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- 5) Simha (S.K.P.): Report containing outlines of a scheme
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- 6) Punjab. Land Records (Director of-): Report on the
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Report: Part 2 - recommendations:
V236CL, 61.N3 G2 2

84 10) Punjab. Punjab Erosion Committee: Report.
J:1:41.236.113t G4

NOTE ON CATTLE

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BIHAR AND ORISSA

1914

BY

G. MILNE, I. C. S.



PATNA :

GOVERNMENT PRESS, BIHAR AND ORISSA.

1915.

[Price—Indian 14 annas ;

English 1s. 2d.]

INTRODUCTORY.

In 1906 the Government of India drew the attention of Local Governments to the increasing importance of the cattle question owing to the restriction of grazing grounds, the extension of cultivation and the steady rise in prices, and to the desirability of placing on record full information regarding the economic conditions prevailing by the gradual completion of a cattle survey throughout India. It was proposed on the recommendation of the Inspector-General of the Civil Veterinary Department that the work of survey should be entrusted to the Superintendents of the Provincial Civil Veterinary Departments, each Superintendent taking up a portion of his charge, say two districts annually, and recording the principal data ascertainable in those districts in connection with the breeds of cattle, their improvement, their diseases, the facilities for grazing, prices and so forth.

2. This proposal was accepted in principle but was found by Local Governments to be generally impossible of execution owing to the lack of funds or staff or both. It was recognised that the original scheme was too ambitious and in 1910 the Government of India suggested that partial surveys of specific tracts where conditions are, or were in the past, favourable to cattle-breeding might give valuable results. About this time some progress in the codification of information regarding the cattle question had been made in certain provinces by means of a conference in the United Provinces and the publication of a note on the cattle of the Central Provinces and of the Punjab and in 1911 the Government of India decided that any detailed surveys ought, where possible, to be preceded by a general survey of the cattle question somewhat on the lines followed in the report prepared under the orders of the Punjab Government.

3. This general survey was to be of a non-technical nature and mainly of an economic character and was to be prepared by an officer not belonging to the Civil Veterinary Department.

4. In accordance with these instructions the Director of Agriculture in the end of 1911 issued a series of questions to district officers, based on the questions that had been circulated in the Punjab and in the end of October of the following year an officer was placed on special duty to collate the answers received after visiting the principal breeding grounds, cattle fairs and shows in the province and consulting the district officers and the Superintendent of the Civil Veterinary Department. This officer drew attention to the fact that the live-stock statistics hitherto accepted and published by the Agricultural Department in the annual return of Agricultural Statistics were discrepant, incomplete and far from reliable. These figures were based partly on police reports, partly on returns made by Settlement Officers at the time of the Survey and Settlement of a district. The defect of the Police figures was, that no procedure had at any time been laid down for the guidance of thana officers in compiling the returns, that generally speaking no one was responsible for supervising the methods actually employed and that the verbal reports of the chaukidars at a parade and the thana officers' reports were accepted without consideration or check. On the other hand the figures of the Settlement Officers although generally held to be more reliable seldom covered the entire area of any given district, but were nevertheless taken as a complete return of live-stock. They were obtained during the open season in the cold and the hot weather, when large numbers of cattle were absent from their owners' villages in precisely those areas, such as riverain tracts or forest jungles, which were omitted from settlement. Moreover the settlement figures when once accepted were reproduced annually without any attempt at revision during the currency of the settlement so that many of these returns are from 10 to 20 years out of date. For these reasons an attempt was made with the approval of Government to obtain more complete and accurate figures of the live-stock of the province by means of a rough census effected through the agency of chaukidari panchayats. The chaukidar was furnished with a list of the persons in his beat assessed to chaukidari tax and exempted therefrom. He was instructed to obtain the assistance of a literate

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| (1) M. Ernest Leroux, 28, Rue Bonaparte, Paris. | (2) Martinus Nijhoff, The Hague, Holland. |
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person, when he himself was unable to write, preferably the enumerator who had numbered the people at the recent census of humans, and to enter under the recognised classification the cattle, sheep, goats, etc., of each householder in his beat. He then delivered this list to his panchayat, who had ten per cent. of the entries checked by the circle dafadar and handed in the returns for the whole circle to the Sub-Inspector in charge of the thana. This system was employed except in the Chota Nagpur Division where the panchayat organisation is not in use, and no dafadars are employed. For this division the settlement figures are either quite new or comparatively recent and can be accepted as fairly correct. These statistics are reproduced in Appendix II and undoubtedly constitute a great advance in accuracy on those previously published. A quinquennial repetition of the census should be made in the same fashion and with further experience and a greater measure of accuracy in enumeration these statistics will form a valuable source of information regarding the resources of the province and the distribution of the live-stock.

APPENDIX I.

EXPERIMENTAL STATISTICS COLLECTED IN FOREIGN COUNTRIES.

The importance of the subject of denudation and erosion has been realised for a long time and many countries including United States of America, Switzerland, South Africa, Ceylon; etc., have carried out experiments to see the relationship between forests and the different climatic and physical features of the locality. A precis of such experiments and the conclusions arrived at has been given below:—

(1) *Dr. Arnold Engler's experiment in Switzerland.*

The Forest Experiment Station at Zürich in 1900 undertook accurate measurements on two small watersheds in the commune of Somiswalde; about 15 miles north-east of Berne. Of the two watersheds selected for the experiment one is known as Sperbelgrabem. It is 177 acres and wholly forested. The other known as Rappengraben is 172 acres and is $\frac{1}{3}$ rd forested. Both lie in the watersheds of two different streams which flow into the river Emme. The mountain range of Hinterarni, which in the peak Farnli reaches an elevation of 4,135 feet above sea level, lies between these two watersheds. The distance between them is 2.4 kilometers in an air line. The gradient is steeper on the forested than on the poorly forested watershed.

Various meteorological and silvicultural observations were carried out on the lines of the "wagon wheel Gap" experiment and Dr. Engler arrived at the following conclusions:—

- (1) That a good forest cover has a very beneficial effect upon the regime of streams in mountainous and hilly regions.
- (2) That streams fed from a forested watershed have a more uniform discharge and carry less debris to the larger rivers which they flow than streams coming from an unforested watershed.
- (3) That the effect of forest cover in stabilising and making the streams flow more uniform was due not directly to the forest cover but to the effect which it has upon the permeability and looseness of the soil and in maintaining a uniform temperature and moisture of the air and soil.
- (4) Dr. Engler discarded the opinion held by many prominent investigators such as Ebermayer, Wolny, Ney, Henry and others that the great water retaining power of the forest soil was due mainly to the great retentive capacity of the leaf litter and moss cover. On the whole he stated that raw humus and moss cover act upon the regime of streams like peat and moor soils.
- (5) The moisture contents of the soil under forest cover and in the open follow different courses. The forest soil contains more ground water while the open soil contains more capillary water, and the moisture contents in superficial layers of the former is more than in the latter.

(2) *Wagon Wheel Gap Experiment, Colorado, United States of America.*

Final report by C. G. BARRS, Silviculturist, Forest Service and A. J. HENRY, Meteorologist Weather Bureau.

Monthly Weather Review No. 946, supplement No. 30, 1928 Washington.

Experiment started in the Central Rockies in 1909. Two valleys of about 200 acres each and as similar as possible in all respects and as typical of the country as could be found, were brought under a very intensive study, most detailed meteorological observations being recorded throughout the year and total run-off and suspended matter carefully measured. After 8 years it was considered that all the data required to establish the comparability of the two valleys had been collected and one valley was completely denuded, observations being carried on for another seven years.

The valleys were at 10,000' altitude, had an annual precipitation of 21", and falls of one inch or more in 24 hours were only experienced once in two years; half the precipitation was snow which covered the ground from October to May; the gradients were moderate and the underlying rocks crystalline.

The authors in their final report warn one of the need for careful inductive reasoning in the attempt to relate even qualitatively their results to another sort of conditions.

The denuded area B had initially on an average 17 per cent. more run-off than the forested area A. The difference reached a maximum three years after denudation then fell off rather rapidly and steadily to the end of the experiment; 'though the snow water was made available earlier and in more concentrated volume, the watershed was still capable of absorbing it and of retaining for discharge throughout the year a greater volume than before.' In other words under the particular conditions of the test, denudation had not resulted in deterioration of the value of the area for water storage. Again, although erosion rate for B was 2.8 per acre per year before and 16.7 after denudation, no visible erosion was noted and the amount is almost insignificant.

- (3) *Forests and water in the light of Scientific Investigation by Raphael Zon, Director, Lake States Forest Experiment Station. Pub. by Forest Service, U. S. Department of Agric., 1927. 106 p. Price Rs. 20.*

This is one of the most authoritative publications on the subject that has ever been written. It is by a man who has long been recognised as an authority upon this broad subject. Coming as it did in a year of the most devastating floods in the Mississippi drainage area, it should have a great influence on the education of the general public on this subject.

