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Regional Distribution and Requirement of Food Grains in Madras Presidency

By

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With the all-round dislocation of civilian life, which is the inevitable consequence of the war, the problem of feeding the population looms largely in importance. Countries like Great Britain, which depend mainly on imports for their food supply, took necessary precautions to provide adequate food for their population. Increasing home production by intensive cultivation and a well-organised system of rationing to provide an equitable distribution of the available food are the two main methods adopted to tackle the situation. Unfortunately in India no such organized plan was adopted to provide an adequate supply of food, although she "was on the borderline in regard to food resources even before the war and was short of many requirements for maintaining the people in health".[1] It was only late in 1943 after the food situation deteriorated considerably, resulting in a high mortality due to actual starvation, that the Foodgrains Policy Committee was appointed to examine "the past policy and present position in India

1. Food Member's reply to South Indian Chamber of Commerce

in relation to the supply, distribution and price of food grains in the light of all relevant conditions."[2]

Madras Presidency never reached that level of acute scarcity in foodstuffs resulting in deaths due to starvation, by the timely measures adopted by the Government. Rationing of rice was introduced in the City of Madras on 5th September 1943, when the acute scarcity for the grain was felt, even before the Food Grains Policy Committee concluded its findings.[3] Ever since, rationing of rice has been extended to several towns and at present "rationing on statutory basis is working satisfactorily in 84 urban areas."[4] In some municipalities rationing is extended to other millets like cholam, ragi and cumbu besides rice, to be used as substitutes for rice in regions which are deficit in the production of the latter.

The complex problem of fixing the grain requirement is solved by considering the age composition of the population, allowing no ration for children under 2 years and one half of the adult ration for children between 2 to 12 years. An adult daily ration, though specified in terms of local measure in different urban areas, weighs about a pound. Even the Food Grains Policy Committee was "unanimously of opinion that apart from any temporary breakdown, the standard ration of cereals per adult per day should not be allowed to fall below 1 lb."[5] Though provision is made for allowing a higher ration for the working classes, the scheme of rationing is based mainly on the one pound cereal requirement recommended by the Committee.

A sufficient and regular supply of grain is necessary for a satisfactory functioning of rationing, which brings to the forefront the availability and production of cereals relative to the requirement. It is of utmost importance to know whether the available grain is sufficient to meet the requirements of all the people at the standards fixed. "Besides rice, Madras produces a large quantity of other cereals (millets) which are also consumed. Under normal conditions she should require only small quantity of food grains to be imported in addition to what she herself produces".[6] Although

2. Food Grains Policy Committee Report, p. 1.
3. The Committee signed the Report only on the 11th September 1943.
4. Press Communique given by the Government of Madras, dated 11th October 1944.
5. Food Grains Policy Committee Report, p. 78.
6. 'Report on the Rice-Production and Trade in the Madras Presidency' by C. R. Srinivasan (1935), p. 4.

a considerable variation is visible in different years, the production of foodgrains in this Province can be taken to keep up almost the same level even in war years. Since the internal production accounts for the major part of the requirement, it is of interest to study the regional distribution of food production within the Province. Here an attempt is made to study the requirements of the population in different districts of this Province, relative to the production of foodgrains under normal conditions, taking the daily adult ration of a pound of cereals as the standard.

Rice is the staple food grain in this province. Cholam, ragi and cumbu, which are produced on a large scale, form the other important food grains for consumption besides rice. Other cereals, korra, varagu, samai, and maize, are cultivated on a small scale and are mainly consumed in the areas of production. There is a wide uneven distribution of the area under these different food grains in various districts depending on climate, soil and irrigation facilities. Here the figures of normal yield[7] given in the "Season and Crop Report" for the year 1940-41 are taken for different districts together with the population according to 1941 census. Column (2) of the Table A shows the population in different districts.

Since children of ages 2 to 12 are taken to need only half the adult ration, the age composition of the population in different districts is necessary to estimate the total number of adult rations. For this calculation, as the population by age groups for different districts is not given in 1941 census report, the same age composition given in 1931 census report is taken to exist in 1941. Even there the population between the ages 10 to 15 is given in a single group. To obtain the population below and over 12 years, uniform distribution is assumed for this age group 10-15, including 2/5 of this population among children and the remaining 3/5 under adults. Column (3) of Table A gives the total number of rations thus estimated in different districts.[8] The annual grain requirement for the estimated rations in different districts at an adult daily ration of a pound of grain is shown in column (8) of Table A. The total annual requirement of the province is 6·5 million tons and among the districts Malabar needs the maximum amount of grain.

7. Appendix IX of the Report gives these figures. 'Normal yield' is taken as the average of three preceeding non-famine years.
8. This scheme may involve a slight error for Vizagapatam, as it was reconstituted after the formation of the Orissa Province.

The normal figures of the production of paddy are taken for estimating the quantity of rice available for consumption in different districts. The available quantity of rice can be obtained by allowing for the seed requirement and for the loss in husking. A quantity of 62½ lbs. per acre[9] is deducted for seed requirement from the total production, taking into consideration the normal acreage[10] under paddy, irrigated and unirrigated. The percentage loss of weight in husking paddy is 33.[11] The quantity of rice available under normal conditions for human consumption after allowing for husking in each district is shown in column (4) of Table A. The total quantity available for the Presidency is 4·9 million tons. It is distributed unevenly throughout the Province, Tanjore, East and West Godavaries producing the maximum.

The available quantity of rice is 4,896,974·8 tons annually, whereas the requirement at an adult ration of a pound is estimated to be 6,529,272·8 tons. If all the population takes to rice and needs the daily minimum requirement of a pound, Madras Presidency, even in normal times, is having an annual deficit of 1,632,298 tons of rice, which works up to 2,436,265·7 tons of paddy, assuming that all the gain is available for equitable distribution among all classes of people without any hoarding. Possibly the Director of Agriculture had in view the above analysis when he said that "if the people of Madras were to be adequately fed, they, would have to raise over seven million tons of rice, nearly two million tons more than what was produced now in the province."[12]

Taking different districts, East Godavari, West Godavari, Kistna, Chingleput, Tanjore and South Kanara are having surplus rice after providing for the needs of their population at the minimum daily ration of a pound. Coimbatore and Salem are the districts having maximum deficit. The surplus and deficit quantities for different districts are shown in column (9) of Table A.

9. "The seed requirements vary widely—if broadcast, it is 50 to 75 lbs. per acre. See 'A Note Book of Agricultural Facts and Figures' (Government of Madras), p. 54. 62½ lbs. of paddy is taken as the average seed requirement by the Government of Madras.

10. 'Normal acreage' is given in Appendix VI of the 'Season and Crop Report'. Normal acreage is defined as the average of the preceeding three non-famine years. (Season and Crop Report, 1940-41, p. 4.).

11. Season and Crop Report'—footnote for Appendix IX.

12. Speech at the Third Annual Meeting of the Madras Provincial Agricultural Association, November 27, 1944.

After rice the millets cholam, ragi and cumbu form the staple foodgrains in some parts of the Presidency. In fact every district produces both rice and millets in varying quantities. To obtain the quantity available for consumption, the normal production of cholam, ragi and cumbu is taken for every district and the necessary deductions are made for the loss in weight due to husking[13] and for the seed requirement.[14] Column (5) of Table A indicates the total grain (cholam, ragi and cumbu together) available for consumption in different districts. The total available for the province is 2·5 million tons which is more than the deficit indicated in rice at the daily adult ration of a pound for the whole population. The production is quite unevenly distributed among the districts, Coimbatore having the maximum.

If it is the problem of providing the basic requirement of a pound of cereals per head daily as recommended by the Food Grains Policy Committee, Madras Presidency never was, nor is in deficit. She is self-sufficient if only all the grain after allowing for seed requirement is made available for equitable distribution and the population takes millets (at least cholam, ragi and cumbu) as equal substitutes for rice even in quantity. According to Dr. Aykroyd "there is no objection, from the standpoint of nutrition, to the substitution of wheat or rice by other cereals. In the case of rice eaters the substitution of a proportion of the rice in the diet by millets may be nutritionally advantageous".[15] The problem of providing adequate cereals at an adult ration of a pound in different districts of this province thus reduces itself to one of inter-district movement of grain rather than of import from outside.

Column (6) of Table A gives the total quantity available for consumption of the other foodgrains korra, varagu, samai and maize after husking and allowing for seed requirements.[16] South Arcot and Ceded Districts have the maximum production of these grains, the provincial total coming upto 5 lakhs of tons annually.

13. The percentage loss of weight in husking is 15 for cholam, 20 for cumbu and 10 for ragi.

14. The seed requirement varies from 10 to 15 lbs. per acre. Here 10 lbs. of clean grain is taken as the seed requirement per acre, considering the normal acreage under the different crops irrigated and unirrigated given in Appendix VI of the 'Season and Crop Report'.

15. Food Grains Policy Committee Report, p. 75.

16. Percentage loss of weight in husking is 20 for korra, 45 for samai, 40 for varagu and maize. A uniform rate of 10 lbs. of clean grain per acre is deducted as seed requirement taking the normal acreage into consideration.

TABLE A.

