PART- 3

AGRICULTURAL PROBLEMS, TECHNIQUES

POTENTIALITIES & PLANNING
CHAPTER XI

FLOODS AND FAMINES

Like China, India is also ill-reputed for being a land of floods and famines. The incidence of flood is normally very high in those parts which receive more than 30" of rainfall whereas the frequency of famines is high in areas receiving less than 40" of rainfall annually. This is really a very broad generalisation. In fact no part of India is completely immune from the visitations of either of these two or both. These natural calamities are related to the behaviour of monsoon rainfall which is very uncertain. Together, they cause incalculable damage to the standing crops, and dislodge a huge section of regional population which becomes homeless and jobless.

(A) FLOODS

In a Symposium on the 'Meteorological and Hydrological Aspects of Floods and Droughts in India' held at Aligarh in the year 1960-61, very different views were expressed on the causes and cures of these two problems faced by India.

(1) Following main causes were advanced in the symposium :-
(a) Local storms; (b) Sun-spot cycles; (c) Intense tropical cyclones; (d) Behaviour of stratosphere; (e) Nature of jet-streams; (f) Type of drainage basin; (g) Size of catchment area and (h) Nature of the river-valley.
GEOGRAPHICAL CAUSES OF FLOODS

A. Steep gradient - NO FLOODS

B. Confluence at 90° - HIGH FLOODS

C. Extensive Meanders and Confluence at 180° - Severe Floods

D. River Islands at the Confluence - MINOR FLOODS

E. Stream intercepted by dyke or quay-reef - Bottle-neck FLOODS

F. Approach of a mountain range towards the stream - Bottle-neck FLOODS

G. Parallel Confluence - MINOR FLOODS

H. Straight Courses and Ideal Confluence - NO FLOODS (Hypothetical Case)

I. Flood Zoning according to Meander Belt - Flooded Area (Hypothetical Case)
It is impossible, even unnecessary, to describe them here in details, but the participants agreed that floods are produced as a result of excessive precipitation when rivers swell beyond their banks.

Flood is not entirely a matter of highly concentrated rainfall. It implies the question of run-off as well. Geography thus rightly comes in when the disposal of rainwater is considered. For run-off, we have to further enquire into the shape and size of the river valley, pattern of confluences, surface-gradient and the character of surface-rocks. Immunity from floods at any place demands a perfect balance between the amount of precipitation and its disposal in the quickest possible time.

Geographical Causes of Floods

1. Relief as a Cause of Floods

To be sure, all floods are as a result of heavy precipitation. Therefore, it is impossible to overlook this basic factor. As a matter of fact, it is the relief which determines the scale of floods. In Cherapunji or along the Western Ghats, there has never been a problem of floods owing to the high relief which permits a quick run-off. On the other hand, in the northern plains, where gradient is very gentle, even a slightly concentrated or well spread out rain causes floods in one or the other sections of the river valley.
In desert or semi-desert areas streams are very shallow and a single down-pour may cause disastrous floods.

Looking at from this point of view, it may be safely asserted that more than half of Bundelkhand, specially southern, is safe from the dangers of high floods. The worse affected are, however, the lower sections of the regional streams near their confluences in the Trans-Yamuna plain. The main streams, together with their tributaries and sub-tributaries, bring into this region huge amount of water from their extra-regional catchment areas and cause floods.

2. Distribution of Rainfall as a Cause of Floods

Plate XXVIII, showing the distribution of weekly rainfall for Central India (East)\(^1\) i.e. Bundelkhand and Baghelkhand clearly establishes the relation between the distribution of rainfall and the occurrence of floods.

Following points may be noted from it:

(a) Floods (black bands) do not always occur during rainy season in Bundelkhand. They are quite frequent in the pre and post monsoon periods.

(b) Certain floods are preceded by normal rainfall (shaded bands). The relation between these two is thus both direct and clear.

