          719.3          719.1
   42          719.3          719.2
   43          719.4          719.2
   44          719.4          719.3
   45          719.4          719.3
   46          719.1          719.3
   47          718.8          719.4
   48          718.4          719.4
   49          718.1          719.5
   50          717.8          719.5
   51          717.5          720.4
   52          717.3          721.3
   53          717.7          722.2
   54          718.1            0.0
   55          718.6            0.0
   56          719.0            0.0
   57          719.2            0.0
   58          719.4            0.0
   59          719.6            0.0
   60          719.7            0.0
   61          719.9            0.0
   62          720.1            0.0
   63          720.3            0.0
   64          720.7            0.0
   65          721.1            0.0
   66          721.6            0.0
   67          722.2            0.0
```

```
FEET FROM CHANNEL TO FLOODPLAIN BOUNDARY AT CROSS-SECTION
                LEFT BANK    RIGHT BANK
                  1340.0        530.0
```

```
FLOOD NUMBER     FLOOD ELEVATION      FLOOD WEIGHT
      1               717.0               2.00
      2               718.3               1.00
      3               719.9               0.33
      4               720.3               0.20
      5               720.8               0.10
      6               721.3               0.04
      7               721.5               0.02
      8               722.0               0.01
```

```
CHARACTERISTICS OF EACH SAMPLE POINT


                                           SAMPLE POINT COORDINANT LOCATION
    2.0     2.0     2.0     2.0     2.0   236.6     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0     2.0     2.0     2.0   150.0   290.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0     2.0     2.0   171.7   102.8     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0     2.0   181.0   133.3   242.8     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0     2.0   155.5   103.4   260.0     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0   185.4   133.8   109.8   228.2     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0   156.4   105.1   232.0   272.3     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    2.0   143.5   208.6   271.4     2.0     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  168.7   129.5   114.0     2.0     2.0     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  133.3   203.7     2.0     2.0     2.0     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  116.0   221.2   282.0     2.0     2.0     2.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
                                          SAMPLE POINT ELEVATION
  725.0   725.0   725.0   725.0   725.0   718.8     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   725.0   725.0   725.0   719.5   719.4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   725.0   725.0   718.4   715.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   725.0   718.3   719.4   718.6   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   725.0   719.5   715.5   718.8   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   719.2   719.4   715.5   718.8   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   719.4   715.7   718.8   719.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  725.0   719.4   717.5   719.0   725.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  719.1   719.4   714.9   725.0   725.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  719.4   710.8   725.0   725.0   725.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  715.4   718.8   719.2   725.0   725.0   725.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
CROP PRODUCED ON EACH SAMPLE POINT
  0   0   0   0   0  12   0   0   0   0   0   0   0   0
  0   0   0   0  13  12   0   0   0   0   0   0   0   0
  0   0   0  12  12   0   0   0   0   0   0   0   0   0
  0   0  10   4  12   0   0   0   0   0   0   0   0   0
  0   C  10  12  12   0   0   0   0   0   0   0   0   0
  0  10   3   3  12   0   C   0   0   0   0   0   0   0
  0  10  12  10  10   0   0   0   0   0   0   0   0   0
  0  10  12  10   0   0   0   0   0   0   0   0   0   0
 12  12  12   0   0   0   0   0   0   0   0   0   0   0
 12  12   0   0   0   0   0   0   0   0   0   0   0   0
 12  12  12   0   0   0   C   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
```

```
PRODUCTIVITY GROUP OF EACH SAMPLE PCINT
  0   0   0   0   0   1   0   0   0   0   0   0   0   0
  0   0   0   0   2   1   0   0   0   0   0   0   0   0
  0   0   0   2   1   0   0   0   0   0   0   0   0   0
  0   0   1   2   1   0   0   0   0   0   0   0   0   0
  0   0   1   1   1   0   0   0   0   0   0   0   0   0
  0   1   1   1   1   0   0   0   0   0   0   0   0   0
  0   2   1   2   1   0   0   0   0   0   0   0   0   0
  0   2   1   2   0   0   0   0   0   0   0   0   0   0
  1   1   1   0   0   0   0   0   0   0   0   0   0   0
  1   2   0   0   0   0   0   0   0   0   0   0   0   0
  1   2   1   0   0   0   C   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
  0   0   0   0   0   0   0   0   0   0   0   0   0   0
```

```
GROSS RETURNS ON ACRES REPRESENTED BY EACH SAMPLE POINT WITH A GIVEN LAND USE
    0.0       0.C       0.0       0.0       0.0       8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0      33.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       8.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0     495.00    355.25      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0     495.00      8.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0     495.00    225.75    225.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0     495.00      8.75    495.00    495.00      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0     495.00      8.75    495.00      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    8.75      8.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    8.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    8.75      8.75      8.75      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
    0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0