District.	Population (1941 Census).	Rations. Taking child as half adult.	Quantity of grain *in Tons.* available for consumption.				Yearly grain requirement at 1 lb. per head daily. (Tons).	Deficit and surplus taking rice. (Tons).	Deficit and surplus taking also Cholam, Ragi and Cumbu (Tons).	Rations after 10 years.	Annual grain requirement at 1 lb. per head daily. (Tons).
			Rice.	Cholam, Ragi and Cumbu.	Korra, Varagu, Samai and Maize	Total Cereals including rice.					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Vizagapatam.	3,845,944	3,118,169	309,655·2	166,993·4	10,421·6	487,070·2	508,105·6	−198,450·4	−31,457·0	3,323,843	541,620·2
East Godavari.	2,161,863	1,758,177	372,887·5	43,533·3	3,635·2	420,056·0	286,494·9	+86,392·6	—	1,979,057	322,487·3
West Godavari.	1,380,088	1,123,140	382,939·4	19,457·9	794·6	403,191·3	183,015·7	+199,923·7	—	1,267,340	206,513·1
Kistna.	1,444,294	1,175,137	289,670·7	60,848·2	5,009·3	355,528·2	191,488·6	+98,182·1	—	1,353,241	220,510·6
Guntur.	2,277,283	1,878,088	197,578·1	142,716·4	21,565·1	361,859·6	306,034·4	−108,456·3	+34,260·1	2,101,017	342,360·7
Kurnool.	1,146,250	931,879	31,242·8	166,984·9	54,158·0	252,385·7	151,849·7	−120,606·9	+46,378·0	1,042,158	169,819·6
Bellary.	1,051,235	851,608	15,155·5	146,490·3	63,992·5	225,638·3	138,769·5	−123,614·0	+22,876·3	923,143	150,426·2
Anantapur.	1,171,419	950,514	67,409·1	130,493·6	51,812·4	249,715·1	154,886·3	−87,477·0	+43,016·4	1,060,013	172,729·1
Cuddapah.	1,056,507	871,277	53,775·3	150,537·2	18,873·4	223,185·9	141,974·6	−88,199·3	+62,337·9	976,251	159,080·1
Nellore.	1,617,026	1,324,507	173,802·0	200,477·1	21,646·3	395,925·4	215,828·4	−42,026·4	+158,450·7	1,441,077	234,823·5
Chingleput.	1,823,955	1,465,454	290,755·8	39,284·0	7,506·2	337,546·0	238,795·7	+51,960·1	—	1,614,945	263,155·3
South Arcot.	2,608,753	2,121,627	281,956·6	90,199·4	61,889·1	434,045·1	345,719·1	−63,762·5	+26,436·9	2,254,950	367,444·1
Chittoor.	1,632,395	1,328,960	116,175·3	133,501·0	5,739·3	255,415·6	216,554·0	−100,378·7	+33,122·3	1,499,120	244,281·6
North Arcot.	2,577,540	2,051,032	273,350·5	103,961·7	29,406·0	406,718·2	334,215·7	−60,865·2	+43,096·5	2,332,003	379,999·9
Salem.	2,869,226	2,296,367	73,424·6	221,609·6	25,803·7	320,837·9	374,193·0	−300,768·4	−79,158·8	2,707,003	441,103·1
Coimbatore.	2,899,648	2,278,324	54,558·8	296,886·7	12,064·5	363,510·0	371,252·9	−316,694·1	−19,807·4	2,618,045	426,610·4
Trichinopoly.	2,194,091	1,808,771	159,220·7	141,425·9	44,282·2	344,928·8	294,739·2	−135,518·5	+5,907·4	2,074,280	338,003·9
Tanjore.	2,563,375	2,109,198	586,649·7	10,850·3	10,494·2	607,994·2	343,693·8	+242,955·9	—	2,266,080	369,257·7
Madura.	2,446,601	1,986,562	186,856·5	111,302·5	24,965·0	323,124·0	323,710·3	−136,853·8	−25,551·3	2,213,527	360,694·2
Ramnad	1,979,643	1,607,198	177,803·7	77,567,5	23,645·2	279,016·4	261,392·9	−84,089·2	−6,521·7	1,736,149	281,927·8
Tinnevelly.	2,241,543	1,831,154	197,926·9	74,117·6	6,976·7	279,021·2	298,386·5	−100,459·6	−26,342·0	2,007,552	327,195·8
Malabar.	3,929,425	3,151,692	349,481·2	6,800·3	1,276·9	357,558·4	513,568·2	−164,087·0	−157,286·7	3,504,398	571,041·7
South Kanara.	1,523,516	1,218,990	251,685·1	2,545·4	21·2	254,251·7	198,634·4	+53,050·7	—	1,353,371	220,531·8
The Nilgiris.	209,708	173,467	3,013·8	1,084·5	757·5	4,855·8	28,266·4	−25,252·6	−24,168·1	214,832	35,006·9
Madras.	777,481	657,889	—	—	—	—	107,203·0	−107,203·0	−107,203·0	790,283	128,776·6
Total.	49,341,810	40,069,181	4,896,974·8	2,539,668·7	506,735·5	7,943,379·0	6,529,272·8	−1,632,298·0	—	44,648,078	7,275,404·2

The inter-district movement of grain is studied by considering only the four main foodgrains, rice, cholam, ragi and cumbu, as the total available quantity of these foodgrains in sufficient to meet the provincial requirement at a pound per adult daily. The other cereals korra, varagu, samai and maize may be taken to be consumed in the regions of production in addition to the pound of minimum requirement.

"It is found that normally there is very little movement of millets from district to district which should mean that what is produced in a district is usually consumed there and any surplus left over is stored for future requirements."[17] So even the grains cholam, ragi and cumbu produced in different districts can be taken to be consumed locally. Further "it is reasonable to imagine that the average consumption per head of population must be more in the district where a large quantity of foodgrain is actually grown than in another which has to import the same from long distances".[18] The quantity of cholam, ragi and cumbu available for consumption in the districts which are having a surplus in rice can be taken to be consumed locally in addition to the basic daily requirement of a pound of rice.

Column (10) of Table A shows the amounts of surplus or deficit for those districts which are deficit in the available quantity of rice, after taking into consideration the quantity of cholam, ragi and cumbu to provide for their population at a pound of cereals daily per adult. There are nine districts having a deficit. Column (4) of the Table B gives the quantity of deficit in the nine districts after excluding the available rice, cholam, ragi and cumbu. There is a total annual deficit of 477,496 tons. Column (2) of the same table shows the quantity of rice available in the six surplus districts after providing for their population at the assumed standard of a pound ration. The total surplus quantity is more than 7 lakhs of tons. The total deficit in the nine districts can be supplied by the surplus rice available.

17. C. R. Srinivasan: Rice Report, p. 15.
18. Ibid, p. 19.

TABLE B

District.	Surplus quantity of rice. (Tons).	District.	Deficit in grain. (Tons).
(1)	(2)	(3)	(4)
East Godavari	.. 86,392·6	Vizagapatam	.. 31,457·0
West Godavari	.. 199,923·7	Salem	.. 79,158·8
Kistna	.. 98,182·1	Coimbatore	.. 19,807·4
Chingleput	.. 51,960·1	Madura	.. 25,551·3
Tanjore	.. 242,955·9	Ramnad	.. 6,521·7
South Kanara	.. 53,050·7	Tinnevelly	.. 26,342·0
		Malabar	.. 157,286 7
		The Nilgiris	.. 24,168·1
		Madras	. 107,203·0
Total Surplus	.. 732,465·1	Total Deficit	.. 477,496·0

The problem thus reduces itself to the planning of a scheme to supply the deficits (shown in Column (4) of Table B) with minimum transport by the rice surplus given in column (2) of the same table.

The deficit districts are divided into three zones and for each zone the corresponding surplus districts from which the required rice can be transported is also noted in Table C.

TABLE C

Deficit area.	Deficit quantity (in Tons).	Correpsonding surplus area.	Available rice surplus (in Tons).
(1)	(2)	(3)	(4)
Zone i:—			
Vizagapatam	.. 31,457·0	East Godavari	.. 86,392·6
Zone ii:—			
Madras Salem Coimbatore The Nilgiris	.. 230,337·3	West Godavari Kistna Chingleput	.. 350,065·9
Zone iii:—			
Madura Ramnad Tinnevelly Malabar	.. 215,701·7	Tanjore South Kanara	.. 296,006·6
Total.	.. 477,496·0	Total	.. 732,465·1

Vizagapatam can make up her deficit by taking rice from East Godavari, which has enough surplus. To provide adequate grain for Madras, Salem, Coimbatore and Nilgris rice can be supplied from West Godavari, Kistna and Chingleput. Tanjore can provide enough rice to meet the requirements of Madura, Ramnad and Tinnevelly, whereas Malabar must make up her deficit by taking rice partly from South Kanara and partly from Tanjore. From the table each zone is seen to be self-sufficient.

Since there is very little visible improvement in the total production of foodgrains in this province, it will be of interest to know how long this production can satisfy the needs of the growing population at the basic requirement of a pound ration.

Column (11) of Table A gives the number of adult rations ten years hence (1951) if the same growth of population continues and column (12) gives the annual requirement of grain in different districts of the Province. The requirements of the Province will be 7·3 million tons which is almost the same as the normal quantity of grain available for consumption (7·9 million tons). If it is only a problem of providing a daily adult ration of a pound of cereals Madras Presidency can be self-sufficient even for a decade with no considerable improvement in the total production of foodgrains, provided the population takes to any of the foodgrains with equal liking or the production of the different grains is so adjusted as to suit the tastes of the people.