\(^1\) Reproduced from the 'Report of Water Rate Committee of M.P.', 1962.
(c) From November to May, floods are experienced without any regional rains. They may be the result of either snow melting on the Himalayas or of extra-regional rainfall or owing to local heat storms, which gather up suddenly, break and dissipate.

(d) Floods may be both long-continued (long black bands) and short-lived (small black bands). Usually they are short-lived and rarely last longer than a fortnight.

(e) Frequency of floods in the region may be both, high as well as low. In the year 1957 flood was experienced only once in the year, but in many years these took place more than six or seven times.

(f) Frequency of drought-spells is higher than the frequency of flood-spells in the region. This means that there is a greater problem of drought than floods in Bundelkhand.

Inset chart on Plate VII gives us some information regarding the discharge of River Betwa. The volume of water here refers to the total amount of rainfall in the catchment area of that river minus a fraction of it lost by evaporation and percolation. The diagram explains that in River Betwa the rate of discharge of water may range from 70 cusecs to more than 4,000 cusecs in any year. The months of the
highest discharge are generally July, August and September, but it may greatly vary from year to year depending upon the time and intensity of monsoon rainfall. This is, however, the normal period of peak floods. The second maxima is found in January and February. The period between May and June is characterised by lowest possible discharge to the extent that the stream may be completely dried up as it happened several times during the prolonged droughts and scarcities experienced in the past.

3. Structural Bottle-necks as a Cause of Floods

When structure and relief combine together to create certain bottle-necks in the course of a stream and water is forced to pass through certain narrow gaps floods are very severe near these spots. This is precisely the case in Mau tahsil where Bindhachal range approaches nearest to Yamuna. Here water accumulates and flood is usually caused. (Plate XXVII F).

4. Pattern of Confluence as a Cause of Floods

The pattern of the confluence of two or more streams is also a very important cause of floods. Various types of river confluences shown on Plate XXVII will explain this point. When streams meet each other at low gradient at right-angles (map No. B) the major stream during the
flood period strikes at the flow of the weaker stream and barricades its natural flow, causing in it flood as water continues to accumulate in its lower valley. This is perfectly the case when Birma nadi meets Betwa or when Ken river meets Yamuna. In the latter case, the flood volume of Yamuna water is many times more than that of River Ken, the water of which is almost completely held-up and jammed. It rises up and then moves upward so that the valley is flooded up to Pailani and beyond with the result that the abandoned valley of River Ken known as 'Turi' is also flooded for many miles. Even more serious are the floods at the confluence of Chambal with Yamuna, (Map No. C). Both these streams meet each other from near opposite directions. Here Chambal is a much bigger stream than Yamuna (see map). When mighty Chambal is in flood it completely stops water of Yamuna and impounds it so that floods are caused in River Yamuna also. When both are in high floods the scene is really awe-some. The result is that water in the weaker stream moves backward causing extensive gullying in the Yamuna-Chambal divide. The ideal pattern of the confluence is presented by map No. G & H, wherein River Yamuna and River Betwa run parallel to each other for a few miles and finally meet near Hamirpur at an acute angle so that water of both moves forward without much difficulty.
5. Meandering as a Cause of Floods

Meanderings reduce not only the dimensional and the flow scale but also the time scale as well. We have already seen that if water drains away as quickly as it accumulates, there will be no problem of floods. One of the conditions for quick disposal, besides adequate gradient, is the straight course of the river. When streams meander water takes more time in moving its load for a given distance. Water naturally accumulates more rapidly than it moves. This causes high floods. (Map C).

6. Failure of Reservoirs as a Cause of Floods

Floods are also caused when a big reservoir is breached and washed away. We are all aware of the floods in Poona city, when suddenly Karagwasla dam failed to withstand the pressure of the impounding water due to heavy rains. No dam in Bundelkhand has so far caused such a disaster. The shape and size (therefore capacity) of different weirs and dams in Bundelkhand have been so designed as to permit maximum possible discharge. They were constructed after a detailed study of the local structure, rainfall, rates of maximum discharge and behaviour of the regional streams. Following table (2) explains the rates of discharge of the streams at the major weirs.