GROSS RETURNS FOR ENTIRE CROSS-SECTION ASSUMING NO FLOODING DAMAGES
         4957.96


ACCUMULATED GROSS RETURNS FOR THIS AND PREVIOUS CROSS-SECTIONS
         4957.96


PERCENT AVERAGE ANNUAL FLOODING DAMAGES ARE OF GROSS RETURNS WITH NO FLOODING FOR CROSS-SECTION
           14.29


PERCENT ACCUMULATED AVERAGE ANNUAL DAMAGES ARE OF ACCUMULATED GROSS RETURNS WITH NO FLOODING
           14.29
```

```
DAMAGES FROM EACH FLOOD ON EACH SAMPLE POINT ON A PER ACRE BASIS


                                          FLOOD ONE
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.19     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.17     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0     12.47     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.16     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.20     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.17     0.C      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                   FLOOD TWO
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.96    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.26   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     18.13   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.24    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.15    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.26    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                   FLOOD THREE
0.0     0.0     0.0     0.0     0.0     0.16    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.38    0.13    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.17   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     17.82   14.43   0.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     11.81    0.27   0.16    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     14.32    8.69   19.01   0.16    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     12.80    0.27   15.87  15.03    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     13.69    0.22   15.10   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.15     0.14    0.27    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.14     0.27    0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.27     0.16    0.14    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                     FLOOD FOUR
0.0     0.0     0.0     0.0     0.0     0.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.56    0.15    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.18   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     19.28   16.32   0.18    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     14.90    0.27   0.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     15.78   10.18   19.01   0.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     15.03    0.27   17.33  16.48    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     15.15    0.25   16.55   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.16     0.15    0.27    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.15     0.27    0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.27     0.17    0.16    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                   FLOOD FIVE
0.0     0.0     0.0     0.0     0.0     0.19    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.63    0.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.22   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     21.24   18.68   0.21    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     16.71    0.27   0.19    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     17.60   12.05   19.01   0.19    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     16.85    0.27   19.15  18.30    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     16.96    0.27   18.37   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.18     0.17    0.27    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.17     0.27    0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.27     0.19    0.17    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                   FLOOD SIX
0.0     0.0     0.0     0.0     0.0     0.23    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.70    0.19    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.26   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     23.05   21.04   0.25    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     18.53    0.27   0.23    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     19.44   13.91   19.01   0.23    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     18.66    0.27   21.10  20.19    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     18.78    0.27   20.27   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.21     0.19    0.27    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.19     0.27    0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.27     0.23    0.19    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                     FLOOD SEVEN
0.0     0.0     0.0     0.0     0.0     0.25    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.72    0.20    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0      0.27   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     23.05   22.19   0.27    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     19.27    0.27   0.25    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     20.22   14.76   19.01   0.25    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     19.41    0.27   21.88  20.97    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     19.54    0.27   21.05   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.23     0.20    0.27    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.20     0.27    0.0     0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.27     0.25    0.21    0.0    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
                                      FLOOD EIGHT
0.0      0.0      0.0      0.0      0.0      0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.88     0.24     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.27     0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      23.05    25.58    0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      21.22    0.27     0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      22.17    17.12    19.01    0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      21.36    0.27     23.05    22.92    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      21.49    0.27     23.00    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.27     0.24     0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.24     0.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.27     0.27     0.25     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

FLOOD DAMAGES ON ACRES REPRESENTED BY EACH SAMPLF POINT FOR EACH FLOOD

```
                                      FLOOD ONE
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.96     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      62.36    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.82     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.98     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.87     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                      FLOOD TWO
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      4.81     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      1.29     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      90.66    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      1.19     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.73     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.32     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                      FLOOD THREE
0.0      0.0      0.0      0.0      0.0      0.79     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      1.90     0.67     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.85     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      89.10    72.14    0.83     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      59.06    1.37     0.79     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      71.62    43.47    95.07    0.79     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      64.01    1.37     79.37    75.14    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      68.45    1.10     75.48    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.74     0.68     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.68     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     0.79     0.71     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                         FLOOD FOUR
0.0      0.0      0.0      0.0      0.0      0.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      2.81     0.75     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.92     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      96.42    81.58    0.90     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      74.48    1.37     0.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      78.89    50.92    95.07    0.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      75.14    1.37     86.64    82.41    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      75.73    1.27     82.76    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.81     0.75     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.75     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     0.86     0.78     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                                  FLOOD FIVE
0.0      0.0      0.0      0.0      0.0      0.95     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      3.15     0.84     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      1.10     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0    106.18    93.38     1.04     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0     83.57     1.37     0.96     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     87.99    60.24    95.07     0.95     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     84.23     1.37    95.74    91.50     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     84.82     1.37    91.85     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.90     0.84     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.84     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     0.95     0.87     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                                  FLOOD SIX
0.0      0.0      0.0      0.0      0.0      1.16     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      3.49     0.93     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      1.31     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0    115.25   105.18     1.25     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0     92.67     1.37     1.17     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     97.18    69.56    95.07     1.16     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     93.32     1.37   105.49   100.95     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     93.92     1.37   101.33     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.04     0.93     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.93     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     1.16     0.97     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                                     FLOOD SEVEN
0.0      0.0      0.0      0.0      0.0      1.24     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      3.62     0.99     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      1.37     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0    115.25   110.94     1.33     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0     96.35     1.37     1.26     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0    101.09    73.79    95.07     1.24     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     97.06     1.37   109.40   104.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0     97.69     1.37   105.23     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.13     0.99     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.99     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     1.24     1.06     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                                  FLOOD EIGHT
0.0      0.0      0.0      0.0      0.0      1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      4.40     1.20     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      1.37     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0    115.25   127.91     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0    106.11     1.37     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0    110.85    85.61    95.07     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0    106.81     1.37   115.25   114.62     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0    107.45     1.37   114.99     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.34     1.20     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.20     1.37     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
1.37     1.37     1.27     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


AVERAGE ANNUAL DAMAGES ON ACRES REPRESENTED BY EACH SAMPLE POINT
0.0        0.0        0.0        0.0        0.0        0.58       0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.0        1.59       0.49       0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.63       2.53       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0       67.31      53.50       0.61       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0       45.62       2.42       0.58       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0       51.83      33.24     170.11       0.58       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0       47.77       2.32      56.96      54.18       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0       49.71       1.40      54.41       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.54       0.50       2.55       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.50       2.74       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
2.45       0.58       0.52       0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0        0.0
```