After stating the object of the report, which is to bring together impartially all the well established facts as to the relation of forest to water supply, the methods of determining the influence of forests on stream flow are divided for purposes of discussion into two divisions as follows:—

- (1) Results by the physical method.
- (2) Results by the hydrometric method.

The first, "The physical method consists in determining through the measurement of individual factors the total amount of water available for stream flow."

In the second hydrometric method, the actual discharge of rivers is measured. The ideal application of the method by comparing the régime of streams from forested and unforested watersheds is outlined.

PART I.—RESULTS BY THE PHYSICAL METHOD.

Under this heading is gathered together and analysed under numerous headings the information published throughout the world by eminent investigators. This information is voluminous and has been drawn upon freely and impartially. Some thirty-five pages are given to the discussion. A summary at the end bringing together in a small compass the findings to the various investigations is given below:—

Summary of the effects of forests in conserving precipitation.

- (1) The hydrological role of forests in level countries differs from that of forests in hilly or mountainous regions.
- (2) In level country, where there is no surface run-off, forests, in common with other vegetation, act as drainers of the soil, hence their importance in draining marshy land improving hygienic conditions. In such country their effect upon springs is unimportant.
- (3) In hilly and mountainous country forests are conservers of water for stream flow. Even on the steepest slopes they create conditions with regard to surface run-off such as obtain in a level country. Irrespective of species they save a greater amount of precipitation for stream flow than does any other vegetable cover similarly situated. They increase underground storage of water to a larger extent than do any other vegetable cover or bare surfaces. The steeper the slope the less permeable the soil, and the heavier the precipitation the greater is this effect.
- (4) In the mountains, the forest, by breaking the violence of rain, retarding the melting of snow, increasing the absorptive capacity of the soil cover, preventing erosion, and checking surface run-off in general, increase underground seepage, and so tend to maintain a steady flow of water in streams.

Between this section and the next is included a two page discussion on the subject of erosion.

PART II.—RESULTS BY THE HYDROMETRIC METHOD.

After discussing the reliability of records from various sources, in which it is pointed out that owing to the complexity of the study due weight is often not given to the factors involved, and needless introduction of extraneous factors, the records of stream flow from the various rivers of the world are discussed. The summary is as follows:—

Summary of effects of forests upon stream flow:

The available observations upon behaviour of streams in this country and abroad have established the following facts:—

- (1) The total discharge of large rivers depends upon climate, precipitation, and evaporation. The observed fluctuation in the total amount of water carried by rivers during a long period of years depends upon climatic cycles of wet and dry years.
- (2) The regularity of flow of rivers and streams throughout the year depends upon the storage capacity of the watershed which feeds the stored water to the streams during the summer through underground seepage and by springs. In winter the rivers are fed directly by precipitation, which reaches them chiefly as surface run-off.
- (3) Among the factors, such as climate and character of the soil which effect the storage capacity of a watershed and therefore the regularity of stream flow, the forest plays an important part, especially on imperme-

able soils. The mean low stages as well as the moderately high stages in the rivers depend upon the extent of forest cover on the watersheds. The forest tends to equalize the flow throughout the year by making the low stages higher and the high stages lower.

- (4) Floods which are produced by exceptional meteorological conditions can not be prevented by forests, but without their mitigating influence the floods are more severe and destructive.

One of the chief features of this publication which makes it a very valuable reference work on the subject of the influence of forests on water and climate is the large bibliography on this subject of thirty-six pages, arranged under authors' names alphabetically.

- (4) *Investigations on soil cover, erosion and run off in progress at Berkeley University, Colifornia, by Dr. W. C. Lowder Milk.*

Studies were designed to measure the influence of forest litter on surficial run-off under experimental control. Eight experimental tanks were designed and installed to provide for soil profiles of 2.5 feet for projectional soil surfaces of ten square feet, sloping at a 30 per cent. gradient; for collection and measurement of surface run-off for elutriation of eroded material, and for the collection and measurement of seepage through the soil profiles.

Conclusion.

The capacity of forest litter to absorb rainfall is unimportant in comparison with its function of maintaining a soil profile at its maximum percolating capacity for precipitation waters.

- (5) *Enquiry by the Government of India into relations between forests and atmospheric and soil moisture in India. (M. Hill, I.F.S. 1916).*

Dr. Nisbat, a retired Conservator of Forests, pointed out the necessity for such an investigation to the Secretary of State on which the Government of India addressed all the Local Governments on the question and arrived at some conclusions which are summarised below:—

- (1) That, in the absence of reliable data lasting over a prolonged period; it could not be said whether there had been any permanent change in the level of the underground water table generally speaking, it appeared that the level depended on the rainfall and varied directly with it.
- (2) On the whole, save perhaps in some cases, it was considered, generally speaking it could not be said that the flow of rivers and streams were less equable, that floods were shorter in duration and more violent, and the streams dried up more quickly.
- (3) That in most provinces no serious damage to the flow of rivers had taken place and no great injury had been done to cultivation. There were, however, several local exceptions and much damage had been done in the Punjab, in Bengal, and to a less extent in Eastern Bengal and Assam, where damage was acknowledged, it was on the whole admitted that this was due to forest denudation.
- (4) That denudation which was in progress before forest reservation had begun, had been checked, and as a matter of fact, much of the catchment areas of many of our important rivers have been formed into either reserved or protected forests. The protection of such catchment areas was, however, by no means complete, and where these lay in Native States or in private lands it was certain that much regrettable denudation had taken and was taking place.
- (5) That the influence of forests on rainfall was probably small, but that the denudation of the soil, owing to the destruction of forests, might, as far as India was concerned, be looked upon as an established fact, while as regards the effect of forest preservation on rainfall and the underground water supply, the papers forwarded did not provide sufficient information to justify any change in the principles on which the forest policy of the Government had hitherto been based. It was remarked that these principles were founded mainly on considerations of directly economic character, connected with the conservation of the grazing resources and forest produce of the country, and that the climatological considerations did not in any way affect these well established principles.

The Government of India in conclusion laid down that experimental stations be established at different centres and further research carried out on this important aspect of forestry.

For details see Hill's book.

(6) *Experiment showing relationship between grazing and floods mentioned in Chapter IV, Section 3.*

The experiment was carried out by the United States Forest Service at the Great Basin Experiment Station at Utah and covered a period of 20 years. Two watersheds 10 acres each were selected. For the first five years both the watersheds were grazed alike. In 1920, one area was closed to grazing and vegetation was aided by sowing grasses, thus increasing the vegetative cover from 16 per cent. to 40 per cent. of the soil surface. The other area continued to be grazed. The run-off and sediment eroded from both was measured for each storm since 1915. The results on a ratio basis between the two areas, showed that after the herbaceous vegetation had improved until it covered 40 per cent. of the soil surface, the run-off from summer rains was 55 per cent. less and sediment eroded was 56 per cent. less than when the vegetation covered but 16 per cent. of the surface.

The conclusion arrived at by this experiment has been given in Chapter IV, Section 3.

(7) *Experiments showing total run-off carried out at Peradeniya (Ceylon) 1909.*

Nine plots, 1/50th of the acre in area were taken, each having a catchment drain at the bottom: the length of the plots was 43 feet. The results as given in 1923, are given below: the rainfall during the experiment was 59 inches.

Treatment.	Approximate loss of soil in tons per acre.
Bare soil weeded monthly.. .. .	115
Bare soil deep forked	79
<i>Covered Soils—</i>	
Dadap (<i>Erythrina</i> sp.)	106
<i>Albizia</i>	67
<i>Impomoea</i>	45
<i>Crotalaria incana</i> across slope	48
<i>Crotalaria</i> and <i>indigofera</i> 1 foot apart of slope	27
<i>Crotalaria</i> across slope 1 foot apart in rows	26
<i>Desmodium trifolium</i>	12

The report at the end states that too much reliance may not be put on the actual figures, but the prevention of soil wash by cover plants was considerable.

(8) *Some figures showing erosion under different conditions.*

(a) From China Dr. Lowdermilk gives the following figures for the run-off from pairs of plots 1,000 square feet area, one being under forest and the other denuded:—

Locality.	Tsing Yuan.	Tung Tsa.	Tsing Taca.
Period of experiment ..	July 20 to August 8.	August 7 to 27	July 7 to August 20.
Rainfall in millimeters ..	807	156	790
Percentage run-off from covered area.	0.1	0.01	2
Percentage run-off from denuded of barren area.	6	8	6

(b) Sampson and Weyl carried out experiments at the Manti National forest at Utah where wheat was grown in pots containing soil from eroded and non-eroded spots. The soils were of the same origin and type and were sifted for the experiment. After the plants were grown the soil was examined with the following results:—

	Eroded	Non-eroded.
Water holding capacity	46.8	67.8
Ca O (Calcium Oxide)	1.26	1.49
K ² O (Potassium dioxide)	1.53	1.80
P ² O ⁵ (Phosphorus Pentoxide)	0.22	0.38
⁵ N (Nitrogen)	0.16	0.49
Loss on ignition (humus)	6.6	14.6
Dry weight of wheat grown	5.5 lbs.	12.1 lbs.
Water requirement for the dry matter wheat	472	848

APPENDIX II.