If Madras Presidency is producing enough grain to feed her population at the adult daily ration of a pound, then why should there be a net import of rice into the province from Burma and other countries in normal times?[19] The causes are not far to seek. The minimum daily adult ration of a pound of cereals is the quantity required in a well-balanced diet which includes many other foodstuffs to provide the necessary energy for the normal functioning of a human being. One pound of grain contributes only about 1600 calories of the daily minimum energy requirement of 2600[20] calories. Also it is difficult for people to take to any grain with equal liking. Further "the quantity consumed per head will vary according to whether it is millets or rice. From the figures available for Ceded Districts it must be assumed that the per head consumption of millets must be much more than that[21] allowed for rice in purely rice districts like Tanjore and Godavari". Finally it can be noted that all the grain cannot be made available for equitable distribution as a certain portion will always be hoarded.

In conclusion it may be noted that the annual requirement of foodgrains for this Province, estimated at a minimum daily ration of a pound per adult, is about 6.5 million tons, whereas the

19. This apparent paradox is pointed out by Mr. Srinivasan (Rice Report, p. 16). Even calculating at an adult ration of 1·25 lbs. there is surplus grain in the Province for which no specific cause is given in the Report.

20. Health Bulletin No. 23. "The nutritive value of Indian foods and the planning of satisfactory diets"—p. 2 (Government of India).

21. Rice Report—C. R. Srinivasan, p. 18.

available quantity of rice is only 4.9 millions tons, thus leaving an annual deficit of 1·6 million tons, provided all the population require rice. Besides there is an available quantity of about 3 million tons of other foodgrains which will compensate the deficit in rice if an equal quantity of these (at least of cholam, ragi and cumbu) can be substituted for an equal quantity of rice. Even after a decade (1951) the total available quantity of foodgrains, without any increase in production, will be sufficient to meet the needs of the population assuming its growth to remain the same. There is a surplus quantity of rice in six districts after providing at a daily adult ration of a pound and a deficit in grain for nine districts after taking into consideration the available quantity of rice, ragi, cholam and cumbu. The surplus rice is sufficient to meet the deficit in grain for all the nine districts. The deficit districts may conveniently be grouped into three zones to make up the deficit by importing rice from the nearest corresponding surplus districts.

Temperate Deserts

By

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No doubt deserts are not important from the human point of view, whether they are hot deserts or temperate deserts. However it does not follow that on account of lack of importance they may be given a step-motherly treatment. So far the deserts have received little attention from the geographers. At persent deserts are treated under two main divisions namely hot deserts and temperate deserts. Now what do we mean by such a division? A little reflection will show that by this division we have put the desert of the world either under the hot belt or temperate belt but no serious attempt has been made to divide them into the climatic types.

Nevertheless, some geographers have tried to classify deserts to some extent. Thus Austin Miller has tried to divide the hot deserts into two main types namely marine type of hot deserts and continental type of hot deserts. However, even Austin Miller has made no attempt in the classification of the temperate deserts. Of course De Martonne has not classified the temperate deserts.

Likewise, Dudley Stamp in his book 'Commercial Geography' has divided the temperate deserts into three types namely (a) Tibet type (b) Iran type (c) Gobi or Mongolian type. Now in such a division the mountain type of climate has been confused with the desert type, for Tibet is no doubt arid, but it has a mountain type of climate. This is quite apparent from even what Dudley Stamp has written in his book about Tibet "In Tibet one gets some extraordinary conditions of temperature; places where the ground temperature in the sun may be over 130° F while it is still freezing in the shade." Of course, this is a characteristic of all regions with a mountain type of climate where on account of great altitude air becomes rarefied. It may be mentioned that Austin Miller has considered Tibet under the mountain type of climate.

Again in the case of Iran type, Persia and the area round the Salt Lake City in U.S.A. are considered to have the same type of

climate. Whether this is actually so or not it can be found out if the mean monthly temperatures of certain stations in these areas are compared. Thus let us compare the mean monthly temperatures of Teheran and Salt Lake City. These are given below:—

Stations	J	F	M	A	M	J	J	A	S	O	N	D	Yr.
Teheran	34	42	48	61	71	80	85	83	77	66	51	52	62
Salt Lake City	29	33	41	50	58	69	77	75	65	52	41	32	52

It is true that at both these stations the mean annual temperature is below 68°F. However, a closer examination of the mean monthly temperatures of these stations shows that the mean monthly temperature at Teheran is similar to the regions with sub-tropical or warm temperate type of climate and Salt Lake City has a cool temperate type of climate, for in accordance with De Martonne, in warm temperate regions the mean monthly temperature never falls below 50°F for more than four months. Thus these two stations do not appear to belong to the same climatic type.

Again, the boundries of the Mongolian type are vaguely defined by Dudley Stamp. It is stated that this type of climate occurs at lower elevations further away from the equator. However, the mean monthly temperatures vary widely in the different parts of the desert regions of Central Asia. This is quite apparent from the comparison of the mean monthly temperatures of Kashgarh and Urga.

Stations	J	F	M	A	M	J	J	A	S	O	N	D	Yr.
Kashgarh	22	34	47	61	70	77	80	76	69	56	40	26	55
Urga	–15	–4	13	34	48	59	64	59	47	29	8	–8	28

Apparently the mean monthly temperature at Kashgarh resembles that of regions with a cool temperate continental type of climate, while the climate of Urga resembles the regions with a cold temperate continental type of climate, for here, there are only three months when the mean monthly temperature is over 50°F and the mean annual temperature is 28°F. In accordance with De Martonne the cold temperate regions have a mean annual

temperature between 23°F and 41°F and this place has no doubt a climate similar to the cold temperate regions. This is also evident from a comparison of the mean monthly temperature of Urga with Fort Vermillion in British Columbia. The mean monthly temperature of this station is given below :—

Station	J	F	M	A	M	J	J	A	S	O	N	D	Yr.
Fort Vermillion	-14	-6	8	30	47	55	60	57	43	32	10	-4	27

From all these examples it follows that in the temperate deserts the mean monthly temperatures vary widely in the different parts. In some parts the mean monthly temperatures are similar to warm temperate regions, while in other parts the temperatures are similar to the cool temperate regions, and yet in the extreme northern portions of certain deserts the mean monthly temperatures are similar to cold temperate regions.

As the climate differs in the different parts of the temperate deserts there is no reason why the mean monthly temperature should not be taken into account in the division of these deserts into climatic regions as it has been done in the case of other climatic regions.

If this principle is applied to the temperate deserts also these may be divided into three main types namely (a) the warm temperate continental deserts such as Northern part of Persia, (b) the cool temperate continental deserts such as the Southern portion of Mongolian desert (c) the cold temperate continental deserts such as the Northern portion of the Mongolian desert in the region around Urga.

A Critique on National Agricultural Planning in India *

By

Suprokash Ghosh, M.A.

Introduction :—The focus of attention and interest of the intelligentsia in India today is—"National Planning" for our Motherland. Enthusiasm is running high as newer and newer plans come out to bathe in the light of publicity. In imagination the 'planner' sees the shrivelled flower of India burst into full bloom in the course of "post-war reconstruction". There are plans and plannings, and all envisage the rise of agro-industrial India through an extensive use of her 'vast reservoir of resources'.

While there is no ambiguity in the significance of National Planning, opinions seem to differ on the question of defining the exact implications of National Planning. According to the writer (who is a geographer), 'National Planning' means a very conscious effort of Man to modify and adapt himself to the environment in a manner which will serve the nation best. It is a question of systematic adaptation—a scheme which shall be clean of the failures of the past, which shall carry the nation along the path of Progress 'en masse' in the present, and which shall lay a stable socio-political economy for the enjoyment of the future generations of the nation. That is 'National Planning.'

A National Economic Plan envisages a thorough and accurate appraisal of the growth and present nature and distribution of the various factors which go to form the natural and cultural landscapes of the land, and their future development. This reveals the phase in which the contribution of the science of Geography lies. Geography gives the planner aids in four different directions: (1) explanation of natural conditions, (2) indication of historic growth or evolution of the cultural landscape, (3) complete survey of existing state, and (4) future possibilities, based on conclusions reached from an integrated study of the previous three aspects.

*The writer has a somewhat long association with the subject of "Geography and National Planning", and had occasion to address a number of meetings, public and scientific, on various phases of national planning and the place of Geography in them. The interested reader is referred to the writer's brochure on "The Place of Geography in Post-War Planning", published as a Special Bulletin by the Commercial Museum, Corporation of Calcutta, in 1943.

Hence the importance of the geographer in National Economic Planning.

Agriculture in our national economy:—Agriculture has had always a dominating place in our national economy—a fact for which we are thoroughly proud. There is also reason to feel that the future of our national economic stability lies in the soil and that of our national social stability lies in our peasantry—workers not of the factories, not of the administrative services, but the tillers of the earth, the sons of the sacred soil. If we are to feel the pulse of the land, we must feel the pulse of our peasantry. It is the soil which really maintains humanity and conserves the dynamo of life. Therefore it is the soil into which the roots of the nation must spread deeply and securely if we are to remain erect as a nation in the troublous and uncertain future. Hence, we advocate the contention that the first major item in National Planning must be Agricultural Planning.