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AVERAGE ANNUAL DAMAGES FOR CROSS-SECTION AREA
       708.73


  ACCUMULATED FLOOD DAMAGES, THIS CROSS-SECTION AREA AND ALL PREVIOUS
                               708.73


                  CROP LEGEND
   CROP NUMBER      CROP IDENTIFICATION
        1                 COTTON
        2               G. SORG.
        3                  CORN
        4               SOYBEANS
        5                  WHEAT
        6                  OATS
        7                 BARLEY
        8               PEANUTS
        9               B.PAST.
       10                ALFALFA
       11                N. HAY
       12               WOODPAST
       13                R.PAST.


 NET RETURNS BY SAMPLE POINT CONSIDERING AVERAGE ANNUAL FLOODING
   0.0       0.0       0.0       0.0       0.0       8.17      0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0      32.16      8.26      0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       8.12      6.22      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0     154.29    174.85      8.14      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0     175.98      6.33      8.17      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0     169.77     26.51   -110.36      8.17      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0     173.83      6.43    164.64    167.42      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0     171.89      7.35    167.19      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   8.21      8.25      6.20      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   8.25      6.01      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   6.30      8.17      8.23      0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
   0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0


 ACCUMULATED NET RETURNS FOR ALL ANALYZED CROSS-SECTION AREAS
                               1603.16


 DISTRIBUTION OF ANALYZED FLOODPLAIN ACREAGE BY NET RETURN INCREMENTS
      NET RETURNS INCREMENT        FLOODPLAIN ACRES
         -50.00 OR LESS                      5.0
       -49.99 TO -25.00                      0.0
       -24.99 TO -10.00                      0.0
       - 9.99 TO - 5.00                      0.0
       - 4.99 TO - 0.01                      0.0
                 0.0                         0.0
         0.01 TO    1.00                     0.0
         1.01 TO    2.00                     0.0
         2.01 TO    3.00                     0.0
         3.01 TO    4.00                     0.0
         4.01 TO    5.00                     0.0
         5.01 TO    7.50                    35.0
         7.51 TO   10.00                    55.0
        10.01 TO   15.00                     0.0
        15.01 TO   20.00                     0.0
        20.01 TO   30.00                     5.0
        30.01 TO   40.00                     5.0
        40.01 TO   50.00                     0.0
        50.01 TO   75.00                     0.0
        75.01 TO  100.00                     0.0
       100.01 TO  125.00                     0.0
       125.01 TO  150.00                     0.0
       150.01 TO  175.00                    40.0
       175.01 TO  200.00                     5.0
       200.01 TO  250.00                     0.0
       250.01 TO  300.00                     0.0
       300.01 TO  350.00                     0.0
       350.01 TO  400.00                     0.0
       400.01 TO  500.00                     0.0
       500.01 OR GREATER                     0.0
```

Computer Routine Unique to the Optimizing Routine

Land use at each sample point is not specified in the Optimizing Routine. Production costs are read in and net returns computed for all land uses included in the data (13 in this illustration) on each sample point. The first portion of the printout unique to the Optimizing Routine is the table of production costs. Cost of production by crop and productivity group follows gross value for each crop by productivity group in the printout. For example, per acre production costs for grain sorghum are $28.86 for productivity group one, $27.16 for group two, $26.26 for group three, and zero for group four since grain sorghum is not considered as a feasible alternative for group four.

Returns net of production costs by crop and productivity group follow the production costs printout. If a flood threat did not exist, these values would be the expected net returns. However, the model is concerned with flood plain sample points, and average annual flood damages must also be deducted to obtain expected annual net returns.

The next section of output unique to the Optimizing Routine is average annual flood damages by crop and sample point. The first crop listed is cotton with average annual flood damages shown for each sample point if cotton were produced. Each of the crops considered (13 in this sample) are presented in this manner. Considering Sample Point 6,2, average annual flood damages for 5 acres are $111.37 for cotton production, $35.80 for grain sorghum, $35.43 for corn, $56.31 for soybeans, etc.

Gross returns, assuming no flooding, are presented for each sample point by crop in the same format as above. Gross returns on the acres represented by Sample Point 6,2 are $648.00 for cotton production, $253.50 for grain sorghum, $225.75 for corn, $355.25 for soybeans, etc.

Average annual flood damages and production costs are deleted from gross returns to give net returns accounting for average annual flooding damages. The returns net of production costs and average annual flood damages are printed for each sample point by crop in the same format as production costs. Expected net returns for the five acres represented by Sample Point 6,2 are $98.88 with cotton production, $73.40 for grain sorghum, $24.32 for corn, $168.89 for soybeans, etc.

The land use that maximizes returns net of production costs and average annual flood damages is given for each sample point. For Sample Point 6,2 this is crop 8 or peanuts. Following the profit maximizing land use are expected net returns associated with the optimum land use by sample point. Expected net returns on Sample Point 6,2 with peanuts production are $174.88. The alternative land uses that are in the solution are accumulated by acreage and printed. For cross section area

N-8, the optimum solution includes 35 acres of soybeans, 45 acres of peanuts, 35 acres of alfalfa, and 35 acres of native pasture.

The next set of data printed are accumulated cross section area values with optimum land use. Gross revenue is $13,856.73, production costs $7,242.94, average annual flood damages $2,469.17, and expected net returns are $4,144.62. These values are also accumulated for all cross section areas analyzed, but since N-8 is the only one considered the values are the same as above.

In addition to identifying the crop with the largest expected return value, the optimizing routine indicates the second most profitable land use at a sample point and expected net returns with the second best land use. For example, second best land use on Sample Point 6,2 is crop 10 (alfalfa) and expected net returns to peanuts are $169.77. The land uses that are the second most profitable at sample points are accumulated by acreage and printed. In the illustration, second best land use on 40 acres is soybeans, 75 acres is alfalfa, and 35 acres is range pasture. Gross revenue, production costs, average annual flood damages, expected net returns, accumulated over all cross section area sample points for the second best land use are $10,503.22, $5,138.23, $1,435.56, and $3,929.44, respectively.

The next set of data to be printed is the price of the optimum land use that equates optimum land use expected net returns with the second best land use expected net returns. On Sample Point 6,2, a price of $9,917 for the optimum peanuts will yield expected net returns equal to the second best land use of alfalfa or establish a condition of indifference between peanuts and alfalfa. Following the above prices, the model prints the percentage price decrease that equates optimum land use expected net returns and second best land use expected net returns. In the case of Sample Point 6,2, this percentage price decrease in peanuts that equates peanut expected net returns with alfalfa expected net returns is 0.83 percent.

The following portion of the printout lists 12 increments of percentage price decline that equates optimum land use expected net returns and second best land use expected net returns. The acreage applicable to each increment is printed for the cross section area. For N-8, a 0.5 percent or less price decrease will invalidate the optimum solution on 30 acres, 0.56 to 1.00 percent applies to 40 acres, etc. The acres applicable to alternative percentage price decline increments are also accumulated over all cross-section areas analyzed. Since N-8 is the only cross section area analyzed, these values are the same as for the cross section area.