STATEMENT SHOWING THE LIVE STOCK IN THE DISTRICTS AFFECTED BY EROSION (FIGURES TAKEN FROM THE AGRICULTURAL STATISTICS OF BRITISH INDIA AND THE PUNJAB CATTLE CENSUSES).

Year.	Sheep and goats.	Other cattle.	Total.
HOSHIARPUR DISTRICT.			
1890-91	180,233	602,734	782,967
1894-95	182,890	574,244	757,134
1898-99	253,039	635,683	888,722
1903-04	239,180	612,058	851,238
1913-14	192,491	651,814	844,305
1923	237,874	562,607	800,481
1928	173,391	600,308	773,699
1930	183,367	576,170	759,537
KANGRA DISTRICT (INCLUDING KULU SUB-DIVISION).			
1890-91	642,714	672,532	1,315,246
1894-95	576,142	680,940	1,257,082
1898-99	867,518	886,105	1,753,623
1903-04	866,031	887,891	1,753,922
1913-14	934,911	873,394	1,808,305
1923	717,090	702,795	1,419,885
1928	612,181	753,688	1,370,869
1930	603,304	743,033	1,346,337
AMBALA DISTRICT.			
1890-91	156,343	644,950	801,293
1894-95	137,089	635,239	772,328
1898-99	154,890	536,581	691,471
1903-04	172,678	515,236	687,914
1913-14	181,610	561,862	743,472
1923	177,984	449,676	627,660
1928	121,287	502,754	624,041
1930	246,708	307,343	554,051
JHBLUM DISTRICT.			
1890-91	295,837	391,089	686,926
1894-95	295,766	391,156	686,922
1898-99	366,379	413,025	779,404
1903-04	339,982	303,173	643,155
1913-14	278,964	368,318	647,282
1923	238,536	..	238,536
1928	254,413	356,881	611,294
1930	203,767	317,733	521,500
RAWALPINDI DISTRICT.			
1890-91	407,576	478,168	885,744
1894-95	422,973	560,145	983,118
1898-99	546,373	562,492	1,108,865
1903-04	267,887	318,290	586,177
1913-14	239,848	342,177	582,025
1923	238,526	..	238,526
1928	203,010	351,612	554,622
1930	308,770	382,385	691,155

Year.	Sheep and goats.	Other cattle.	Total.
GURGAON DISTRICT.			
1890-91	124,179	626,145	750,324
1894-95	145,769	592,778	738,547
1898-99	203,228	550,727	753,955
1903-04	276,434	477,426	753,860
1913-14	233,614	593,791	827,405
1923	243,271	522,878	766,149
1928	144,708	..	144,708
1930	..	..	..
ATTOCK DISTRICT.			
1890-91	..	..	..
1894-95	..	..	..
1898-99	..	..	..
1903-04	381,620	298,960	680,580
1913-14	331,940	388,197	720,137
1923	318,018	..	318,018
1928	335,317	405,268	740,585
1930	..	..	..
GURDASPUR DISTRICT.			
1890-91	149,424	680,796	830,220
1894-95	89,766	618,934	708,700
1898-99	195,110	689,190	884,300
1903-04	234,285	678,922	913,207
1913-14	199,637	722,956	922,593
1923	192,077	628,357	820,434
1928	..	..	..
1930	..	..	..
PUNJAB (EXCLUDING NORTH-WEST FRONTIER PROVINCE).			
1890-91	5,620,556	12,357,331	17,977,887
1894-95	5,692,881	13,056,021	18,749,902
1898-99	7,640,114	9,267,734	16,907,848
1903-04	9,556,613	14,356,949	23,913,562
1913-14	9,108,736	14,951,079	24,059,815
1923	8,738,310	12,356,777	21,095,087
1928	8,161,595	12,563,775	20,725,370
1930	8,074,578	11,632,380	19,706,958

APPENDIX III.

DRAFT OF PROPOSED AMENDMENTS OF THE CHOS ACT.

Section 8.—(1) Whenever it appears to the Local Government that it is desirable ~~that measures should be taken in the bed of any cho~~ ~~that measures should be taken in the bed of any cho~~ ~~considers it desirable to take measures or in any uncultivated land adjacent thereto or in~~ ~~to regulate the beds of chos.~~ ~~both for the purpose of—~~

(a) regulating the flow of water within, and preventing the widening or extension of such bed or

(b) Reclaiming or protecting any land situate within the limits of such bed,

then if (i) in the opinion of such Government the measures deemed necessary for the said purposes are of such a character in regard to extent and cost that the interference of the Local Government is absolutely necessary, or if (ii) the persons possessing rights in the land within the bed of any cho in any estate or group of estates or a number of landowners therein responsible for the payment of more than half the land revenue ask that reclamation operations should be undertaken by Government, such Government may by notification declare that the whole or any part of the area comprised within the limits of the bed of any cho or of any uncultivated land adjacent thereto or of both shall vest in the Government for such period and subject to such conditions (if any) as may be specified in the notification: Provided that while the reclamation operations are in progress, a separate account shall be kept for each estate of their cost and of the income from the land affected by them, and that the net income, if any, shall be distributed among the persons possessing rights in the land comprised in the said notification in proportion to their several rights as the Deputy Commissioner shall from time to time determine; and that, when the reclamation operations have been completed, the land and surplus of net income, if any, shall be restored to such persons free of charge; and further that before such land is restored, it shall be assessed to land revenue.

(2) In place of proceeding at once in the manner given in sub-section (1) provided, such Government may, in the first instance by notification specifying the nature and extent of the measures to be taken and the locality in and the time within such measures are to be taken, invite all persons possessing rights in the land situate in such locality to themselves carry out the measures specified in such notification accordingly; and in the event of such persons failing to comply with the requirements of such notification, such Government may proceed as in sub-section (1) provided.

(3) When the persons mentioned in sub-sections (1) and 2 are unable to agree among themselves regarding the carrying out of such measures the decision of those paying the larger amount of land revenue shall be held to be binding on all.

(4) The Local Government may from time to time by like notification extend the period during which any such area shall remain vested in the Government.

Section 9.—Upon the publication of any declaration under section 8 (1) all private rights of whatever kind existing in or relating to any land comprised within the area specified in the notification at the time of the publication thereof shall be suspended for such period as may be specified in such notification and for such further period (if any) to which such period may at any time be extended.

Section 10.

In sub-clause (1) add after the word cho " and uncultivated land adjacent thereto."

Section 12.

Should be repealed, and the following sections enacted in its place:--

Section 12-A.

When any persons possessing rights in the whole or any part of the bed of a cho lying within the boundaries of an estate or group of states represent to the Deputy Commissioner that they wish to undertake reclamation operations in the bed of such cho or in the bed of such chos together with uncultivated land adjacent thereto, the Deputy Commissioner may—

(1) fix the limits of the area within which operations shall be undertaken;

(2) ascertain whether such portion of the owners of the land comprised within the said limits as pay more than half the land revenue assessed on such land agree that such reclamation operations shall be undertaken, and if so, or if no land revenue is assessed thereon, may proceed to appoint from among the persons possessing rights in such land, after consulting their wishes, a committee of not less than three members to manage the reclamation operations and appoint one of them president.

Section 12-B.

The Committee shall draw up a scheme of measures of reclamation, and shall submit it for sanction to the Deputy Commissioner. Such a scheme may among other things,—

- (a) prohibit the cutting and lopping of trees within the area to be reclaimed except by permission of the Committee;
- (b) prohibit the cutting or removal of grass within such area except at such time and in such manner and subject to such conditions as may be arranged by the Committee;
- (c) prohibit or regulate the grazing or browsing of cattle within such area;
- (d) prohibit any other acts within the area likely to endanger the success of the operations;
- (e) provide for the establishment of a common fund to which shall be credited all the income from the land to which the operations extend, and from which shall be defrayed all expenditure incurred in connection with the operations;
- (f) provide for the levy of a contribution towards such operations from all persons possessing right in such land.
- (g) provide for the distribution from time to time among such persons of any surplus income over expenditure.

Section 12-C.

All fines imposed under section 19 (2) or contributions levied under section 12-B shall be credited to the common fund established under that section, and all such contributions shall be recoverable as if they were arrears of land revenue payable by the persons from whom such contributions are due.

Section 19.