Geography indicates that the future of India lies in agriculture, coordinated with a simultaneous development of large and small scale manufacturing industries. The development of manufacturing industries is essential. However, extensive industrialisation with the object of making India fit to embark on competition with the other industrial countries in the world-market of manufactures will lead India nowhere other than disaster. "Industrialisation for the Indian market, industrialisation not for the world-market" should be our motto. It is against the dictates of Geography to build up an industrial Germany or an industrial Japan or an industrial Britain out of an agricultural India. We repeat that the future of India lies in *'Scientific Ruralisation'*. We must build an economy which has its foundations in the agricultural industry of the country.

Some aspects of Agricultural Planning:—The interest of Geography in Agricultural Planning lies essentially in problems of agricultural land utilisation. Agriculture in India is primarily controlled by the climate (water-supply in particular). It is for the geographer to study the agricultural climatology of the land to make it one of the first bricks in the foundation of Agricultural Planning. The second control in Indian agriculture is the edaphic factor—the soil. Climate determines the general form of agriculture; it is the differences in soils which introduce variations in agricultural practices. For an agricultural country like India, it is imperative that there should exist climatic and soil survey reports with special reference to agriculture. As is with many other things, there does not exist any comprehensive report on

agricultural climatology. Neither has there taken place any form of soil survey, though one such under the authority of the Imperial Council of Agricultural Research is proposed. Just as in agricultural climatology, the geographer is vitally interested in soil surveys also. In the United States, where the most comprehensive soil surveys have taken place, geographers have been actively engaged in the problem. As geographers we demand that any form of soil survey for India must have as its purpose the solution of agricultural problems and not for academic researches. Soil survey means not only the delimitation of soil types but also the study of soil erosion and soil conservation problems. Further, a soil survey is largely a matter of field work; and we wish to make it thoroughly clear that any form of social survey conducted largely by agricultural chemists with their laboratory pedantics will not be accepted by the Indian people. We want a soil survey by pedologists and soil geographers, as in all other progressive countries of the world.

Some time back suggestions were made that as one of the future activities of the Geological Survey of India, a specialised branch, namely, Agricultural Geology and Soil Conservation (which apparently includes Soil Survey) should be organised. Such views have set us thinking seriously. We must say we are opposed to a soil survey carried out with a geological bias. If we were to accept such surveys we would be clearly dallying with antidiluvian ideas. Geology has hardly anything to do with the formation of 'Mature Soils'. The Modern Science of Pedology, under the leadership of Dokuchaiev, Glinka, Marbut, Shaw, Stremme, Wolfanger, Schokalsky and others, has blasted out the bogey of geological control in the formation and classification of soils. The 'mature soils' of the world are absolutely independent of the underground geology. It is the geographical elements of climate and vegetation which determine the character and individuality of soils.

The beginnings of soil are found either in the direct weathering of the solid rocks or in similar processes in the upper layers of the regolith defined as soil and sub-soil. Weathering depends on the local climate, which does not cease to exert its effect after soil has been formed. Climatic effects become more complex when this soil becomes capable of supporting plant life. So long as the vegetation cover remains intact the growing plants themselves exert a notable influence. The presence of humus resulting from organic decay affects soil texture and this is but one effect. The particular type of plant community present also is dependent

mainly on climatic factors, so that climate has a double effect on soil.

Climate therefore influences the mechanical and chemical changes which occur in the mineral particles; it determines the nature of plant cover, and this in its turn exerts much influence on soil character.

The rock particles are only the primary raw materials. The final resultant "Solum" is the product of complex pedogenic and geographic factors. As against geologic factors, it is the geographic factors, climate, vegetation and land-forms, which are at the helm of command. Geological formations play a minor role—just helping to build up the skeleton of the soil, none of its essential characteristics.

Geologists and Indian economists (the latter have so long taken their inspiration from the former in the matter) have been extremely enthusiastic regarding the classification of Indian soils into—alluvial soils, basaltic or trap soils, and crystalline soils. It is time that they give up their 19th century ideas and march with 20th century tendencies. It is desirable that they now accept and propagate the modern version of the division of the soils of India into Lateritic Soils, Tropical Bed Soils, Brown Steppe Soils, Grey Desert Soils, etc. It will be somewhat out of place to discuss this classification in detail here.

Soil erosion and conservation:—One of the most serious problems in the agricultural planning of the country is the control of the growing menace of soil erosion. Erosion is a physiographic process and it is beyond human power to stop it completely. Nevertheless, it is Man himself who is the real agent of what may be called 'accelerated soil erosion.' It is Man's thoughtless interferences with the delicate balance set up by Nature which is causing the real trouble. Reckless destruction of forest cover, continuous 'monoculture,' serious over-grazing—all combine to lead to the most dangerous form of soil erosion facing agricultural India.

It is almost axiomatic that any process which destroys the essential productivity of the soil can exercise only an adverse effect on an economy that depends fundamentally upon the soil. Erosion is such a process, perhaps the most vicious. Other factors being equal, its adverse effect on agricultural economy is reflected usually in the progressive deterioration of productive land and in lower farm returns. In extreme cases it may lead to 'submarginality' abandonment, rural migration, disruption of the tax base, general community disruption and similar maladjustments of an economic

and social nature. This is not to say, of course, that soil erosion is either the sole or a primary cause of such maladjustments. But it must certainly be grouped with other physical, social and economic factors which exercise a debilitating effect upon agriculture generally.

Temporarily its ill effects may be totally or partially offset by other factors of a physical or economic nature. For instance, the application of manures may serve for a time to extend the crop-productivity life of the land against the inroads of erosion. In a similar way, high prices may for a time compensate for high cost of production on land depleted by erosion. In the former case however, failure to control erosion will result eventually in the complete removal not only of the naturally fertile surface soil but of the sub-surface soil which has been artificially manured. In the latter case, uncontrolled erosion will eventually make it uneconomic to attempt to produce from the land, regardless of prices, since it is physically impossible to grow crops on soil-less land, or fields too riddled by gullies for cultivation.

Because soil erosion and conservation problem has not so long been recognised in all its ramifications in practically any country, far less in India, no accurate appraisal has been made of many of its effects. Yet while precise statistical information is sorely needed, little more than casual observation is required to gauge the trend and ascertain the enormous amount of damage to the physical soil resource of the land. The problem of soil erosion and conservation, we repeat, admits of the most serious consideration in the future scheme of national agricultural planning in India.

Concluding remarks:—Various other factors constitute the agricultural environment and it is for the geographer to correlate the relationships existing between the agricultural environment and cultural practices. Further, the geographer not only investigates the present situation, but in view of the present situation his business is to plan and direct future lines of agricultural land utilisation.

India is still without a plan for her future. May be one is in the offing. In that would-be future National Plan agriculture must receive the premier consideration. The successful initiation and working of a scheme of National Economic Plan shall depend on how best all the contributory branches of human knowledge are pooled for the purpose. And in the scheming and operational phases of such a Plan, geographers of Hind shall surely be commissioned to play their part in the planned national regeneration of our Motherland.

Mewar, The Land of Lakes

By

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An eminent tourist has rightly remarked that "If anyone can spare two days and a half for seeing India, he should, on the first day, see Udaipur, on the second Srinagar, Kashmir, and on the half of the third day see the Taj Mahal at Agra and fly off to his home." With an area of 13,170 sq. miles Mewar is the fifth amongst the Rajputana States, a little less than the size of Switzerland. Mewar occupies the eastern portion of the Aravallis with many ranges and valleys. The ranges become lower and narrower towards the north and east where they consist generally of an alluvial plateau, open and undulating country. The rugged regions in the south and west embrace the wildest portions of the Aravallis. It is the hills and the lakes which have attributed to the country the worthy name of "An Oasis in the desert of Rajputana." On entering the territory of the State a visitor, though he usually expects to find dryness and desert topography is surprised to see a country full of hills, ridges and ravines covered with rich forests and spotted here and there with wide expanses of water. He is still more amazed to hear that these lakes are not Nature's gift, but are the result of man's continued and determined efforts. Any traveller who has been charmed by these man-made lakes would, at least at certain moments, explode Rousseau's maxim "that everything is good as it comes from the hand of the Author of Nature, but everything degenerates in the hands of Man." Mewar indeed offers many points of contrast with the neighbouring States. The panoramic scenery of the lakes girdled by magnificent hills and their nearness to those States of Rajputana whose business communities have money to spend on such holidays is giving much impetus to the tourist industry. Hindus, Marwaris and Gujeratis visit Mewar with the double mission,—first to sanctify their soul through pilgrimage to Shri Eklinji, Shri Nathdwara and Kankroli, and then to enjoy the beauties of Nature.

All the lakes of Mewar have a great history behind them. Mewar is that portion of Rajputana about which the historians are proud to remark that it is the country which has, like a true Rajput lady, never seen the face of anybody except her husband. The lakes remind us of the chivalry of the Rajputs who have made Mewar a land that prides itself on lakes. Energy was the characteristic of the time. One for a moment is puzzled to think how the river courses have been marred by gigantic man-made barriers. All the lakes in the State have been constructed by the late Maharanas as their names indicate. It has become customary for every Maharana to get one lake constructed in his name. There are innumerable lakes—big and small—but the following are the chief ones:—

Pichola:—Udaipur's chief contribution to scenic Mewar is its three beautiful lakes. It is famed for its lakes—two large ones—within the city limits, its picturesque antiquity makes the artist reach for his brushes in a happy daze. Pichola lake is said to be the oldest in Mewar. This lake was built nearly 500 years ago by one 'banjara,' a member of a nomad tribe in the reign of Maharana Lakha. The lake measures about 2·5 miles in length and 1·5 miles in width. The Royal Palaces which occupy a unique position near its waters command magnificent view of the lake below. The entire town of Udaipur is situated on the banks of the lake. People derive the highest benefit from its water as it is used for drinking, bathing and washing purposes. On the other three sides it has a background of a range of mountains protecting its chastity. Towards the town one finds regular bathing ghats. The 'Nao' (boat) and 'Ganghor' (an important Rajputana festival) ghats have their own characteristic uniqueness. Words cannot describe the picture of the Rajputana beauty in the women in their colourful attires congregating on these ghats every morning and evening fetching water in big brass pots for demostic use. These stout women have been performing this task for centuries.