```
                 PRICE PER UNIT OF CROPS GROWN
COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
  0.29    1.69    1.05     2.45    1.30    0.60     0.85   10.00     2.50    22.00   22.00     2.50     2.50     0.0


      CROP YIELD ON EACH PRODUCTIVITY GROUP
GROUP                                       CROP
       COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
   1   450.00   30.00   43.00   29.00   29.00   50.00   40.00   15.00    7.20    4.50    1.50    0.70    2.70
   2   450.00   30.00   43.00   29.00   29.00   50.00   40.00    0.0     7.20    4.50    1.50    0.70    2.70
   3   360.00   25.00   36.00   26.00   26.00   48.00   38.00   18.00    7.20    3.50    1.20    0.60    2.20
   4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     3.20    0.0     0.0     0.30    0.80


      GROSS VALUE BY CROP IN EACH PRODUCTIVITY GROUP
GROUP                                       CROP
       COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
   1   129.60   50.70   45.15   71.05   37.70   30.00   34.00  150.00   18.00   99.00   33.00    1.75    6.75
   2   129.60   50.70   45.15   71.05   37.70   30.00   34.00    0.0    18.00   99.00   33.00    1.75    6.75
   3   103.68   42.25   37.80   63.70   33.80   28.80   32.30  180.00   18.00   77.00   26.40    1.50    5.50
   4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     8.00    0.0     0.0     0.75    2.00


    COST OF PRODUCTION BY CROP AND PRODUCTIVITY GROUP
GROUP                                       CROP
       COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
   1    87.55   28.86   33.20   26.01   32.73   35.06   32.69   88.73   30.19   54.68   12.80    0.0     0.0
   2    87.55   27.16   32.45   25.38   31.87   34.20   31.83    0.0    30.19   54.68   12.80    0.0     0.0
   3    81.36   26.26   33.43   25.71   32.43   34.86   32.49   92.01   30.19   47.58   10.82    0.0     0.0
   4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0    29.44    0.0     0.0     0.0     0.0


  NET RETURNS BY CROP AND PRODUCTIVITY GROUP ASSUMING NO FLOODING OCCURS
GROUP                                       CROP
       COTTON G. SORG.  CORN  SOYBEANS  WHEAT   OATS    BARLEY PEANUTS B.PAST.  ALFALFA N. HAY WOODPAST R.PAST.
   1    42.05   21.84   11.95   45.04    4.97   -5.06    1.31   61.27  -12.19   44.32   20.20    1.75    6.75
   2    42.05   23.54   12.70   45.67    5.83   -4.20    2.17    0.0   -12.19   44.32   20.20    1.75    6.75
   3    22.32   15.99    4.37   37.99    1.37   -6.06   -0.19   87.99  -12.19   29.42   15.58    1.50    5.50
   4     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0   -21.44    0.0     0.0     0.75    2.00