Should run thus:—

Any person (1) who within the limits of any local area notified under section 3 commits any breach of any regulation made or restriction or prohibition imposed under section 4 or section 5 or (2) who commits any breach of any regulation made or restriction or prohibition imposed by a committee under section 12-B, shall be punished with imprisonment for a term which may extend to one month or with a fine which may extend to Rs. 100, or with both.

APPENDIX IV.

RELEVANT EXTRACTS FROM THE INDIAN EASEMENT ACT.

Section 4.

An easement is a right which the owner or occupier possesses as such, for the beneficial enjoyment of that land to do or continue to do something, or to prevent or continue to prevent something being done, in or upon or in respect of certain other land not his own.

The land for the beneficial enjoyment of which the right exists is called the Dominant Heritage, and the owner thereof the Dominant owner; the land on which the liability is imposed is called the Servient Heritage, and the owner or occupier thereof the Servient owner.

Section 22.

The dominant owner must exercise his right in the mode which is least onerous to the servient owner; and when the exercise of an easement, can without detriment to the dominant owner, be confined to a determinate part of the servient heritage, such exercise shall, at the request of the servient owner be so confined.

Section 23.

Subject to the provision of section 22, the dominant owner may, from time to time, alter the mode and place of enjoying the easement, provided that he does not thereby impose any additional burden on the servient heritage.

Section 24.

The dominant owner is entitled, as against the servient owner, to do all acts necessary to secure the full enjoyment of the easement, but such acts must be done at such time and in such manner as without detriment to the dominant owner to cause the servient owner as little inconvenience as possible; and the dominant owner must repair as far as practicable, the damage (if any) caused by the act to the servient heritage.

Accessory rights.

Rights to do acts necessary to ensure the full enjoyment of an easement are called accessory rights.

Section 25.

The expenses incurred in constructing works or making repairs, or doing any other act necessary for the use or preservation of an easement, must be defrayed by the dominant owner.

Section 26.

When an easement is enjoyed by means of an artificial work, the dominant owner is liable to make compensation for any damage to the servient heritage arising from the want of repair of such work.

Section 27.

The servient owner is not bound to do anything for the benefit of the servient heritage, and he is entitled against the dominant owner, to use the servient heritage in any way consistent with the enjoyment of the easement; but he must not do any act tending to restrict the easement, or to render its exercise less convenient.

Section 31.

In the case of excessive user of an easement the servient owner may, without prejudice to any of the remedies to which he may be entitled, obstruct the user, but only on the servient heritage: provided that such user cannot be obstructed when the obstruction would interfere with the lawful enjoyment of the easement.

APPENDIX V.

NOTE ON THE INADEQUACY OF A CLOSURE PERIOD OF TEN YEARS IN THE SCRUB FOREST OF THE KANGRA FOREST DIVISION.

1. In the history of the forest conservancy of the Kangra Forest Division, closures were first effected under what are known as the 1859 rules, which were framed under the general 1855 rules. The system of closures provided for the division of all forest land into three parts and for the closure of each part (one-third, *tihai* or *trihai*, the name still in use for any closed area) for three or more years in rotation. In 1859 and 1860 the *trihais* (one-third or thereabouts of the forest in each *mauza*) were marked off and closed to the rights of user in Kangra and part of Dehra *tahsils*. The work was never done in Nurpur and very imperfectly in other *tahsils*, only the *trihai* itself was demarcated and no arrangement was made to carry out the original intention of closing in rotation with the result that the original *trihais* remained unchanged till the legislation of the Forest Settlement in 1897 when in vast majority of cases they were again notified for closure for 20 years under Section 29 (b) of the Indian Forest Act. The second period of closure expired in 1917. The underlying principle of "the closure in rotation" was lost sight of for 57 years (1860 to 1917) and no statistical or scientific *data* were available in 1917 for the determination of the *minimum* closure period necessary for the regeneration and development of a young crop.

2. The Inspector-General of Forests to the Government of India (Mr. G. S. Hart, C.I.E.), toured in the Kangra division in 1915 and advocated the adoption of "closure in rotation", a procedure which he had suggested in paragraph 103 of his working plan for the Kangra Forest division (1903-04 to 1919-20). His recommendations formed the foundations of the policy later on accepted by Government and it would be instructive to reproduce his main proposals in *extenso*. In paragraph 47 of his "Note on tour of Inspection in the Kulu and Kangra Forest divisions, Punjab" he says:—

"I believe the time has come when the Government must say yes or no to the plain question whether it proposes to take adequate action under these powers and so maintain a reasonable proportion of forest in the district for the use of future generations and for the prevention of denudation with all its attendant evils.

If the answer to this question be in the affirmative, I submit for consideration that the best and indeed the only satisfactory course of action is to mark off on the ground now all areas which it may be decided can and shall be closed to the exercise of rights under these powers; such closure to be on a rotation of four sub-periods of 30 years duration in the case of pine, oak and fir forests and of three sub-periods of 10 years in the case of scrub forests. This will not necessitate any alteration in the present distinction between Demarcated and Undemarcated Protected forest, or any revision of the rights recorded in the Forest Settlement. It will mean only that instead of future closures being left to chance, the total area of both closures being left to chance, to total area of both closures of protected forests (demarcated and undemarcated) which Government intends to close and so maintain permanently for the use of the people, will be settled now and marked out definitely on the ground."

3. Sir Michael O'Dwyer (the then Lieutenant-Governor) expressed his general concurrence with Mr. Hart's proposals in a speech which he delivered at a *darbar* held at Kangra in October, 1916. His Honour said:—

"The general policy of Government in regard to the forest is to maintain a reasonable proportion of forests for the use of future generations. To secure this it is necessary in the areas selected for conservation to arrest the denudation which is now taking place and which not only prevents any new forest growth from springing up the absence of young trees is obvious to any one who passes down the valley-but in many places threatens the safety of the cultivation. In pursuance of that policy a scheme is, as you know, now being worked out to mark off the areas in which effective protection should be retained or regeneration should be secured and to close in rotation portion of such areas for the period necessary for regeneration. The selection of those areas is being carried out by a civil officer and a Forest officer in consultation with the zamindars."

4. Sir George Hart's proposals and the Government policy as enunciated by Sir Michael O'Dwyer thus from the basis of the Scheme of Rotational Closure evolved by Mr. Mitchell, I.C.S., and Mr. Walters, I.F.S. The scheme, in accordance with Sir George Hart's suggestion limited the closure period to ten years in the case of scrub forests (with which alone this note deals) though the maximum period of closure permissible under the Indian Forest Act is 30 years.

5. It may be emphasised that the *scheme of rotational closure is a means to an end and not the end itself*. The end is "to maintain a reasonable proportion of forests for the use of future generations" and the means "to close in rotation portion of such areas for the period necessary for regenerations" (*vide His Honour's durbar speech*). The closure period for ten years was then deemed to be sufficient for purposes of regeneration but the fixation of the period was not based on any scientific observation as none were then available. The deficiency has now been made good as the *trihais* closed under the Rotational Closure Scheme have had ten years protection (1921—1931).

6. The class of forests termed the scrub forests are situated on diverse geological formations. One forest is in the Himalayan zone; an other is immediately in the vicinity of the "Main Boundary fault"; a considerable number is met with on the sub-Himalayan Series. The Siwaliks beds of the latter are composed of alternating strata of blue softish sandstone and marl (red clay). The sandstone dips at an angle of perhaps 20° to the north-east and is frequently exposed in sheets. In places the strata are almost vertical where the marl is subject to deep erosion. By far the larger number of forests is found on conglomerate. The soil is generally shallow and dry; and very stony on the conglomerate due, no doubt, to excessive grazing and steady removal of the forest cover in a district where the rainfall is very heavy.

7. The scrub forests can be divided into 3 Sub-Types:—

- Composition of the scrub forests.
- (a) The Tree-scrub Sub-Type containing a considerable proportion of tree growth, the height of which does not exceed 30 feet and a very dense undergrowth of brushwood.
 - (b) The Scrub-Tree Sub-Type containing a small proportion of tree growth and a comparatively open undergrowth of brushwood.
 - (c) The Scrub Sub-Type containing very little tree growth and a very open undergrowth of brushwood.

The existence of the sub-type is in part traceable to soil and aspect but the varying intensity of grazing and browsing and of demand for timber are generally the chief determining factors.

The principal species met with are:—

- (a) Trees. *Acacia Catechu* (*khair*). *Anogeissus latifolia* (*dhao*) *Aegle marmelos* (*bil*). *Limonia acidissima* (*billan*), *Ehretia laevis* (*chamror*) *Odina Wodier* (*kehmal*). *Stephegyne parvifolia* (*kalm*) and *Flaccurrta Ramontchi* (*kangu*).
- (b) Brushwood. *Mallotus philippinensis* (*kehmbal*), *Hycatanthes Arbor-tristis* (*kuri*) *Carissaspinarum* (*garna*), *Dodonaea Viscosa* (*menhdhar*), *Woodfordia floribunda* (*dhain*) and *Adhatoda vasica* (*basuti*).