The dam was breached in 1795 resulting in a great loss to the town, but Maharana Bhim Singh, the then ruling Prince, made it stronger with pucca structures. Inside the lake two island palaces—Jagmandir and Jagnivas—nearly half a mile apart add a peculiar beauty to the lake. Jagmandir has great historical importance. Centuries ago Prince Khurram (later King Shahjahan) having rebelled against his father at Delhi is said to have taken refuge in Mewar. He was accommodated in Jagmandir. In accordance

with the etiquette of the time, the head-dresses of the Rana and the Prince were exchanged. The turban of the Royal Moghul family in its original folds is still preserved in the State Museum. Times have altogether changed, but not the spirit of hospitability among the inhabitants of this land. A tourist comes here not as a refugee, but as a friend welcomed with open hands and a warm heart. Jagnivas is a Palace equipped with the most modern facilities of life. It is occupied by the Maharana during the hot hours of the day in summer. The lake can be crossed in a boat from the 'Nao Ghat.' A visitor can push off in a boat to Jagnivas, from this water palace to Jagmandir and thence to "Khas Odi" the Royal Pig Feeding House at a corner of the lake. Several maunds of maize are thrown every day from the top of the building for hundreds of wild boars who assemble at the regular time. Sunset is the prettiet on this lake. The Royal Palace with the golden rays of the sun falling on it and its reflection in the lake can be best enjoyed from either of the two Island Palaces.

In Ganghor the Royal boat in its pomp and grandeur with the Maharana and his courtiers, the illumination and fireworks with reflections, thousands of men and women in gaudy clothes congregating at the ghats is a scene for everyone to see.

Udaisagar:—Maharana Udaisingh, the worthy father of the heroic and patriotic Maharana Pratap constructed a dam to impound water between two ranges of mountains. It took nearly 5 years to construct this magnificent barrier (1559-1564) which assumes a breadth of 180 ft. The lake can be reached by a six-mile motor road east of Udaipur. Nearly 185 sq., miles of land contributes to the waters of this like, which is 2·5 miles long with a maximum breadth of 2 miles. The surrounding hills are densely populated. These forests are the hunting grounds of the wild animals. The river Ar meets the lake and after emerging from it, it is named Berach which beyond the old grim Chittorgarh becomes a feeder of Banas which joins the Chambal before it meets the Jamuna and the Ganges river-system.

The lake has some historical importance. Raja Mansingh of Jaipur whose family had blood-relationship with the Moghul throne of Delhi paid a friendly visit to Maharana Pratap, who also came from Kumbhalgarh (where he was then staying) to Udaisagar to meet him. At the mid-day meals Prince Amar Singh, the illustrious son of the Maharana informed the noble guest that he (Amar Singh) had come to attend on him in place of his father who because of a headache would not have his meals that morning, but would certainly meet him after he had finished his meals. Raja Mansingh was good enough to understand the motive of the Maharana behind his refusal to dine with him as his paternal aunt was wedded to the great Moghul King Akbar. Mansingh having been insulted registered a protest and remarked that he, with the help of the Moghul forces, would take revenge on this insult. But the Maharana, the true Rajput hero as a saver of the sanctity of Hinduism had not the fear of being a victim of the wrath of the furious Moghuls. At the moment when Mansingh challenged the Maharana one of the local Sardars tauntingly uttered, "Also bring your paternal uncle, Akbar along with your forces. Forget it not." Mansingh with anguish went direct to Akbar at Delhi. Thus, in the intense heat of June 1571, this event at Udaisagar led to the famous historic battle of Haldighati where the heroic Maharana Pratap on his brave Chetak faced the furious Moghul armies of Akbar.

Rajsamand:—For four generations after Maharana Udaisingh no important lake was built in Mewar. Maharana Rajsingh selected a fascinating spot for this magnificent lake 40 miles north of Udaipur. It is 4 miles long and 1.75 miles broad. The construction of the dam started in 1662, but it took fully 17 years for its completion. The zigzag semi-circular barrier is nearly three miles long, but at Rajnagar it is 600 ft. long and 270 ft wide. The Maharana had to incur Rs. 1,05,07,584 for this mammoth construction. The Rajnagar section of the dam is called 'Now-chouki.' There are three marble 'chatris' facing the lake under whose roofs one finds the finest specimen of 17th century architecture and sculpture. The chariot of the God of Sun, the image of Brahma, the unique poses of classical female dancers, the pigeons at fight, the well-adorned elephants of kings etc., etc. are carvings well worth seeing. These attract the attention of all visitors to Mewar as revealing the ancient art of carving.

Two small towns Rajnagar and Kankroli lie on its banks. From Now-chouki at Rajnagar the view of the whole lake with crystal blue water is a magnificent sight. Kankroli, a sacred town of the Hindus, within easy reach by Me. S. Ry. is a place of pilgrimage which goes on throughout the year. The lake is the second largest in Mewar and well worth a visit. Anywhere a visitor

stands on the barrier, the spot commands a magnificent view of the entire lake bearing eloquent testimony to the love of natural scenery and the taste of the Rajput rulers of Mewar. Every morning and evening the prayer bells in temples and grottoes fill the atmosphere with ecstasy.

On the eastern end of the lake the Imperial Airways have established a Marine Air Base for the landing of sea-planes on their way to and from Gwalior and beyond. Who would not like to watch a plane eddying and circling above the blue waters of the lake for its mid-day rest?

Jaisamand:—This lake is said to be the second largest artificial lake in the world. It lies 32 miles south-east of Udaipur connected by a motor road. Maharana Jaisingh in the 17th century had the dam constructed across a river course during four years between 1687—1691. At the time of the high floods, 9 miles long, this largest lake in Mewar is more than 6 miles wide. The crystal-pure Jaismand water has inside it three islands —'Pairi' and the other two called 'Baba-ke-Magre' (Hills of Sadhus). The natives of these islands, comprising mostly of Meenas and Sadhus, have intensely cultivated flats that have been kept productive for generations through irrigation. The homes of the natives look like hollow shells of stone roofed with thatch, but generation after generation beauty found content and inspiration in this fair scene.

To raise a double-walled dam 1,600 ft. long and 95 ft. high the ambitious Maharana had to incur lakhs of rupees with the cheap native labour of his glorious time. About seven rivulets join this lake. The river Sabarmati has its source in its waters. Its still waters are flanked by steep-sided hills of the Aravallis whose forested slopes grotesquely speak of the marvels of engineering of the 17th century. These forested hills are haunted by tigers, panthers, wild boars, blue bulls etc. One is here reminded of Wordsworth's description of the solitary Mountain lake in "The Excursion as" "Shut out from all the world.....a liquid pool that glittered in the sun." Facing the lake there are three 'Chatris' on the dam and in front of each chatri, there boldly and proudly stands with its head high, an elephant carved out of stone bathing in the sky-blue water of the magnificent lake. Who being a romanticist would not pause for a moment to think of the immortality of the pleasures from the song of the waves that these elephants have been enjoying for three centuries. If Keats was inspired with the

immortality of the love of the boy in the "Grecian Urn," it is certain that a romanticist would be caught with the elephant's immortal admiration of the glittering waters of the lake. In fine, the lake may be considered as unique in its endowment of natural beauty and superb in achievements of human genius and skill.

One interesting feature on the Jaisamand lake is the raft navigation. The navigation of the rafts is entirely in the hands of the Meenas and the Sadhus who form a considerable percentage of population of the three islands. Rafts carry on considerable local transport of fuel, vegetable, and grain to and from the neighbouring villages. The raftsmen find many oddments of city life to take back to their families. Raft-making is a comparatively easy task for the natives. The rafts are a framework of four poles lashed securely together fastened with three cross-sticks. They can be managed with comparative ease as they float on quiet water, but the perfect balance of the body and cargo that has to be maintained and their clumsiness make it practically impossible for a new man to pole. The solitary voyage on a one—or two-man raft of the ill-clothed Sadhu, with the sun throughout the day beating down relentlessly in a blinding glare on the water and the strenuous labour in rowing is a scene no one can forget. These hardy raftsmen are a happy and friendly lot.

The author with some of his friends pushed off in a good boat to secure safety against high winds in quiet waters of the evening. But with the advance of night and the moon hanging high in the sky the lake was turned a pool of active silver. A moderate wind blowing across a wide stretch of water was capable of generating large waves. Breaking waves were certainly more efficient in rowing of the boat. The whole expanse of water represented a heavy monsoon-tossed sea, but with star less skies. Lake Jaisamand tends to temper the winds of the region around it, but not the chivalry and heroism of the Rajputs.