AVERAGE ANNUAL FLOOD DAMAGES BY CROP AND SAMPLE  POINT



                                             COTTON
    0.0     0.0     0.0     0.0     0.0   124.26    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0    88.28  105.11    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0   135.64  520.36    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0   149.38  106.11  130.86    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0    97.36  498.84  125.15    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0   111.37  106.11  498.59  124.26    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0   101.97  480.41  124.26  117.31    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0   106.11  295.66  117.90    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  116.04  106.11  522.18    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  106.11  552.97    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  504.39  124.26  110.99    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                            G. SORG.
    0.0     0.0     0.0     0.0     0.0    41.96    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0    27.69   32.93    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0    46.95  177.04    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0    51.74   33.24   44.85    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0    30.52  168.90   42.35    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    35.80   33.24  168.82   41.96    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    31.95  162.97   41.96   38.62    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    33.24   97.44   38.89    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   38.01   33.24  177.49    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   33.24  185.06    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  170.69   41.96   35.62    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                              CORN
    0.0     0.0     0.0     0.0     0.0    40.79    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0    27.66   32.93    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0    45.40  178.58    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0    50.09   33.24   43.47    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0    30.50  170.20   41.15    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    35.43   33.24  170.11   40.79    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    31.94  163.29   40.79   37.90    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0    33.24   97.21   38.14    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   37.37   33.24  179.22    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   33.24  190.15    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  172.28   40.79   35.28    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
                                         SOYBEANS
      0.0      0.0      0.0      0.0      0.0    63.21      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    44.51    52.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    69.24   266.36      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    76.27    53.50    66.70      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    49.09   255.09    63.68      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    56.31    53.50   254.96    63.21      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    51.41   245.56    63.21    59.49      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    53.50   150.28    59.80      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    58.81    53.50   267.28      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    53.50   282.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   257.96    63.21    56.11      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                          WHEAT
      0.0      0.0      0.0      0.0      0.0    36.95      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    23.43    27.91      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    42.68   188.50      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    47.41    28.18    40.28      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    25.84   180.32    37.39      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    30.70    28.18   180.19    36.95      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    27.07   169.95    36.95    33.59      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    28.18    93.07    33.87      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    32.97    28.18   188.50      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    28.18   188.50      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   183.45    36.95    30.52      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                          OATS
      0.0      0.0      0.0      0.0      0.0    33.18      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    20.98    24.92      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    37.55   136.81      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    41.34    25.15    35.70      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    23.11   130.42    33.52      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    27.53    25.15   130.36    33.18      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    24.19   126.42    33.18    30.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    25.15    75.12    30.36      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    29.55    25.15   137.01      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    25.15   140.37      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   131.62    33.18    27.37      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                          BARLEY
      0.0      0.0      0.0      0.0      0.0    37.60      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    23.78    28.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    42.55   155.05      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    46.86    28.51    40.46      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    26.19   147.81    37.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    31.20    28.51   147.75    37.60      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    27.41   143.28    37.60    34.12      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    28.51    85.14    34.40      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    33.49    28.51   155.28      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    28.51   159.08      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   149.17    37.60    31.01      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                        PEANUTS
      0.0      0.0      0.0      0.0      0.0   144.57      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0   124.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0   547.06      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   170.40      0.0   150.77      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   115.68   529.29   145.40      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   131.47   126.03   529.11   144.57      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   516.06      0.0   137.47      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   333.01      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   136.18   126.03   548.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   126.03      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   533.27      0.0   131.09      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                        B.PAST.
      0.0      0.0      0.0      0.0      0.0     5.92      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0     4.25     5.07      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0     6.46    26.07      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     7.13     5.11     6.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     4.69    24.92     5.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     5.34     5.11    24.90     5.92      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     4.91    23.83     5.92     5.61      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     5.11    14.45     5.64      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     5.55     5.11    26.19      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     5.11    28.20      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    25.24     5.92     5.33      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

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                                          ALFALFA
      0.0      0.0      0.0      0.0      0.0    56.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    41.37    49.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    61.29   220.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    67.31    49.71    59.47      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    45.62   213.37    57.30      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    51.83    49.71   213.29    56.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    47.77   207.33    56.96    54.18      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    49.71   132.53    54.41      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    53.68    49.71   221.49      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    49.71   230.51      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   215.18    56.96    51.68      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                          N. HAY
      0.0      0.0      0.0      0.0      0.0    14.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    10.79    12.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    16.10    62.93      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    17.74    12.98    15.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    11.90    60.36    14.95      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    13.51    12.98    60.33    14.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    12.47    57.99    14.85    14.13      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    12.98    35.82    14.20      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    14.00    12.98    63.19      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    12.98    67.52      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    61.07    14.85    13.47      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                         WOODPAST
      0.0      0.0      0.0      0.0      0.0     0.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0     0.41     0.49      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0     0.63     2.53      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     0.69     0.50     0.61      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     0.46     2.42     0.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     0.52     0.50     2.42     0.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     0.48     2.32     0.58     0.55      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     0.50     1.40     0.55      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     0.54     0.50     2.55      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     0.50     2.74      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     2.45     0.58     0.52      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                          R.PAST.
      0.0      0.0      0.0      0.0      0.0     2.22      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0     1.59     1.90      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0     2.42     9.78      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     2.67     1.92     2.34      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     1.76     9.34     2.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     2.00     1.92     9.34     2.22      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     1.84     8.94     2.22     2.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     1.92     5.42     2.11      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     2.08     1.92     9.82      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     1.92    10.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
     9.47     2.22     2.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
GROSS RETURNS BY SAMPLE POINT AND CROP