8. The soil in the first two sub-types has improved considerably with closure for 10 years and the tree growth, immune as it has been from lopping, shows unmistakable signs of partial recovery. The seedling regeneration varies from 6" to about 3 feet in height but its destruction is certain as soon as the closed areas are thrown open to grazing, browsing and lopping rights at the end of 10 years. The regeneration generally consists of *Acacia Catechu* (*khair*), *Ehretia laevis* (*chamror*) and *Cassia fistula* (*amaltas*) seedlings. In the third sub-type a slight improvement in the soil and the proportion of brushwood is visible but the most debased types show no appreciable improvement. In almost all the areas re-opening of the forests after only 10 years closure will cause reversion to the original deplorable condition in the face of heavy lopping and browsing and the advantage gained by a closure for ten years will be sacrificed.

The geological formation is conglomerate. As a result of closure dense grass (in scattered tussocks) has covered the soil; seedlings have established themselves; erosion has been checked and the crowns of trees have recovered to a considerable extent.

Ten years closure has had very little effect on marl but brushwood has improved on sandstone while a sapling of *Cassia fistula* has attained a height of some four feet. The improvement is very likely to disappear in a course of a few weeks as the area has been opened and the erosion will be accelerated.

9. The experience of the last ten years definitely proves that a closure period of ten years is inadequate for a sufficient recovery of the older trees from heavy lopping to enable them to produce seed for purposes of regeneration and for the establishment and development of young regeneration of the tree species named in paragraph 7 under the edaphic factors outlined in paragraph 6. A closure period of ten years has failed and must fail to realise the aim of the closure scheme, *viz.*, "to maintain a reasonable proportion of forests for the use of future generations."

Closure period of ten years insufficient. Extension to 30 years suggested.

Ten years are barely sufficient for the soil to recover and to be able to support new vegetation. The advisability of the extension of closure period is self-evident; and the extension to 30 years (the maximum permissible) is forced by the silvicultural need of the species met with, which in 30 years can grow to a size immune from the danger of heavy browsing and grazing.

10. The objections to the extensions of a closure period of 30 years are as follows:—

- (i) It involves a breach of faith as the villagers were definitely told that the scrub forests would be closed for ten years, one-third of the area being closed at a time.
- (ii) The closure of one-third of the area for 30 years will cause the concentration of rights on the remaining two-thirds which will be ruined beyond redemption.

11. The first objection is certainly valid to the extent that the villagers were told that the closures will rotate at the end of ten years period in accordance with the professional advice then offered, but Government nowhere abandoned its right of closure up to 30 years and His Honour's *darbar* speech (paragraph 3 *supra*) expressed in unequivocal terms the necessity of maintaining a reasonable proportion of forests for the use of future generations and closing in rotation portion of such areas *for the period necessary for regeneration*. The period of ten years has been found to be inadequate for purposes of regeneration and extension does not involve any breach of faith as the policy and intention of Government remain unchanged. On the other hand, it has become abundantly clear that a closure period of ten years cannot result in the maintenance of a reasonable proportion of forests for the use of coming generations. Under such circumstances if the Government were to stick to the provisions of the closure scheme and adopt a ten years closure period it would clearly imply that it was not prepared to take effective measures to pursue its professed policy.

It is thus obvious that there is no finality in the ten years closure period nor is there a breach of faith involved in the extension of the closure period.

The second objection emanates more from theoretical conceptions than from any practical knowledge of the forests in question. The selection of the areas for inclusion in the closure scheme was in practice limited to areas which could respond to some silvicultural treatment and over a considerable area there is no serious apprehension of irremediable deterioration of the factors of the locality provided the incidence of rights is not increased. A closure of 30 years can ensure a satisfactory recovery to each part; but a closure for ten years positively ensures the *slow* extinction of the forest and thus defeats the principal object of the closure scheme.

12. The extension of the period of closure from 10 to 30 years in scrub forests is necessary for the continued existence of the forests and the proposal does not involve any action of doubtful legality. With a closure of ten years no sowings can be attempted as all the seedlings are certain to be destroyed when the area is opened to the exercise of all rights in the eleventh year as the height attained by the young crop does not exceed 4 feet and is generally very much less than 3 feet. Whatever improvement may take place in the soil factors in a short period of ten years vanishes in the eleventh year. It is not only necessary to raise a young crop during the closure period but to ensure that it attains a height and size sufficiently big to withstand the effects of grazing, heavy browsing and lopping. And it is here that the ten years closure period fails and fails completely.

APPENDIX 5.

ANSWER TO QUESTIONNAIRE FOR JHELUM DISTRICT, BY MR. BRAYNE, I.C.S.

I. (a), (b) and (c). These are difficult to answer offhand, as although doubtless very desirable they are not the first things to do.

I. (d) Nomadic and non-resident animals should certainly be excluded. These wander into the Jhelum District from the direction of the Frontier. They pay nothing, destroy a great deal and are a great nuisance. They should be registered, taxed and strictly controlled with the final object of excluding them altogether.

II. 1. The first big step to take is education:—

(a) The people must be taught through the Press—particularly such papers (e.g., the *Nai Zindgi* and *Fauji Akhbar* as circulate among Zamindars and in Schools—the object and value of forests and the results of over-grazing—tree-cutting neglect, etc., etc. The articles must be written with an eye to their literary and journalistic value and not merely as dry statements of fact. There are many ways of writing about a subject—stories, dialogues and so on and whatever is written must be attractive to the people for whom it is intended.

(b) These things must be taught to every school boy both in the village schools and high schools, either as part of civics or of general knowledge or of local geography or however it comes best, and they must be taught in a really interesting way with fullest reference to the facts of the locality in which the school is situated. These lessons must be carefully prepared in consultation with the forest experts.

(c) Forest Officers and others must lose no chance of attending a D. B. or D. C. C. meeting or a *Mela* or fair and teaching and demonstrating—a good forest exhibition is put up annually at Chakwal and Chua Fairs. This sort of work could easily be further developed. Similarly forest officers on tour must make every effort to teach the villagers they come in contact with. Lantern slides must be made and issued with lecture notes to all who control magic lanterns in the Districts.

2. The public can never be expected to respect Government forests till they appreciate the value of forests and learn to respect their own. Their own forests are usually *Shamilat* and are ruined because there is no authority vested in anyone in the village to protect them. Everyman's concern is no one's concern.

Villagers must be encouraged to divide their *Shamilat* and by intensive educational methods each man urged to lay up, and wall or fence in, his own share and preserve it. This has been done in many Salt Range villages with conspicuous success. When the people have by practical experience learnt the value of their own forests there will be less desire to destroy Government forests.

3. The exact effect of denudation in each district must be worked out and published locally and those who are suffering down below from the iniquities of the hill people must be told exactly how it is being done, and public opinion must be worked up until those who ruin the hill sides can be firmly tackled without a howl from the sentimental plain dwellers, e.g., the *Kahan Naddi* near Jhelum has increased its width three-fold within living memory. Thousands of acres of good land have been turned into sand. The owners of this land should be told exactly how this has come about.

If all the facts were known the popular clamour for a strong afforestation policy would be irresistible.

4. The following facts relating to the Jhelum district should be checked and if found accurate published and taught in the schools of that district:—

(a) The Salt Range used to be well covered with grass and forest, at no distant period of time.

(b) In 36 years Jhelum has lost 50,000 acres of cultivated land. A large part of this has been caused by the widening of all the big hillstreams between the hills and the river and even in the hills as well. Many village *abadis* are being rapidly washed away. A part of this lost acreage is due to salinisation, which is as likely to have been caused by denudation as by anything else. In any case by reason of denudation the Salt marl is every year becoming exposed over a largely increasing area and it is very likely that by water action this leads to salinisation of the soil down below.

(c) The bed of the river Jhelum is rapidly rising. The allegation that the Rasul and the Mangla Weirs cause this, is absurd. A far more likely cause is the meeting of the Silt laden Jhelum and the silt laden torrents that emerge from the Salt Range all along its flank; which results in vast deposits of silt in the bed of the Jhelum.