(2) Courtesy: 4th Irrigation Division, Jhansi (U.P.)
### Table No. LV

**Discharge rates from some weirs in Bundelkhand**

<table>
<thead>
<tr>
<th>Name of Weir</th>
<th>Designed Max. flood in cusecs</th>
<th>Max. discharge so far in cusecs</th>
<th>Max. discharge in 1964-65 in cusecs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhukwan</td>
<td>6,52,000</td>
<td>5,65,100</td>
<td>2,75,000</td>
</tr>
<tr>
<td>Parchha</td>
<td>7,60,000</td>
<td>7,28,000</td>
<td>3,57,500</td>
</tr>
<tr>
<td>Pahuj dam</td>
<td>N.A.</td>
<td>35,000</td>
<td>1,840</td>
</tr>
<tr>
<td>Pahari Dam</td>
<td>4,65,000</td>
<td>3,40,000</td>
<td>2,22,500</td>
</tr>
<tr>
<td>Lachhura Dam</td>
<td>5,10,000</td>
<td>5,60,000</td>
<td>2,56,200</td>
</tr>
</tbody>
</table>

It may be noted that as a whole the designed maximum flood discharge rates in these dams are very much higher than their maximum actual discharges so far experienced. The only exception is Lachhura dam where maximum discharge in a certain year surpassed its designed capacity.

7. **Deforestation and Soil-erosion as Causes of floods**

Deforestation and soil erosion are inter-related phenomena and both are indirect causes of high floods. When a stream is in spate, its load is very great. It comes from the areas where erosion is extensive. Sand, mud and clay etc. which form the river-load, reduce the velocity of stream and cause floods. Some times when this load gradually settles down, specially in the bottom of the channel, the bed is
raised and floods usually touch new levels and inundate large areas.

Estimates of Flood Flows

Estimates of floods are based on the observations and records of climatological, hydrological and structural data of the catchment area of the individual stream. In the United States, Canada and other countries of Europe, streams are fitted with gauging stations which are equipped with hydrographs so that a continuous record of the falling or rising level of the stream is maintained.

Based on these records and the observations in the catchment areas, certain regional floods formulae have been devised as if it were a mathematical problem. There are no such well-equipped flood gauging and forecasting stations in our region. Records of monthly flows are, however, maintained by the Irrigation Departments.

Measures for Flood Control

Following the disastrous floods during 1954 monsoon season, the Government of India formulated a comprehensive national programme of flood control in September, 1954. There were three distinctive stages of this programme i.e. (1) investigation and collection of data on floods, (2) preliminary short-term measures, such as construction of embankment
channel improvement and (3) envisaging long-term measures, such as the construction of flood moderating reservoirs. State governments were also directed to follow the scheme and undertake flood control measures on priority basis with the technical assistance of Flood Control Boards, which now exist in almost all the states. The Central Government allotted Rs. 61 crores for this purpose which was subsequently raised to Rs. 84 crores.

In Bundelkhand no scheme was undertaken purely as a flood control work. They were all meant partly for controlling the floods and partly for increasing the irrigation potentials in the region. Nata tila dam on Betwa River, is a multipurpose scheme of this type. Drainage channels were, of course, taken out in some parts of Jalaun district, but without proper surveys, as a result of which they have deteriorated the flood situation instead of improving it.

**Flood Control Measures in Lower Mississippi River**

Let us now study the case of lower Mississippi which the Government of United States has undertaken for flood control. Following main steps will be taken to reduce the incidence of floods in this river.

1. **Protection of levees**

   Natural levees confine the channel of the stream. Therefore, these are being protected and strengthened in
order to check the over-flow of water along each side of the river, except at the entrance of tributaries, back-water areas and the high banks.

2. Cut-offs

Cut-offs are essential for straightening of the river-course so that water may move on without much loss of time. These have to be created where large loops exist.

3. Emergency Storage Areas

These are naturally the back-water areas. They should be improved in such a way as to permit flood water to come into them and leave them slowly.