                                          COTTON
      0.0      0.0      0.0      0.0      0.0   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   648.00   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   648.00   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   648.00   648.00   648.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                       G. SORG.
     0.0     0.0     0.0     0.0     0.0  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  253.50  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  253.50  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  253.50  253.50  253.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                         CORN
     0.0     0.0     0.0     0.0     0.0  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  225.75  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  225.75  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  225.75  225.75  225.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                       SOYBEANS
     0.0     0.0     0.0     0.0     0.0  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  355.25  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  355.25  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  355.25  355.25  355.25     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                        WHEAT
     0.0     0.0     0.0     0.0     0.0  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  188.50  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  188.50  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  188.50  188.50  188.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                         OATS
     0.0     0.0     0.0     0.0     0.0  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  150.00  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  150.00  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  150.00  150.00  150.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                        BARLEY
     0.0     0.0     0.0     0.0     0.0  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  170.00  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  170.00  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  170.00  170.00  170.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
                                      PEANUTS
     0.0     0.0     0.0     0.0     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  750.00     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  750.00  750.00  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  750.00  750.00  750.00  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  750.00     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  750.00  750.00  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  750.00     0.0  750.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                      B.PAST.
     0.0     0.0     0.0     0.0     0.0   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   90.00   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   90.00   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   90.00   90.00   90.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                        ALFALFA
     0.0     0.0     0.0     0.0     0.0  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  495.00  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  495.00  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  495.00  495.00  495.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                         N. HAY
     0.0     0.0     0.0     0.0     0.0  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  165.00  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  165.00  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  165.00  165.00  165.00     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                      WOODPAST
     0.0     0.0     0.0     0.0     0.0    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.75    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.75    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8.75    8.75    8.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                         R.PAST.
     0.0     0.0     0.0     0.0     0.0   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   33.75   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   33.75   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   33.75   33.75   33.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

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NET RETURNS BY CROP ON EACH SAMPLE POINT AREA   WITH AVERAGE ANNUAL FLOODING DAMAGES ACCOUNTED FOR


                                              COTTON
      0.0      0.0      0.0      0.0      0.0    85.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0   121.97   105.14      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    74.61  -310.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    60.87   104.14    79.39      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   112.89  -288.59    85.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    98.88   104.14  -288.34    85.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   108.28  -270.16    85.99    92.94      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   104.14   -85.41    92.35      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    94.21   104.14  -311.93      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   104.14  -342.72      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  -294.14    85.99    99.26      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                            G. SORG.
      0.0      0.0      0.0      0.0      0.0    67.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    90.01    76.27      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    70.75   -67.84      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    57.46    84.46    64.35      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    78.68   -59.70    66.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    73.40    75.96   -59.62    67.24      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    85.75   -53.77    75.74    70.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    84.46    11.76    78.81      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    71.19    75.96   -68.29      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    75.96   -67.36      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   -61.49    75.74    73.58      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                               CORN
      0.0      0.0      0.0      0.0      0.0    18.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0    35.84    26.82      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0    18.10  -118.83      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0     9.66    30.26    16.28      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    29.25  -110.45    18.60      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    24.32    26.51  -110.36    18.96      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    31.56  -103.54    22.71    21.85      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    30.26   -37.46    25.36      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    22.38    26.51  -119.48      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    26.51  -126.65      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  -112.53    22.71    24.47      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                              SOYBEANS
      0.0      0.0      0.0      0.0      0.0   161.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0   183.84   172.21      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0   159.11   -41.16      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   148.93   174.85   158.50      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   176.11   -29.89   161.52      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   168.89   171.70   -29.76   161.99      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   176.94   -20.36   165.14   165.71      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   174.85    74.92   168.55      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   166.39   171.70   -42.08      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   171.70   -54.61      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   -32.76   165.14   169.09      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                                WHEAT
      0.0      0.0      0.0      0.0      0.0   -12.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0     5.72    -3.06      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0   -13.53  -163.65      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   -22.56     0.97   -15.43      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0    -0.99  -155.47   -12.54      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0    -5.85    -3.33  -155.34   -12.10      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     2.08  -145.10    -7.80    -8.74      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0     0.97   -68.22    -4.72      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    -8.12    -3.33  -163.65      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    -3.33  -159.35      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  -158.60    -7.80    -5.67      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


                                                OATS
      0.0      0.0      0.0      0.0      0.0   -58.48      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0   -41.98   -50.22      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0   -58.55  -162.11      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   -66.64   -46.15   -61.00      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0   -48.41  -155.72   -58.82      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   -52.83   -50.45  -155.66   -58.48      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   -45.19  -151.72   -54.18   -55.40      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0   -46.15  -100.42   -51.36      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   -54.85   -50.45  -162.31      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   -50.45  -161.37      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  -156.92   -54.18   -52.67      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
```