Fatehsagar:—North of Udaipur near the village Diwali there, of late years, existed a small tank. The late Maharana Fatehsingh raised the dam with the result that now the water of the lake extends farther south reaching the northern tongue of Pichola and beyond. Both of these premier lakes of Udaipur have been connected through a canal which in the rainy season is a navigable link. At the Fatehsagar end, an iron gate has been constructed. The lake measures 1·5 miles in length and 1 mile at its broadest.

The dam is 2800 ft. long and it has been named after the Duke of Connaught who laid the foundation stone. A beautiful small marble palace accompanied by three 'Chatris' on either side stands in the middle of the Connaught dam. Except for the dam the lake is enclosed by low hills. Beyond Pichola and Fatehsagar towers Sajjangarh, a palace on the highest peak in the neighbourhood. Behind the old Dewali village, Neemuch Mata, the temple of a goddess overlooks the lake and the whole town. This bright-eye sentinel is a guiding star to Lake Fatehsagar. The environmental scenery of the richly forested hill shares the teacher' task. All the institutions under the Viday Bhawan Society find shelter under the protection.

Bhupalsagar:—The present ruler of the State Maharana Bhupal Singh Ji built a lake near Karera which also enjoys a beautiful natural surrounding, but it is not so picturesque as the other lakes are.

Besides these big lakes and a few smaller ones Mewar is speckled with about 2514 tanks—big and small—contributing to the scenic beauty of the land. Owing to some mineral content in these lakes there is an extraordinary cleaning capacity in the water. With a few dabs with the locally manufactured soap the clothes appear as clean and white as snow. These artificial reservoirs of water are a great source of irrigation. The author proposes to write a separate article on the irrigation systems of Mewar. Fishing is strictly forbidden in the State. In July 1943 there were very heavy downpours of rain. On account of the incessant abnormal cyclonic rainfall on a large part of the region, about 200 big artificially dammed storage tanks received a water supply far beyond their capacity, and were breached. Hence catastrophic floods* occurred that year.

Udaipur is a small circular valley enclosed by low hills sufficient enough to procure it the delightful climate it enjoys. The wild grandeur of the surrounding mountains and loveliness of valley itself are a favourite haunt of visitors in summer specially in the rainy season, when the lakes as a rule play with the water falls. In a land where the setting sun lends a golden colour to

*See my article on "The Rajputana Floods" in the Indian Geographical Journal, Vol. XVIII No. 4, Pp. 156-164.

the waters of the lakes, sitting at the lakes is not entirely an idle occupation or waste of time. It is pleasure to pause and think in what ways is this remarkable among the deserts of Rajputana, and to consider what a new comer would find striking in its geography. Each lake in Mewar—like an Arab street—has its shady side, morning and afternoon, so that one can escape or welcome the warmth of the sun according to one's own desire. Each lake in the rainy season has a fall, quite unlike the other in form and foams, in its loveliest moods. If the one at Fatehsagar is high and splendid, the one at Pachola is long and sublime. If the one at Jaisamand is the source of the Sabarmati, the one at Udaisagar is forceful and majestic, the cascade at Rajsamand is low and in musical song. Unlike Kashmir, Udaipur with its impressive reminiscenes of the inherent tragedy and incidental glory of history-making warfare in the recent past, has never been adequately pictured, much less described either by geographers, romanticists or visitors, essayists or poets. Where is the traveller who hears the mention of Udaipur and does not think of the beauty of Padmani, the saintliness of Mira and chivalry of Pratap? The lakes should draw an increasing number of tourists, for such simple, restful pleasures as the rich yearn for and poor men enjoy are available at every hand. Let them visit Udaipur and seek repose from the dust and din of busy life in the unruffled lakes.

Rice in India

By

George Kuriyan

Rice plant—Oryza Sativa—is a grass included in the great family "Gramineae". The word 'oryza' may be said to have some resemblance to the Tamil word 'arisi', the Telugu word 'vari' and the Malayalam word 'ari'. In Spanish and Portuguese, the word for rice is 'arros'. The original Asiatic word 'erus' must have been modified into rice, riz, and reis. Besides Oryza Sativa, there are three other wild forms of rice found in India. They are Oryza coaractata (an aquatic plant growing wild in the Indus valley), Oryza granulata (growing on dry soils at altitudes of 3,000 feet in Assam, Malabar, Bengal and Burma) and Oryza latifolia (an aquatic plant found in Burma). Some species, however, are said to be indigenous to Africa (e.g. Oryza longistaminata)[1] and others are found in the Philippines, Java and South and Central America. Rice and the other species of Oryza must have common ancestors and must have originated where those ancestors lived. We may therefore be sure that before rice was cultivated, it was a native plant existing in a wild stage in the same region where the other wild species are found today.[2] China and Indo-China are characterised by a great diversity of forms, rich in varieties, so that either of them could be considered the original habitat. The Ganges-Brahmaputra delta however, is probably much wealthier in both the cultivated and wild varieties than any other like area. Further more, the adaptation of varieties to fine details of environment is more perfect here than is known anywhere else, and consequently rice may be deemed to have been indigenous in this territory with more reason than can be found for locating its native habitat anywhere else.[3]

Linguistic evidence is older and more valuable than historic, for language is of course immeasurably older than its use in permanent records. In the ordinances of Manu, food is used as

1. K. Ramiah: Rice in Madras, a popular handbook, p. 129.
2. Copeland, Rice, p. 2.
3. Ibid, p. 269.

synonymous with rice and in classic Chinese, agriculture and rice culture are synonymous, which suggest that this was the staple crop while the language was taking form. It is recorded that the sowing of rice was an important religious ceremonial in China nearly 5,000 years ago.[4] Again, rice and food are used as synonyms in languages so widespread that it can certainly be stated that it was the principal food in the misty dawn of life. It is safe to assume therefore that rice has been one of the most important cereal foods of man since the earliest times, doubtless to be reckoned in thousands of years, when its regular cultivation first gave employment to man. Ancient Egyptians, however, did not know anything about rice, nor has this crop been mentioned in the Old Testament.

It is impossible to state even approximately when the cultivation of rice first assumed importance in India. The first mention of rice occurs in the Atharva Veda, probably the last of the Vedas, as late as 800 to 1,000 B.C., while barley and other food grains were mentioned in earlier works.[5] Indeed, as in Egypt, barley appears to have been the first cultivated grain in India, although in its wild form, rice in all probability might have been a source of food of the inhabitants of eastern and southern India from the remotest times. The time-honoured religious customs obtaining in many parts of India which entail the use of rice in the form of offerings, give some indication of the antiquity of the cereal.

The spread of rice to the western countries had its beginning in early Grecian times and later developed considerably as the result of increasing economic intercourse between the Greeks and the Persians. During the Roman period, rice had become a well-known article of food in the countries bordering the Mediterranean Sea and its cultivation, though comparatively restricted, was not uncommon throughout Syria, Palestine and Egypt. The actual introduction of its culture into Europe dates from the conquest of Spain by the Arabs or the Moors in the 8th century. From Spain, it spread into Italy in the 16th century when it came under the Spanish rule. Still later, it spread gradually into the Balkans. Although the first attempt was made by Columbus in 1493 A.D.

4. Douglas: Rice, p. 2.
5. Is it because the Vedic Aryan was not a rice eater that it is not mentioned in the earlier Vedas? Probably so.

to introduce rice into America, yet it was only in 1694 that the Dutch were successful in introducing it from Madagascar. In the beginning of the 18th century rice spread into South America.

Statistical records show that the world production of rice has increased by about 30% during the last thirty years and in 1937—the latest year for which reliable data are available, it was about 95·9 million tons. The Indian output was 30·9 million tons, i.e. 31% of the world production. The tabular statement below gives the area under rice and the production of the major producing countries.

Name of the country.	Percentage of area under rice.	Percentage of production of rice.
India* [5a]	39	31
China* [5a]	23	34
Burma	6	5
Indo-China	7	4
Java	5	4
Japan* [5a]	4	8
Thailand	3	3
Philippines	3	2
Others	10	9
Total for the world ..	100	100

Although as regards the quantity produced, rice approaches the principal agricultural products like wheat and maize, the international trade in rice amounts only to a small fraction of the total production—about 9 million tons, less than 10 %[6] while for wheat it is about 20%. It is significant that while India and China together account for practically two-thirds the entire world production of rice, both these countries import large quantities to supplement their domestic supply, even in years of bumper harvests.[7] This is also true of Japan which obtains her supply mainly from Korea and Formosa.

5-a* India has 39% of the area but produces only 31% of the total, while China with only 23% of the area has a production of 34%. The remarkable production of Japan is also noteworthy; with only 4% of the area, it has 8% of the total production.

6. During the period 1914-1918, it was only 6 million tons!

7. India imports more than 1·5 million tons on an average. The other large importers are Ceylon and Malaya.

The three principal exporters of rice are Burma, Thailand and Indo-China. Of these Burma is the most important with the average annual exports being in excess of 3 million tons (30% of the world trade), half of which normally goes to India. About 2/3 the rice production of Burma is shipped abroad and the importance of the rice trade can be guaged when it is realised that 40% of her exports and about 80% of the population are directly concerned in the cultivation, transport and milling of this cereal.

The "agricultural statistics of India" show that rice is by far the largest single crop grown in India. For the decade 1927-37, the average area was 76·26 million acres, about 18% of the total cultivated area in India. "These official statistics, however, must be regarded as less reliable than estimates for crops such as wheat, since rice is grown mainly in Bengal and Bihar, in the permanently settled districts in which the chief sources of information are the reports of petty village officials. In these tracts, the collection of primary data is far from being satisfactory, being invariably an under-estimation,[8] omitting to take count of about 6½ million acres annually." Nearly 40% of the total crop is put on the market and its importance as a cash crop is therefore obvious.