4. Reservoirs

Large-sized reservoirs collect much water and thus withhold substantial volume of water. Consequently severe floods in the lower valley are averted.

5. Flood-ways

Flood-ways may be dug out at suitable points to divert water of high floods to outside area.

6. Flood-zoning

Demarcation of the area most usually affected by annual floods is very essential. In India many hundred thousands people are annually dislodged from their homes.
which are either inundated or swept away by the swelling rivers. The situation is worst in Assam and Bengal. People usually return to their homes soon after the floods subside, but even their temporary settlement in relief camps or in surrounding villages cost the state governments crores of rupees every year. In order to save these sums, areas which are generally flooded every year, be demarcated and gradually the people should be permanently shifted to safer places without affecting their legal rights over their fields in the flood plains. No one should be allowed to resettle in these flood affected zones and such recurring sums, which are annually spent in flood relief, be diverted to other more radical measures of flood control.

As far as the author is aware, no such steps have been taken by the Central or the State Governments on any appreciable scale for want of funds. Construction of reservoirs on the streams has of course been taken on a large scale, but decidedly reservoirs and dams alone can not solve the problem of floods fully.

(B) FAMINES:

One of the main factors of poor agricultural condition in India has been ascribed to recurrence of the droughts and famines since very early times. The lengthy accounts of the more recent Indian famines are preserved in various
famines reports which repeatedly mention about the vagaries of monsoon rainfall as their chief cause. The detailed account of the known droughts of the past 100 years, however, show how frequent the region, whose total rainfall is from 20" to 35" has been subjected to severe scarcities and famines. The famine of 1873-74 in north Bengal was exceptional in the sense that it occurred in a region of abundant average rainfall.\(^{(1)}\)

Plate V map No. A shows that Bundelkhand lies in a region where the annual rainfall varies from 30" to 50" and hence the whole of it, specially the western part, is subject to the visitations of these calamities. Since 1813 as many as 10 famines and a dozen of droughts and severe scarcities have occurred in this region. In fact no famine of Northern or Central India has ever left Bundelkhand untouched in some degree or the other.

**Causes of Bundelkhand Droughts and Famines**

The causes of droughts and famines in Bundelkhand are precisely the same as of any other part of India, indeed of the world. Following Mallory \(^{(2)}\) the causes may be (a) Natural, such as vagaries of rainfall, invasion by locusts,


\(^{(2)}\) Mallory, W.H. : 'China : Land of Famine' A.G.S. Special Pub No. 6, 1929 (See content)
pests and earthquakes etc. (b) Economic, such as poor standards of the masses, over crowding, surplus labour, lack of credit and loss of soil fertility etc. (c) Political, which may embrace over-taxation, instable government, excessive troops and inefficient government machinery etc.

For the purpose of analytical study(1) of these causes important famines of Bundelkhand have been described below as they throw sufficient light on the causes of individual famines. Intensity of a few of these famines has been shown on Plate XXIX.

Famine of 1933-34:

This famine was widespread over the whole of Bundelkhand, but it was extremely severe over Jalaun, Kalpi and Kunch purganas of north-west Bundelkhand. In Jalaun and Hamipur districts famine, pestilence and emigration deprived half its population.

This famine was caused by premature cessation of rainfall in August. The drought continued in 1934 and as far as Banda district both rabi and kharif harvests were severely damaged in succession. It, however, killed the 'Kans' - a perennial unwanted regional grass which prospers on black soil under moist conditions.

(1) Source: Famine Reports, District Gazetteers and Settlement Reports
Famine of 1837-38 (Plate XIX map No. B)

The whole of Northwest Province was severely affected by this famine. Its affliction was severest in Jalaun district, but eastern districts were only partially affected. In this year rains were unusually late; July and August were entirely dry and scorchingly hot. It was followed by unusually heavy rainfall in September, but it was very badly distributed. This caused eastern districts of Banda and Hamirpur to suffer most by excessive rain and Jalaun by poor rain. Distress in Kalpi tahsil was severest. Waves after waves of migrating people moved into Saugor and Damoh districts. When relief works were started, people returned to their area for seeking employment and to earn their livelihood.