```
                                            BARLEY
     0.0     0.0     0.0     0.0     0.0  -31.05     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  -12.93  -21.69     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  -31.70 -148.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  -40.31  -17.66  -33.91     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  -19.64 -141.26  -31.44     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -24.65  -21.96 -141.20  -31.05     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -16.56 -136.73  -26.75  -27.57     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -17.66  -78.59  -23.55     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  -26.94  -21.96 -148.73     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  -21.96 -148.23     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 -142.62  -26.75  -24.46     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                          PEANUTS
     0.0     0.0     0.0     0.0     0.0  161.78     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0  181.50     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0 -240.71     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  135.95     0.0  155.58     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  190.67 -222.94  160.95     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  174.88  180.32 -222.76  161.78     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0 -209.71     0.0  168.88     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  -26.66     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  170.17  180.32 -241.75     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  180.32     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
 -226.93     0.0  175.26     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                          B.PAST.
     0.0     0.0     0.0     0.0     0.0  -66.87     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  -65.20  -66.02     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  -67.41  -87.02     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  -68.08  -66.06  -67.19     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  -65.64  -85.87  -66.91     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -66.29  -66.06  -85.85  -66.87     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -65.86  -84.78  -66.87  -66.56     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  -66.06  -75.40  -66.59     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  -66.50  -66.06  -87.14     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  -66.06  -89.15     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  -86.19  -66.87  -66.28     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                             ALFALFA
     0.0     0.0     0.0     0.0     0.0  164.64     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0  180.23  172.36     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0  160.31    0.64     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  154.29  171.89  162.13     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0  175.98    8.23  164.30     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  169.77  171.89    8.31  164.64     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  173.83   14.27  164.64  167.42     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0  171.89   89.07  167.19     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  167.92  171.89    0.11     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  171.89   -8.91     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6.42  164.64  169.92     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                            N. HAY
     0.0     0.0     0.0     0.0     0.0   86.15     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0   90.21   88.15     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0   84.90   38.07     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   83.26   88.02   85.42     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0   89.10   40.64   86.05     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   87.49   88.02   40.67   86.15     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   88.53   43.01   86.15   86.87     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0   88.02   65.18   86.80     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   87.00   88.02   37.81     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   88.02   33.48     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   39.93   86.15   87.53     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0


                                           WOODPAST
     0.0     0.0     0.0     0.0     0.0    8.17     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0    8.34    8.26     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0    8.12    6.22     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0    8.06    8.25    8.14     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0    8.29    6.33    8.17     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.23    8.25    6.33    8.17     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.27    6.43    8.17    8.20     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0    8.25    7.35    8.20     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8.21    8.25    6.20     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    8.25    6.01     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
    6.30    8.17    8.23     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

```
                                         R.PAST.
   0.0     0.0     0.0     0.0     0.0    31.53    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0     0.0     0.0    32.16   31.85    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0     0.0    31.33   23.97    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0    31.08   31.83   31.41    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0    31.99   24.41   31.51    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0    31.75   31.83   24.41   31.53    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0    31.91   24.81   31.53   31.65    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0    31.83   28.33   31.64    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  31.67   31.83   23.93    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  31.83   23.17    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
  24.28   31.53   31.75    0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
   0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0



   LAND-USE MAXIMIZING NET RETURN ON EACH SAMPLE   POINT CONSIDERING FLOODING POTENTIAL
 0   0   0   0   0  10   0   0   0   0   0   0   0   0
 0   0   0   0   4   8   0   0   0   0   0   0   0   0
 0   0   0  10  11   0   0   0   0   0   0   0   0   0
 0   0  10   4  10   0   0   0   0   0   0   0   0   0
 0   0   8  11  10   0   0   0   0   0   0   0   0   0
 0   8   8  11  10   0   0   0   0   0   0   0   0   0
 0   4  11   4   8   0   0   0   0   0   0   0   0   0
 0   4  10   4   0   0   0   0   0   0   0   0   0   0
 8   8  11   0   0   0   0   0   0   0   0   0   0   0
 8  11   0   0   0   0   0   0   0   0   0   0   0   0
11   4   8   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0



  EXPECTED NET RETURNS ON EACH SAMPLE POINT AREA WITH OPTIMUM LAND-USE IN VIEW OF POSSIBLE FLOODING
   0.0      0.0      0.0      0.0      0.0    164.64    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0    183.84   181.50    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0    160.31    38.07     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0    154.29   174.85   162.13     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0    190.67    40.64   164.30     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    174.88   180.32    40.67   164.64     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    176.94    43.01   165.14   168.88     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    174.85    89.07   168.55     0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
 170.17   180.32    37.81     0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
 180.32    33.48     0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  39.93   165.14   175.26     0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


ACCUMULATED ACRES OF EACH CROP UNDER OPTIMUM LAND USE
          CROP          ACRES
          COTTON            0
        G. SORG.            0
           CORN             0
        SOYBEANS           35
          WHEAT             0
          OATS              0
         BARLEY             0
        PEANUTS            45
        B.PAST.             0
         ALFALFA           35
         N. HAY            35
        WOODPAST            0
         R.PAST.            0
                            0
                            0


  VALUES FOR THIS CROSS-SECTION WITH OPTIMUM LAND USE
      GROSS          PRODUCTION    AVERAGE ANNUAL       NET
     REVENUE            COSTS      FLOOD DAMAGES      RETURNS
    13856.73          7242.94         2469.17         4144.62



ACCUMULATED VALUES OVER ALL ANALYZED CROSS-SECTIONS WITH OPTIMUM LAND-USE
      GROSS          PRODUCTION    AVERAGE ANNUAL       NET
     REVENUE            COSTS      FLOOD DAMAGES      RETURNS
    13856.73          7242.94         2469.17         4144.62


SECOND BEST LAND-USE ON EACH SAMPLE POINT CONSIDERING FLOODING POTENTIAL
 0   0   0   0   0   4   0   0   0   0   0   0   0   0
 0   0   0   0  10  10   0   0   0   0   0   0   0   0
 0   0   0   4  13   0   C   0   0   0   0   0   0   0
 0   0   4  10   4   0   C   0   0   0   0   0   0   0
 0   0   4  13   4   0   0   0   0   0   0   0   0   0
 0  10  10  13   4   0   0   0   0   0   0   0   0   0
 0  10  13  10  10   0   0   0   0   0   0   0   0   0
 0  10   4  10   0   0   0   0   0   0   0   0   0   0
10  10  13   0   0   0   0   0   0   0   0   0   0   0
10  13   0   0   0   0   0   0   0   0   0   0   0   0
13  10  10   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0   0   0   0   0
```

```
EXPECTED NET RETURNS ON EACH SAMPLE POINT WITH SECOND BEST LAND-USE IN VIEW OF POSSIBLE FLOODING
   0.0      0.0      0.0      0.0      0.0    161.99    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0    180.23   172.36    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0    159.11    23.97     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0    148.93   171.89   158.50     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0    176.11    24.41   161.52     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    169.77   171.89    24.41   161.99     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    173.83    24.81   164.64   167.42     0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0    171.89    74.92   167.19     0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
 167.92   171.89    23.93     0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
 171.89    23.17     0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  24.28   164.64   169.92     0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   0.0      0.0      0.0      0.0      0.0      0.0     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


ACCUMULATED ACRES OF EACH CROP WITH SECOND BEST    LAND-USE
          CROP        ACRES
         COTTON          0
        G. SORG.         0
          CORN           0
        SOYBEANS        40
          WHEAT          0
          OATS           0
         BARLEY          0
        PEANUTS          0
        B.PAST.          0
         ALFALFA        75
         N. HAY          0
        WOODPAST         0
         R.PAST.        35
                         0
                         0


VALUES FOR THIS CROSS-SECTION WITH SECOND BEST LAND-USE
     GROSS          PRODUCTION    AVERAGE ANNUAL      NET
    REVENUE           COSTS       FLOOD DAMAGES     RETURNS
   10503.22          5138.23         1435.56        3929.44


ACCUMULATED VALUES OVER ALL ANALYZED CROSS-SECTIONS WITH SECOND BEST LAND-USE
     GROSS          PRODUCTION    AVERAGE ANNUAL      NET
    REVENUE           COSTS       FLOOD DAMAGES     RETURNS
   10503.22          5138.23         1435.56        3929.44


PRICE OF OPTIMUM LAND-USE THAT YIELDS NET RETURNS EQUALTO SECOND BEST LAND-USE
  0.0      0.0      0.0      0.0      0.0     21.867    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      2.422    9.854    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0     21.939   18.962    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0     21.724    2.426   21.816    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      9.770   18.587   21.860    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      9.917    9.865   18.583   21.867    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      2.425   18.259    2.446    9.976    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      2.426   21.141    2.439    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  9.963    9.865   19.000    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  9.865   19.673    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
 18.689    2.446    9.914    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
  0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


PERCENTAGE DECREASE IN PRICE OF OPTIMUM LAND USE  REQUIRED FOR SOLUTION TO BE INDIFFERENT BETWEEN OPTIMUM AND SECOND BE
    0.0      0.0      0.0      0.0      0.0      0.60     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      0.0      0.0      1.16     1.46     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      0.0      0.28    13.81     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      1.25     0.98     0.83     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      2.30    15.51     0.64     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.83     1.35    15.53     0.60     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      1.03    17.00     0.17     0.24     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.98     3.90     0.46     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.37     1.35    13.63     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    1.35    10.58     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
   15.05     0.17     0.86     0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0
    0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0


DISTRIBUTION BY CROSS SECTION ACREAGE OF PERCENT PRICE DECLINE REQUIRED FOR OPTIMUM TO EQUAL SECOND BEST LAND USE NET RE
  PERCENTAGE PRICE DECLINE REQUIRED            ACREAGE
    TO AFFECT LAND USE SOLUTION                AFFECTED
                0.0   -   0.50                   30.0
                0.56  -   1.00                   40.0
                1.01  -   2.00                   35.0
                2.01  -   3.00                    5.0
                3.01  -   4.00                    5.0
                4.01  -   5.00                    0.0
                5.01  -  10.00                    0.0
               10.01  -  15.00                   15.0
               15.01  -  20.00                   20.0
               20.01  -  25.00                    0.0
               25.01  -  50.00                    0.0
               50.01  -  99.90                    0.0
                     100                          0.0
```