- (d) The floods of the Jhelum which are becoming more disastrous each time, they occur, are due to this depositing of silt and to the denudation of the Kashmir hills. They are not due to any increase in the rainfall.
 - (e) If hill-sides are properly laid up by partition and walling, within five years the carpet of grass and other vegetation will practically stop erosion and the income from grass-cutting will be many times that of free grazing.
5. As part of the campaign the people must be taught to cut grass instead of sending their animals to graze it. The Salt Range farmer is essentially idle and must be taught to work.
6. Every effort must be made to replace goats with sheep, and for this purpose,—
- (a) a good wool-sheep that will live in the Salt Range must be found either by cross breeding with merinos or by selective breeding of local sheep or by acclimatization of some foreign breed or in whatever way it is possible.
 - (b) by every sort of advertisement and publicity mutton must be popularised and made fashionable in preference to goat's meat.
 - (c) a keen demand for wool must be created by teaching every school girl to knit woolly clothes.
7. The villagers must be taught, in the same careful way that I have suggested for the other part of the work, to keep a few good milking stall-fed cows in preference to herds of goats and of small-milking grazing cows.
8. It is essential that a system of land revenue remission for land effectually closed to grazing should be instituted and a small staff appointed to organise and control this work. This staff will also teach and preach as explained above. The cost of this will be very small indeed and infinitesimal in comparison with the good done. If Government is afraid of pledging itself to an unknown amount of land revenue remission let it lay down that the total for the next five years shall not exceed a certain sum, say Rs. 25,000. Remission for each plot closed to grazing will be given year by year subject to fulfilment of the conditions for say five years, after which it will cease, as the work will by then be complete and the lesson learnt.
9. In addition to land revenue remission, as money allows small bands must be built to hold up water in the hills. The objects of these are: (1) to help to control hill torrents and stop erosion, (2) to reinforce the subsoil water in the plains below, (3) to encourage vegetation all the way down below the band and above the bands as far as the effect reaches, (4) for irrigation and *sailaba* where possible, and (5) object lessons to the people of the value of band.
- The same staff that build these bands will encourage and help the people to build private bands.
- The cost of these bands will be very small as the torrents in the Salt Range run at right-angles to the axes of the hills and offer innumerable sites for very cheap and effective bands.
10. If the first action taken is a crude campaign against grazing, nothing but harm will be done. The villager is a shrewd fellow and if he is carefully taught he will respond, but more harm than good will be done by rushing bald-headed at what he now ignorantly believes to be, one of his best sources of income. As in everything else the big thing is education.

APPENDIX 6.

SUMMARY OF WRITTEN REPLIES TO THE QUESTIONNAIRE.

A.—FROM PUNJAB CIVIL DISTRICTS.

1.—Gurgaon.

The Deputy Commissioner advocated a cattle tax in all districts where denudation was causing damage. In Gurgaon district he proposed further closures under some form of compulsion. Remission of land revenue had not proved a sufficient inducement to voluntary closure owing to the large number of suspensions and remissions of lands revenue in the district due to bad harvests under ordinary rules. He recommended a general policy of conservation and that the period of closures should be extended.

No reply was received from the District Board nor any private individual.

2.—Ambala.

The Deputy Commissioner produced a written reply at the meeting held at Chandegarh on 12th March 1932, this is given at page XVIII with the Ambala proceedings.

No reply was received from the District Board. Khan Bahadur Sayed Mohamed Akbar Khan, Mir Sahib of Garhi Kotaha (Morni Ilaqa) sent the following proposals—

- (a) The number of buffaloes should be reduced, he would impose a tax of Re. 0-8-0 or 1-0-0 but he would not reduce the number of sheep or goats.
- (b) A scheme of three year rotational closure should be adopted in the grazing grounds of every village, planting being done during the closures.
- (c) Lopping except for a very few species to be prohibited.
- (d) Incursion of nomadic animals should not be stopped.
- (e) The cutting of Khair, Sain, Chir, Tun, Mahove and Jamun to be prohibited but a few trees of Khair should be given annually for making ploughs.

* Not traceable.

A letter written by the Deputy Commissioner, Ambala (Mr. Fyson), on the subject of the Morni Ilaqa in 1928 is attached.*

3.—Hoshiarpur.

The Deputy Commissioner submitted a written reply at the meeting held at Hoshiarpur on 16th December 1931, this is given at page II of Appendix I with the Hoshiarpur proceedings.

The District Board did not reply.

Chaudhri Sant Ram, Zaildar, submitted a reply opposing any cattle tax and also the application of section 5, Chos Act to areas referred to in the questionnaire. He gave as his reason that there was plenty of grass and bushes in the Siwaliks and no further improvement was needed. He advocated rotational closures and the exclusion of nomadic animals.

4.—Kangra.

The Deputy Commissioner submitted a written statement at the meeting held at Dharmsala on 19th December 1932, this is given at page X of Appendix II with the Dharmsala proceedings.

The District Board sent no reply.

Lieutenant Chaudhri Kirpa Ram, Zaildar, of Chetru, opposed taxation of animals but favoured exclusion of nomadic animals. He advocated rotational closures with the consent of the zamindars. He considered the Kangra Cattle tax had resulted in a reduction in numbers but there had been no improvement in the grazing for which reason he favoured exclusion of nomads.

5.—Gurdaspur.

A joint reply was received from the Deputy Commissioner Mr. E. M. Jenkins, I.C.S., and Mr. G. Breadon, District Engineer. They opposed exclusion of nomadic herds on the ground that Gaddis did good as well as harm. They considered that limitation of grazing without sowing and planting would be of little use while limitation would deprive Gaddis of their livelihood. They admit denudation in the low hills is general and in some cases serious. They advocate the introduction of seeds of Mesquite (*Prosopis glandolosa* and *Juliflora*) and other useful shrubs and trees by the method of feeding goats on the pods and seeds and allowing the animals to evict the seeds all over the hills.

NOTE by Mr. Holland, I.F.S.—This method of introducing plants overlooks the facts that goats while evicting the seed continue to devour the vegetation and will certainly destroy the useful trees and shrubs as soon as ever the seeds germinate. The only result will be that Government will be providing food for the goats but no improvement in the vegetation will result.

6.—Gujrat.

The Deputy Commissioner did not reply.

The District Board considered that steps must be taken to stop the destruction of the vegetation and advocated that certain areas should be closed to nomadic animals.

The Revenue Assistant, Gujrat and the Tahsildars of Kharian and Gujrat advocate exclusion of animals from the worst eroded tracts, the Tahsildar of Kharian proposing afforestation in the ravine lands in his tahsil.

Mian Fateh Mahomed, Sub-Registrar, advocated taxation and closure but Chaudhri Abdul Ghani was not in favour of any steps being taken so long as the zamindars were suffering from the present depression.

Malik Maula Bakhsh suggested that the Agricultural Department should devote its special attention to the low hills. He advocated demonstration areas, a graded tax on animals and complete exclusion of nomads.

Chaudhri Bahawal Bakhsh, President, Zamindara League, and Honorary Magistrate, Anjuman Islahi Zamindaran, Gujrat, opposed taxation but advocated exclusion of animals from tracts affected by denudation, introduction of rotational closures and the entire exclusion of nomadic animals.

7.—Jhelum.

A reply was received on behalf of the Deputy Commissioner from Mr. Brayne, I.C.S. This is attached in original at page XII of Appendix VI with the proceedings of the meeting held at Lahore on 23rd January 1932.

Mr. E. P. Moon, I.C.S., Sub-Divisional Officer, Pind Dadan Khan, criticised the work of the Forest Department being of the opinion that the only results of their work during the last twenty years had been the preservation of the grazing grounds from deterioration. He doubts whether Government ownership of the rakhs has had any beneficial results. He considers that afforestation of the Salt Range would be expensive and not commensurate with the results. He advocated sub-division of the *shamilat* on the ground that the property of everyone is cared for by no one. He opposed taxation of cattle. He suggested that one or two rakhs at present under the control of the Deputy Commissioner should be divided up and leased to villagers for a period of five or ten years, if the results are satisfactory all rakhs except those commercially valuable for production of firewood should be divided among the villagers. Rakhs at present under the Forest Department suitable for cultivation, should be leased for cultivation.

M. Nur Khan of Chakwal advocated taxation of camels and goats only.

8.—Shahpur.

No reply was received from the Deputy Commissioner. The District Board, submitted the views of five of its members. All propose the exclusion of nomadic animals but otherwise their views are conflicting. The majority oppose reduction in the number of animals and any taxation. One only proposes to close areas to grazing during the rains. Two members the building of earth bunds to check the run off of water, two the system of rotational closures.

9.—Rawalpindi.

No replies were received.

10.—Attock.

The Deputy Commissioner did not reply.

Mr. Curtis, I.C.S., Sub-Divisional Officer, Pindi Gheb, advocated caution in reducing the number of cattle unless it could be proved that the quality of cattle and the profits therefrom will increase in direct ratio with the decrease in numbers. He strongly advocated taxation of camels and goats and rotational closures with the support of public opinion.

The Revenue Assistant stated that there was no scarcity of grazing but advocated the exclusion of goats from village grazing grounds.

The Tehsildar of Fateh Jang advocated a light tax on goats and suggested improvement of grazing could be effected by afforestation and sowing grasses. He opposed sub-division of the *shamilat* but favoured exclusion of nomads.