Temperature:—The mass production of rice is confined to South East Asia. The restriction of rice culture to fairly warm regions and its inability to grow at low temperatures is related to its probably tropical origin. Temperature is generally considered the limiting factor of rice culture, both in latitude[9] and altitude. The crop is seldom successful where the mean temperature during the growing season is less than 75° F. During the period of the most active vegetation, a higher temperature is necessary than either for germination, or for ripening, and in this respect it offers a contrast to its rival cereal wheat, which requires the highest temperature during the period when the grain ripens.

8. Report on the Marketing of Rice in India, 1941, p. 13. It is very doubtful if this conclusion is warranted, especially when there is such a remarkable dearth of rice in this tract at present.

9. In Japan, rice is cultivated as far as 42° N where the average summer temperature is 70° F and in Italy, it reaches the latitude of 45° N. Since 1928, the zone of rice production in N. E. Asia has been pushed considerably northwards, chiefly as a result of Japanese and Russian enterprise and is now probably about 48° N.

According to Akemine, the minimum temperature for germination is 10° to 13° C (50° to 55° F), the maximum 40° C (104° F), and the optimum 30° to 35° C (86° to 95° F). Silayan working at Stanford obtained similar results on Japanese and Italian types. Copeland found that the seeds of Louisiana and the Philippines do not germinate at 12° C (54° F) and that even at 20° C (68° F) germination is incomplete. Independently, this was confirmed by McLean in the Philippines. The obvious conclusion is that the varieties grown near the northern limit of rice culture can germinate at materially lower temperatures, than the characteristically tropical varieties.[10]

An average temperature of 95° F to 105° F is a suitable maximum for rice growing. With sufficient water-supply, it can stand even higher temperatures,[11] but it cannot withstand too low a temperature during the growing season. Too low a temperature may either kill the plant,[12] or arrest the activities of the plant without doing any irremediable harm, (except by exposure to injury consequent on the delay involved), or destroy vitally important structures without killing the plants, e.g. the blasting of the crops by frost, either during, or soon after flowering. The greatest damage it suffers from cold is when it is forming tillers.[13] Great daily variations of temperature are generally intolerable.

The total temperature required to mature a rice crop (obtained by an addition of the mean daily temperatures throughout the growing period) has been determined in Spain and Italy for a number of varieties and found to vary between 2,500 and 4,000°F. The Chinese put it at 2,400 to 3,000°F and the Japanese at 3,500°F. In Madras, they vary from 7,500°F for a three months' crop in Malabar to 16,800°F for a six months' crop in Tanjore. There is thus no uniformity in the total temperature requirements among the different varieties. It is also probable that a particular variety of the plant gets so used to its environment that it does not thrive under different conditions. This is to some extent indicated by the

10. Copeland, Op. Cit. p. 7.

11. High temperatures are said to injure rice, but the statements are not accompanied by field evidence. See Copeland, Op. Cit. p. 8.

12. Although there are Korean varieties which can withstand frost.

13. Ramiah, op. cit. p. 4, e.g., in December-January in Godavari, the cold inhibits the early growth and tiller production and makes the crop subject to insect pests.

fact that all trials made in Madras to grow the Japanese and Italian varieties have proved futile, since they have ripened too quickly to be of use economically.

While heat is essential to the cultivation of rice in bulk, it is found to do well in countries where intense cold prevails for a portion of the year, as in the Caucusus, Himalayas, Japan and Manchukuo. Prolonged cold however delays flowering and ripening.

Rice can be grown up to 7,000 or even 8,000 feet elevation as in the Himalayas and is regularly grown up to 3000′ in Java, Madagascar, Mysore, Wynaad and Coorg and up to 5,000′ in the vale of Kashmir. It is however found that low temperatures delay flowering, e.g., at Gudalur, at an altitude of 2,000′ to 3,000′ above sea-level, rice which matures in 4 to 5½ months in the plains, takes nearly six months or more to ripen.

Light:—Though there are exceptions, rice generally requires plenty of light and it is certainly one of the light-loving species.[14] Prolonged cloudy weather is everywhere recognised as detrimental to it delaying its development at all stages after germination,—particularly so, at germination and when the crop is in flower,—and making it susceptible to disease and other injury. A summation of the hours of sun light may perhaps be significant in defining the climatic conditions for rice culture.

The ash content of rice straw being high, large quantities of water must be transpired by the plant and hence the need for light. Active transpiration is necessary for the sake of an adequate supply of food from the soil. The rate of transpiration is governed by two factors (i) the openness of the stomata and (ii) the possible rate of evaporation of free water. The former depends upon the illumination and the amount of water in the plant, the latter upon the temperature and the dryness of the air. Direct sunlight makes the leaves materially warmer than the air about them, which increases the transpiration, and hence the need for sunlight. A drainage of the water, during some part of the season of growth, also promotes transpiration.

Gentle movement of the air is favourable to the vegetative vigour of rice, as it increases transpiration and assists in the move-

14. In Malabar, there is a variety of rice—Chennellu (red rice)—which is successfully grown under shade.

ment of gases which prevents saturation of the air about the leaves. Violent wind, however, is dangerous, as it wears down the dykes by wave action and causes lodging[15] and shattering of the ripening crop. The choice of varieties which do not lodge or shatter badly, and the retention of deep water as late as is practicable are means of minimising this danger. Continuous submergence predisposes to lodging by interfering with the mechanical tissues of the culm and stimulating its growth in length. Too much nitrogen works in the same way by stimulating growth in height and of the leaves. Cold weather at the time when stooling should be most active, checks root development and results in lodging.

Humidity:—Correct information about the requirements of rice with regard to atmospheric humidity is lacking but it appears to stand wide variations. Constant high humidity is likely to make heavy crops impossible, although no direct field evidence is available.

Rainfall:—Being a semi aquatic plant, more important than even temperature is an adequate supply of water, available either as rainfall, or as irrigation. In parts of Sind where the rainfall is less than 10″ it is grown, but water has to be artificially supplied; and in Malabar, it is grown with the help of rains only. This distinction, whether it is grown under irrigation or otherwise, divides the cultivation of rice into two categories; (1) lowland or wet cultivation and (ii) upland or dry cultivation. Nearly 98% of the world's rice crop is a wet crop; water in fact so dominates over other climatic factors that with good irrigation facilities, it is the safest of all the world's great crops. The choice of varieties, the preparation of the land and the cultural practices are all adapted to the quantity and the period of availability of the water.

As a swamp crop requiring flooding from the time of sowing till maturity, a five months' crop requires about 70 acre inches of water.[16] For good crops, an average rainfall of 1″ in 2 to 3 days thorughout the growing season is considered necessary, if the

15. As the crop fills and the plants come to bear a considerable weight at the top, winds may blow them over, or they may even fall down themselves. The rice is then said to be lodged.

16. In Italy a five to six months' crop is said to take about 100 acre inches.

crops depend only on rainfall. The rain must be well distributed without the dry spells being longer than ten days; the heavy rainy period however should not synchronise either with sowing or harvesting. It has been found that a long break during the growing period followed by heavy rains at the time of harvest, not only reduces the yield considerably but damages the quality of the rice. Serious deficiency in rainfall cannot always be made good by artificial irrigation, because the available water will have to be distributed among all the other competing *Kharif* crops. Where irrigation facilities are perfect, no rainfall is needed,[17] but where they are not provided, rice must depend on the rains and the accompanying cloudiness is then an evil.

In the case of rice, the water requirement does not give a true indication of the amount of water which must be supplied to the field. Varieties differ exceedingly, upland rice thrives in unsaturated soil, while most varieties require more or less submergence, and some thrive in water 6″ to 15″ deep. It has been found that the least water requirements were shown by plants growing in soil to each 200,000 parts of which there had been added one part of calcium nitrate and substances yielding two parts of soluble sulphuric acid.[18]

Very much more complete information, especially as to the relation between the water requirement and the climatic and soil conditions ought to be obtained, because of the intimate relation between this subject and the plants' use of fertilisers.

The total quantity of water required by a rice crop under swamp conditions varies according to (1) the duration of the variety, (2) the soil in which it is grown, and (3) the nature of the particular irrigation system, etc. As yet, no direct information is available which gives the relationship between the yield and the duty of water. The greatest amount of water is required when the water is just let in and the fields are puddled; after the fields are in flower, the quantity required is less. The requirements[19] at Coimbatore for the CO 3 variety are as follows:—

17. There is however a popular saying which suggests that without rain water which is necessary to wash the leaves of the plant, the yield will not be good.

18. Copeland, Op. Cit. pp. 18, 19.

19. Ramiah, Op. Cit. p. 52.

	Acre inches including irrigation and rainfall.
Preparation of plots up to planting	25·63
Planting to flowering	48·27
Flowering to last irrigation	10·89
Total. ..	84·79

The drainage of the water before the harvesting should be done neither too early nor too late.

Rainfall plays an important part in determining the extent of irrigated and unirrigated areas; where precipitation is more than 50″ per annum as in Bengal, Assam, Bihar and parts of the United Provinces, the area irrigated is much smaller than that dependent on rain. On the other hand, where the rainfall is light and variable as in the Punjab, Sind and in many parts of Madras, the area under irrigation greatly exceeds that dependent on natural conditions. Of all the crops grown under irrigation in India, rice is by far the most important, occupying nearly 30% of the total irrigated area.[20] The average figures for the decade 1927-37 show that out of a total area of 76 million acres under rice, 20 millions are irrigated.