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ACCUMULATED DISTRIBUTION BY ACREAGE OF PERCENT PRICE DECLINE REQUIRED FOR OPTIMUM TO EQUAL SECOND BEST LAND USE NET RETURNS
  PERCENTAGE PRICE DECLINE REQUIRED         ACREAGE
    TO AFFECT LAND USE SOLUTION              AFFECTED
               0.0  -  0.50                     30.0
               0.56 -  1.00                     40.0
               1.01 -  2.00                     35.0
               2.01 -  3.00                      5.0
               3.01 -  4.00                      5.0
               4.01 -  5.00                      0.0
               5.01 - 10.00                      0.0
              10.01 - 15.00                     15.0
              15.01 - 20.00                     20.0
              20.01 - 25.00                      0.0
              25.01 - 50.00                      0.0
              50.01 - 99.90                      0.0
                   100                           0.0


                CROP LEGEND
CROP NUMBER      CROP IDENTIFICATION
        1             COTTON
        2            G. SORG.
        3              CORN
        4            SOYBEANS
        5              WHEAT
        6              OATS
        7             BARLEY
        8            PEANUTS
        9            B.PAST.
       10             ALFALFA
       11             N. HAY
       12            WOODPAST
       13             R.PAST.
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OKLAHOMA STATE UNIVERSITY
AGRICULTURAL
EXPERIMENT STATION

0474/1M