The Tehsildar, Pindi Gheb, advocated a tax on goats and camels and blames the Forest Department for the present state of affairs. He proposed the formation of village panchayats in all villages adjoining rakhs, the panchayats to help in protection and to have a say in assessing compensation for forest offences.

The Tehsildar, Tallagang, advocated that the rakhs should be given up for cultivation and the cultivators to be asked to sow seeds of trees.

The Tehsildar of Attock denies the Kalachitta hills suffer from denudation and remedial measures are unnecessary. He stated that camels, sheep and goats did much damage and should be taxed and also advocated rotational closures.

B.—FROM PUNJAB STATES:

Replies received through the Honourable the Agent to the Governor-General, the Superintendent, the Simla Hiss States and the Commissioner, Ambala.

1.—*Mandi State.*

The Durbar stated it was essential to reduce the number of animals and that steps had been taken during the last two years to increase the tax on goats and buffaloes. Rotational closures to improve the grazing are advocated, exclusion of nomads is not desirable but the damage done by them should be checked by taxation. They consider the state of the high hills should also be considered.

2.—*Sirmur State.*

The State recommended that the number of animals should be reduced and that goats, sheep and buffaloes be taxed. They propose the introduction of better grasses and stress the need of propaganda.

3.—*Bilaspur State.*

The State oppose any reduction in the number of cattle as opposed to Hindu sentiment. They suggest rotational closure but consider it impracticable at present and the exclusion of nomadic animals but are not prepared to carry it into effect in their own territory.

4.—*Chamba State.*

Say the matter does not interest them.

5.—*Suket State.*

Recommends a reduction in the number of animals but is opposed to taxation. Rotational closures are advocated and the discouragement of nomads.

6.—*Kalsia State.*

Stated the grazing grounds in the low hills of the State were well protected by thick undergrowth and needed no further protection. The grazing grounds were rotationally closed and the number of animals had recently decreased owing to disease.

7.—*Nalagarh State.*

NOTE.—This State owns lands on the eastern slopes of the Ambala Siwaliks.

The State reported that it was difficult to reduce grazing as the people depended largely on their animals for their livelihood. They opposed taxation. Nomads were already excluded. Rotational closure was recommended.

8.—*Mahlog State.*

The Thakur Sahib stated that his people were opposed to any change. The whole of his State, he said, was exposed to erosion, even the smallest streams caused erosion and every year land was washed away. Streams which a few years ago were very small had greatly increased. He opposed any reduction in the number of cattle owing to the need for manure.

He advocated rotational closures. He stated that much harm had been caused by unrestricted cutting of the vegetation and proposed that this should be restricted. The Divisional Forest Officer, Simla, stated that in Mahlog State particularly nomadic goats were encouraged by the Thakur Sahib to increase his revenues.

9.—*Patiala State.*

The Foreign Minister to the Government wrote stating as follows:—

- (1) The number of right-holders' cattle had been fixed in A. D. 1892 at the time of settlement, keeping in view the demand of right-holders and protection of existing vegetation.
- (2) In first and second class forests the grazing of sheep and goats was prohibited.
- (3) The people had rights to collect dead and dry wood to cut grass and graze either free or no nominal fees according to the rights recorded at the settlement.

In reply to the questionnaire he replied:—

- I. (a) It is essential to reduce the number of animals grazing in the low hills of the Siwalik ranges because it is an admitted fact that the heavy grazing always causes destruction of the vegetation, the maintenance of which is most essential to stop erosion as the plant roots are a good binder of soil.
- (b) Yes, the imposition of a tax on the grazing animals is very essential to minimize grazing and in the beginning it should not be very heavy, but it can be increased annually to discourage the upkeep of useless cattle by the villagers. However a heavy tax should be levied on goats and camels so as to exterminate these animals altogether from the adjoining villages.
- (c) There are no separate grazing grounds in Patiala low hill forests, but the free grazing is allowed to right-holders in particular forests in which they have got such rights.

II. There is no other suggestion worth mentioning with reference to the terms of reference.

I. Mr. J. B. G. Smith, C.I.E., Chief Engineer, Irrigation, states that in the absence of information as to the rate of forest denudation over comparative short periods of years for which river discharge observations are available it is doubtful whether definite correlation can be established. The Canal Department's reliable records of river discharges are only for the last nine years.

He admits that forests have an effect on evaporation and absorption and says it is recognised that trees generally encourage undergrowth, which is what matters, as it keeps the soil porous and tends to retain moisture and increase absorption. This tends to retard erosion and run off. He considers that evidence so far collected is not enough to definitely justify the proposition that deafforestation is a real threat to the welfare of the canals yet a policy of conservation is worthy of support owing to the effect on evaporation, absorption and run off.

He attaches a statement of the proceedings of the second annual meeting of the Central Board of Irrigation held at Delhi on November 16th and 17th, 1931.

At this meeting the Board recorded the following conclusions—

“ During the past 15 years many of the largest rivers in India *e.g.*, Ganges, Sarda, Jumna, Chenab, Jhelum and Indus, have exceeded the highest recorded floods. Whereas in some of the above cases it is known definitely that such floods were due to an extreme intensity of rainfall, the Board are of the opinion that the information available is insufficient to enable them to reach any final conclusion.”

Discussion led to the conclusion that if disforestation had any effect on floods, the removal of the undergrowth was of more importance than the cutting of trees and that the removal of undergrowth was largely attributable to the enormous increase in the grazing, cattle, particularly goats of which absolute evidence in the form of statistics was available.

The Board recorded the opinion that the experience of individual members went far to allay the fears expressed at the last annual meeting that *rabi* supplies on the larger rivers were likely to diminish in the near future, as a result of disforestation and denudation.

APPENDIX 7.

PROPOSAL FOR TRAINING THE CHOS IN THE PLAINS.

Note by K. S. Allah Bakhsh, I. F. S.

Mr. Holland has dealt with fully the position in the Siwaliks in his book entitled "Report on Denudation and Erosion, in the Low Hills of the Punjab". Erosion in the hills and the havoc done by the chos in the plains are inter-connected but they present two distinct problems, viz., the afforestation of the hills and reclamation of land thrown out of cultivation by cho action in the plains. In this note it is intended to deal purely with the latter problem.

While considerable improvement has been made in the hills as a result of action taken so far, little seems to have been done to help the cultivators in the plains who own more valuable lands.

Although afforestation operations have had beneficial results in the hills, the position in the plains has continued to become worse and worse. The man in the hills can take to other avocations such as keeping cows and buffaloes, sheep and goats, but the man in the plains is entirely dependent on agricultural land and he and his land are always at the mercy of torrents descending from the hills. It is, therefore all the more important that work should be started on definite lines in the plains simultaneously with the work that is being carried out in the hills.

The figures supplied by the Deputy Commissioner, Hoshiarpur, as given in the statement appended, show that the area under chos rose considerably from 1852 to 1897. Although the area under sand has decreased considerably since then, there has been considerable increase in the area under Kharkana and on the whole the position was no better in 1927 as there was no gain in the area under cultivation. The increase under Kharkana is apparently due to the efforts of the people to divert the flow of the chos by planting Kharkana. This did not reclaim for them much area for cultivation as what was reclaimed went under Kharkana and the cho bed was diverted in other directions to continue its destruction in new lands.

It is, therefore, all the more necessary that concerted action be taken to tackle the work in the plains systematically and this can only be done by the Government as individuals can only protect themselves against others as it has proved in the past.

Little work has been done in the past in the reclamation of areas gone out of cultivation by cho action. As seen by the writer in 1924 the work carried out was absolutely on the wrong lines and it was in wrong hands. The Civil Department have no time to devote to this kind of work and do it more as a side show. Moreover they do not understand it as it is not their proper work. The engineering department can carry out anything but only at exorbitant price. Neither the Government nor the people can afford to pay the price as it will be out of all proportions to the results obtained. The only way to tackle it is to make the forces of nature do our work with very little assistance to guide those forces in the right channels.

A close study of the rivers and nallas flowing in the plains will show that the tendency in a river bed is to flow in loops and bends so as to reduce its gradient by lengthening its course and thus secure a steady bed and a steady flow. In spite of the best efforts of the rivers to secure a permanent bed other factors come into play which are beyond their control. As a river flows past a bend it needs considerable resistance to get out of it and in doing so it scours the outer side of the bend. As the current passes into next bend the flow of the current is considerably slackened and consequently it deposits a good deal of silt at the junction of two bends so that in the course of time the junction of the bend is so badly silted that the current has to seek a side channel thus making a new course. If a little assistance is rendered to a stream bed to stick to its course it could do so and thus it is prevented from seeking a new channel. It is here that artificial assistance could be rendered to a river to keep its own course to stop scouring the banks and to make its own embankments.