Famine of 1868-69 (Map C)

Although entire Bundelkhand came into the grip of this famines, its severity was not uniform. Jhansi district was the worst sufferer; Hamirpur was only slightly touched. This famine is well known by the name 'great pachisa' i.e. having occurred in Samvat 1925.

In the Jalaun district rains started in time but stopped on August 3 and a prolonged break ensued till the middle of September. Kharif failed entirely and rabi was damaged by 40% for lack of moisture. Partial damage of rabi...
The famine in 1977-78 (Map F) was caused by the complete failure of the monsoon rainfall in Banda. However, the total out-turn was half of the normal for Jhansi. The crops failed there, with the total harvest being only 3/4 of the normal. Prices of grains rose so high in October that they caused great distress, despite of large imports from Allahabad.

In Jhansi, the situation was different. Extensive cultivated areas could not be sown for want of rains during southwest monsoon period, when only 14" (out of 40") of normal rainfall fell. In July, June, and August, it rained very little; in September, it rained heavily. Rain in October was so heavy and concentrated as to cause not only high floods in the plains and the valleys, but also to destroy roads and bridges.

Famine was absolute, and there was no food available. In January, people had little money and lacked in purchasing capacity.
monsoon over Bundelkhand. By August 20, only 4" of rain fell in Jalaun district against 24" as its normal. Consequently kharif area shrunk from 2.6 lakh acres to 17000 acres only. In Banda it created scarcity (and not famine) as kharif was good in Baberu and Badausa areas of this district. Jhansi district escaped this famine completely as there was excellent rain in October and November which secured the rabi crops.

Famine of 1895-97 (Map F)

This was the most desolating calamity for Banda and Hamirpur districts because of very heavy rains there in 1894-95. It was nearly twice as much as the normal for these districts. It was disastrous to kharif and rabi was damaged by hail storms in Hamirpur. In the following year monsoon started well but ceased in August. Kharif was largely damaged not so much by paucity of rain as by dry hot-winds after cessation of rains. Resowing could not be done due to lack of moisture as September passed off rainless. Prices of food grains in October became inordinately high i.e. 15 to 17 seers per rupee (indeed very cheap with the present-day prices). All the four districts of U.P. Bundelkhand suffered from these conditions.

The total affected area of this famine in U.P. Bundelkhand was 10,414 sq. miles. It period of duration was
300 days when relief was provided. Out of the total of lakh
2,297,000 affected people only 2.5% people could be provided
with famine relief. (1)

Famine of 1905-06

Although most of Bundelkhand was affected by the
scarcity of 1900-01, the worsening condition intensified
in 1905-06 when the rainfall was everywhere below the normal
except in the eastern districts in Banda and Hamirpur where
it was inversely very high. However, it did not take the
shape of a famine till 1907-08 when monsoon failed to break
till July 20th and ceased prematurely on August 27. Lack
of moisture never permitted kharif to mature and rabi could
not be sown on large areas except those protected by Betwa
canals. Then the pilgrims from Kumbh Fair imported cholera
epidemic in Jhansi district so that mortality rose very
high. Calamity aggravated as the entire area between Talbaha
and Bansi was hit by hail storms, which apart from destroy-
ing crops, killed about 400 heads of cattle. In Hamirpur
construction of Dhasan canal provided employment to some
10,000 persons.

From the above accounts of more important famines,
it is clear, that the chief cause of droughts and famines

(1) Report of Indian Famine Commission, 1880, Measures of
Protection and Prevention, p. 149
in Bundelkhand has been the unreliability of rainfall. But alone it could not produce absolute famine, except when the vagaries continued continuously for more than one agricultural year. Usually long continued droughts or exceptionally high rainfall were combined with such phenomena as frost (1894-1995), hailstorms (1905-08), epidemics and pests (1895-96), poverty of the masses and the corrupt habits of the officials. These have combined in varying degrees in all the past famines in some or the other parts of Bundelkhand.

**British Policy on Famines**

Following were, in brief, the main principles of adopted famine policy (relief) by the British Government:—

1. To create a special department to collect authentic data of the famines with the assistance of various government offices and departments.

2. To provide work to affected people capable of earning livelihood.

3. To offer gratuitous relief.

4. To organise suitable system of village protection so that the people may take advantage of the relief measures.
5. To maintain policy of non-interference with the operation of trade, except under exceptional circumstances when there may be evidence that without such interference the supply of food will not be maintained.

6. To grant aid to the land-owning farmers together with the remission of land revenue.

7. To avoid obligations and responsibilities of providing relief to the people of the native states for which rulers alone are responsible.

In pursuance of the objectives of the above principles measures of protection were taken up during different famine periods in Bundelkhand but at least half of it (native states) was left out at the mercy of small petty native chiefs, who had inadequate resources at their disposal. In British Bundelkhand following steps were taken during famine operations:

1. Relief works of permanent value were undertaken such as construction of canals. Dhasan canal, for example, employed 10,000 persons in Hamirpur during the famine of 1905-06. Many roads were constructed such as from Chandaut ghat of Lachchura ghat, Kulpahar to Pawai and from Baberu to Nowgong in the famine of 1868-69. Lakes were also dug
and existing ones deepened. In the famine of 1896-97, about 51 lakes were constructed in Hamirpur district alone.

2. Poor houses and village gratuitous relief programmes were started as during the famine of 1896 in Banda. In the poor houses, affected people were given ration in the form of breads. The people, however, never took full advantage of such arrangements and those who obtained these were out-casted by their brothers in the village. Alms were also distributed in these houses by charitable institutions.

3. Peasants were given relief in terms of monetary help to purchase seeds, working animals (who died in thousands for want of adequate fodder), implements etc. Total loans advanced in 1896 in the whole of Bundelkhand were Rs. 42 lakhs.

4. Land revenue was also suspended as in 1896 when land revenue to the tune of Rs. 2 crores was suspended in British Bundelkhand.\(^{(1)}\)

But despite this the peasantry suffered hard. The measures of protection were inadequate. The backbone of rural economy was broken and it took a number of years to bring them back to normalcy. Therefore, the report of the

\(^{(1)}\)Report of Indian Famine Commission 1898 p. 54
famine commission of 1898 recommended that railway projects should also be included in the relief works to provide greater employment to the people and contract system of hiring labourers be abolished. Above all, district magistrates and commissioners should be given more powers not only to implement the relief programmes but also to punish corrupt officials. The famine commission of 1901 further recommended that the principle of saving every life (which was not adopted previously) should also be the responsibility of the government. Since the famine of 1899-1900 was really a fodder famine, the government also took the responsibility of supplying fodder to the affected areas. But one of the main recommendations of this commission was that special emphasis be laid on the 'moral strategy'. To quote its words 'there is no greater evil than the depression. It is a matter of universal experience that moral depression leads down a sharp incline to physical deterioration.'(1) People must realise that famines are inevitable and that they must face them boldly and should cooperate with the government.

Though droughts and scarcities in Bundelkhand still occur, yet famines have almost vanished.(2) This has happened

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(1) Report of Indian Famine Commission, 1901 (by A.P. Macdonnell) p. 11

(2) Famine of 1965-67 is an exception as it is Indian-wide phenomena. Monsoon more or less completely failed except in Bengal & Assam.
as a result of well directed policies of the National Government. More works of permanent value were taken up soon after Independence. Means of communications were greatly improved to regulate distribution of food and fodder effectively. Distribution of seed and fertilisers was seriously implemented. Veterinary services were introduced through 'key village schemes'. High prices of food grains helped the farmers to build up a more sound basis of their economy. Credit facilities are also being improved in rural areas and many branches of co-operative banks and state-banks are being opened.