In 1924 the undersigned was considerably surprised and amused when he had the opportunity of inspecting in the company of the then Deputy Commissioner of Hoshiarpur the work being carried out under his control on a cho lying close to where the road to Bharwain goes up the Siwaliks. Money had been wasted in making earth bunds parallel to the stream which could stand no cho action and which was a sheer waste of money. The undersigned explained the mistake and suggested other methods but apparently the advice was of no avail.

It would be better to take action in one or two chos from catchment areas down to where they disappear in the plains below. After determining the maximum single rainfall in a catchment area from the past records and the speed of water at which it flows in the plains at various points in its course it should be possible to work out the extent of cho bed required to pass down a maximum flood. A detailed survey map of its course could give the gradient and after determining the gradient at which the flood could pass at an optimum speed without silting the main bed the length of the cho bed required could be worked out and determined on the spot after visual survey of the area. Once the capacity of cho bed required and its location on the ground is

worked out action then could be taken to train it so that it makes its own embankments helping it here and there to stop scouring the side banks by means which are well known to the foresters and which have worked in practice and which I need not enter into detail here. All that would be required is trestles and spurs made of wooden stakes intertwined by bamboos and branches of trees laid at various angles according to the requirements of each occasion so that they would afford minimum possible resistance to the water, slow down its speed along the banks and make it deposit its sand wherever required.

In the course of time good sand banks will come into existence automatically which could be planted up with shisham and eucalyptus root and shoot cuttings and other fast growing species suitable for the locality in order to consolidate the banks and protect them against further damage. There would be cases when such embankments would be attacked by the chos in later years. This could be counteracted and prevented so that in course of time the cho would flow within a definite course with strong embankments on either sides instead of branching out wherever it liked and changing its course here and there. The village lands could thus be protected and if necessary sluices could be provided to supply flood water both for irrigation and for silting up low land under proper control. In this note it seems unnecessary to enter into minute details of the methods to be adopted to carry out this work and therefore this has not been attempted.

The action as proposed in the preceding paragraph would be limited to the minimum possible assistance so that when the flow of the cho is controlled it will spend all its strength in carrying out our works instead of spending it for destructive purposes. The expenditure required for the work would consequently be considerably small as compared with extensive sums required for making bunds and embankments when the work is done by engineering department.

The Government would be justified in recovering royalty per acre of land reclaimed and it could be based on value of land. The value of land in Hoshiarpur and Ambala Districts varies from place to place. The average figure for 'barani' land which is the main type of agricultural land in these districts worked out to Rs. 1,044 per acre during 1929-30. The prices of land have gone down considerably since and if in the future they steady down to half of what they were in 1929-30, the value of one acre can be roughly taken at Rs. 500. The revenue records would furnish all details of lands gone out of cultivation in the past and when these are reclaimed as a result of training of chos surely the agriculturists will not grudge to pay a small sum per acre reclaimed to meet the cost of reclamation. It would not be fair to fix a figure at this stage to represent the cost of reclamation per acre. As the quality and price of land reclaimed would vary from place to place, an arbitrary figure could not be given at this stage. As, however, it is not intended that such an imposition should be a source of income to the Government. It would also depend on the expenditure incurred in training the chos details of which it is difficult to give at this stage. Considering what little expenditure will be required the cost of reclaiming per acre should not be very high and the agriculturist would not grudge it. Besides the reclamation of land will automatically bring considerable benefit to the Government in the form of land revenue which should not be difficult to estimate from revenue records. It would, therefore, appear that the writer's proposal would not cost the Government anything except during the experimental stage and as soon as the details of training work have been successfully worked out on one or two chos the recovery of cost from the reclaimed area would reimburse the Government and when the work is further extended the Government will have to invest very little as the expenditure will be met from revenue coming in as the areas are reclaimed and handed over to the owners. Besides the advantage to the public in reclaiming their land and advantage to the Government in the form of extra revenue, the planted cho banks would be a source of new income to the public and additional facility in the form of grazing will also be available. Under section 12 of the Cho Act it should be possible to recover from the public the amount spent by the Government and the capitalized value of the net income from the plantations on the cho banks which will be an additional source of income to the owners. Such a scheme would be welcomed by the inhabitants as it will restore to them the lands they have lost and will protect them from the danger of eroding agricultural lands and village sites in the future.

Although history of the chos in the pre-British days is obscure it is definitely known that the damage both in the hills and the plains was accelerated as a result of individual ownership created at the first settlement after the British occupation and heavy fellings for fuel and timber to meet the requirements of fuel for railways and fuel and timber for the cantonments. It is, therefore, only right that everything possible should be done by the existing administration to ameliorate the condition of the people living in the plains who have suffered heavily.

It would be futile to tackle the chos by making expensive bunds and embankments through human agency as has been tried in the past with little result. Such expensive operations need money and the engineering department cannot work without money which is not forthcoming.

The simplest way to make bunds and embankments is to make nature do its own work with little artificial help and this is the work of foresters. As is evident from the excellent results obtained in the training of the rivers by the forest officers in Burma and reclamation of waterlogged area and areas devastated by sand storms from the sea coast in the south-west of France by means of gigantic sand dunes.

Little has been done during the past eighty years in reclaiming the areas in the plains that have gone out of cultivation in the Hoshiarpur and Amala Districts and the coming generations will never excuse the indifference of the present administration in this respect.

Action was taken under section 8 of Chos Act in Hoshiarpur on a very small scale and apparently the Government was justified in ceasing operations on the outcry of few individuals who were most vocal and who did not realize that good of the community as a whole may involve loss to a few individuals.

The failure to obtain results was apparently due to lack of sympathetic methods. When a whole community will realize that a few individuals must suffer for the common good the outcry of the limited number against action for reclamation of land lost through the action will have no effect and the Government need not be afraid of going ahead with its scheme.

STATEMENT SHOWING AREAS IN ACRES UNDER CHOS IN THE WESTERN SLOPES OF HOSHIARPUR DISTRICT.

Tahsil.	AREAS UNDER CHOS.			AREAS UNDER CHOS AND SAND IN 1927.			AT LAST SETTLEMENT, 1913-14.		
	At regular settlement, 1852.	At first revised settlement, 1884.	In 1897.	Under chos sand.	Under kharkana.	Total.	Under sand.	Under kharkana.	Total.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Hoshiarpur	28,449	44,797	49,427	28,556	19,757	48,313	33,950	20,647	54,597
Dasuya	2,784	6,514	9,476	12,136	2,266	14,402	10,030	2,307	12,337
Garhshankar	16,973	28,746	35,423	15,368	6,770	22,138	24,033	7,981	32,014
Total	48,206	80,057	94,326	56,060	28,793	84,853	68,013	30,935	98,948

NOTE.—Figures supplied by Deputy Commissioner, Hoshiarpur.

Minute of Dissent.

I regret I cannot agree with the remedies proposed for solving the erosion problem in the Hoshiarpur district. The suggestions made for dealing with the problem in the Report are not new, and they have been acted upon in the past many years but without bringing any appreciable relief to the people of the Hoshiarpur district. The problem is very serious. A fairly large sum of money is needed to tackle the problem with necessary seriousness and earnestness. The Government does not seem inclined to find any money for this most essential work. The question of tackling the *chos* problem has been under consideration of the Government for over 30 years. The only remedy which has found favour with the Government so far, is the application of *Chos* Act to this area or that. It is apparent from the history of past years that the scheme has not benefited the people to any extent. While the Government calls upon the people to make sacrifices it has not itself contributed anything for the relief of the people and for dealing with the problem of the *chos* in a generous spirit.

The following suggestions are made for the consideration of Government:—

- (1) In order to remedy the damage done by the *chos* or hill torrents the Government must find out a solution for compensating the owners of the tracts which are sought to be brought under the *Chos* Act. The obvious remedy for the Government is to acquire these tracts and to compensate the owners and those having interests in these tracts by grant of lands or payment of money. And then to carry out a scheme for the proper afforestation of the hills on a well-planned scheme.
- (2) The Government must study with the help of an expert Committee a scheme for the proper storage of rain water discharged by the Siwalik hills and utilizing the same for cultivation and other necessary purposes by laying out temporary canals for the raining season.
- (3) The Government is not unaware of the fact that in various parts of the Hoshiarpur district there is a great complaint of the scarcity of water both for cultivation and drinking purposes and the water level in the wells is falling down. A well thought out plan for storage of water and temporary canals will greatly help in solution of this difficulty also.
- (4) I am sure that the residents of the district will be prepared to co-operate with the Government in financing scheme for the development of the Hoshiarpur district on the lines suggested above, if suitable terms are offered to them.

I have studied the problem in all its bearings so far as the Hoshiarpur district is concerned and I am of the opinion that the remedies suggested by the Committee are wholly inadequate to solve the problem.

NANAK CHAND, *Pandit*,
M. L. C.