(To be continued)

20. Wheat, the second largest food crop in India, occupies only 14% of the total irrigated area.

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Location of the Original Aryan Home and Other Early Aryan Settlements

A Historico-Geographical Solution of the Problem

BY

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THE ARYAN HOME

CHAPTER I

INTRODUCTION

One of the most knotty problems of the Historical Geography of Asia is the location of the original Aryan Home. Hitherto only Oriental scholars have attempted its solution, most of them having depended upon the scriptural texts of which the translations were doubtful, and a few of them even upon uncertain philology and linguistic palaeontology. None of these scholars had a clear idea of the major geographical aspects of the regions they were dealing with, nor was there any correlation sought between the description of the Aryan Home given in the available literature and the physical environment of the localities, provisionally identified by them. The result was a vague and unscientific generalisation which cannot be accepted by any modern geographer.

While some of the European Orientalists had a distinct bias towards their home-lands and proposed the location of the Home somewhere in Europe, Tilak and his followers clung to their pet theory of the Arctic Home from meagre literary data and from miscalculations and strange notions of geological and archaeological discoveries, even to the extent of supposing that radical climatic changes had taken place in Asia within the past 10 or 12 milleniums!

But Europe, really speaking, is a mere peninsula of Asia. For centuries before any Aryan (civilised) tribes entered a European country, there was cultural darkness prevailing in it. In Europe actually the Neolithic Age began a thousand years after Asia experienced it, and the Bronze Age came to Britain full 2000 years later.[1] Again, though Asia is the most cultural continent in the world, it is not *materially* changed in its geography during the last few milleniums.

Fantastic conjectures were made by these Scholars from the state and development of the spoken and written languages, *without* any regard to the distances travelled by the tribes, their mode of living, the native soil, the water supply, the economic resources found, the natural obstacles or hindrances they could overcome, the natural catastrophes through which they had to pass, any lines of communication that were available and the stage of evolution they could reach under the natural, physical conditions.

THE OLD THEORIES

The following Table shows the main theories propounded by the Oriental scholars[2] so far :—

Name of Author	*Location of Aryan Home*	*Remarks*
1. Mr. Balgangadhar Tilak.	The Arctic Home.	Doubtful translations of the Vendidad and wrong geological dating. The author thought the Arctic Region had quite a different climate, and conditions prevailing in the Tropics today, prevailed within the Arctic Circle about 10,000 B.C. and in the Inter-glacial age. Vedic antiquity is exaggerated .

Name of Author	*Location of Aryan Home*	*Remarks*
2. Prof. Max Muller.	The Pamir.	Central Asia home-land. Credit given to Asia as the mother of civilisations. Oriental scholarship valued. This theory was long upheld.
3. Prof. Dr. O. Schrader of Breslau.	The Lower Volga.	A sort of *a priori* argument from a study of Slavonic languages.
4. Dr. Peter Giles (Cambridge).	Hungary.	A junction of languages, within the limits of the Carpathian. Mts. A linguistic study with a bias for his homeland as Aryan relics are also found here.
5. Dr. Latham.	Scandinavia.	*A priori logic.* From a study of Scandinavian languages.
6. Dr. Hirts.	S.E. shore of the Baltic.	Lithuania, from the primitive condition of the Lithuanian language spotted here.
7. Dr. Sirdesai.	Lake Balkhash.	A strange comparison of the land of the Seven Rivers (Punjab) with this region, showing small streams on the sides of the Lake, compared to the mighty rivers of the Punjab.
8. Several other scholars.	Asia Minor.	From the discovery of the Hittite inscriptions, showing Vedic gods etc.
9. Mr. J. D. Nadirshaw.	Azarbaijan.	Evidently some parts on the Iran plateau were given the same names as of old, Airyane vaejo recalled, so to say. The Araxes river compared to the Daitya of the Avesta. Supported by Dr. J. J. Modi.

Name of Author	*Location of Aryan Home*	*Remarks*
10. Dr. A. C. Das.	Sapta Sindhu (Punjab).	Picture of the Aryan Home given in the Rig Veda, which may have been partly written on the banks of the Sarasvati, now lost in the Rajputana desert. It does not mean that the *old* Aryan Home also was located here. How and where could the ancestors of the Persian Aryans and the Vedic Aryans live together in a *common* home? A *prejudicial* theory. The Arghandab in Modern Afghanistan has been identified by Stein as the Western Sarasvati.

DEFECTS OF THE INVESTIGATIONS

Some of these theories were based upon the assumption that the language stream *first* started from the proposed localities, while they were, in all probabilities, mere *halting* places of the Aryan tribes, as they went on, migrating from one place to another, after their separation from the original Aryan cradle. They cannot be taken for granted as the chief centres, merely from a study of comparative philology and a discussion of the names of plants and animals and also from any grammatical relationship between the words of different languages.[3] Besides, the authors did not verify their statements with the actual physical conditions found in the lands of their choice. It was generally forgotten that for human beings to exist and to produce a civilisation *as high as that of the Aryans, a most suitable and congenial region was needed for the interaction of man and nature.* Human evolution, it must be remembered, is an exceedingly slow process and the general tendency of the human race is to settle in those areas most suitable to the supply of their needs and to the development of their peculiar genius. A very high mountain top, a marshy, open and unprotected plain or valley, a distant sea-shore having no connection with any transcontinental trade routes, or an out-of-the-way place

far removed from the old and civilised centres of Asia, or a locality in the frigid zone of the earth on the presumption that it had a tropical or subtropical climate about 10,000 years ago, cannot be the probable Home of the Aryans, who developed a high degree of *culture, born of the natural environment,* in which they found themselves in that age. Evidently the physical map of the then-known world was not before the eyes of the researchers. How the tribes could migrate from one locality to another, what resources and materials they found and utilized, what natural obstacles they had to overcome and what routes they had to follow, these had not struck them. Besides, the *extraordinary* physical and climatic changes assumed by some of the authors have not been accepted by geographers of today.

TILAK'S THEORY OF THE ARCTIC HOME

Balgangadhar Tilak has been particularly at pains in his "Arctic Home of the Vedas" to prove that the original Aryan Home must be within the Arctic Circle, and it is necessary to examine this theory in detail. Summarising his treatise of the Glacial Period based upon certain scientific data, he says:—

"(1) In the very beginning of the Neolithic age, Europe is found to be inhabited by races from whom the present races of Europe, speaking Aryan languages, are descended.

(2) But though the existence of an Aryan race in Europe in early Neolithic times is thus established and therefore the theory of migrations from an Arctic Home in Post-Glacial times is untenable, it does not prove that the Aryan race was autochthonous in Europe and the question of its original race home cannot therefore be regarded as finally settled.

(3) There are good reasons for supposing that the metal age was introduced into Europe by foreign people.

(4) The different ages of Stone, Bronze and Iron were not synchronous in different countries and the high state of civilisation in Egypt is not, therefore, inconsistent with the Neolithic stage of European civilisation at the time.

(5) According to the latest geological evidence, which cannot be lightly set aside, the last Glacial period must have closed and the Post Glacial commenced at about 10,000 years ago, or 8,000 B.C. at the latest, and the freshness of the Siberian fossil deposits favours this view.

(6) Man is not merely Post Glacial as he was believed to be some years ago and there is no conclusive geological evidence to prove his wide-spread existence in the Quarternary, if not also in the Tertiary era.

(7) There were at least two Glacial and one Inter-Glacial period and the geographical distribution of land and water on the earth during the Inter-Glacial period was quite different from what it is at present.

(8) There were great vicissitudes of climate in the Pleistocene period, it being cold and inclement during the Glacial, and mild and temperate in the Inter-Glacial period, as far as the Polar region.

(9) There is enough evidence to show that the Arctic regions both in Asia and Europe were characterised in the Inter-Glacial period by cool summers and warm winters,—a sort of what Herschel calls a *perpetual spring;* and that places like Spitzbergen, where the sun goes below the horizon from November to March, was once the seat of luxuriant vegetation that grows at present only in temperate or the tropical climates.

(10) It was the coming of the Glacial age that destroyed this genial climate and rendered the regions unsuitable for the habitation of tropical plants and animals.

(11) There are various estimates regarding the duration of the glacial period, but in the present state of knowledge it is safer to rely on geology than on astronomy in this respect, though as regards the causes of the Ice Age, the astronomical explanation appears to be more probable.

(12) According to Professor Geikie, there is evidence to hold that there were in all five Glacial and four Inter-Glacial epochs and that even the beginning of the Post-Glacial period was marked by two successions of cold and genial climate, at least in N.W. Europe.

(13) Several eminent scientific men have already advanced the theory that the cradle of the human race must be sought in the arctic regions and that plant and animal life originated in the same place".[4]

Relying also upon other doubtful astronomical data, Tilak calculated that the vernal equinox was in the constellation Orion during the period of the Vedic hymns about 4,500 B.C., but it receded to the constellation Pleides in the days of the Brahmanas about 2,500 B.C. According to him, therefore, the ancestors of the

Vedic Rishis lived in the Arctic Home in Inter-Glacial times! The commencement of the Post-Glacial period is placed at 8,000 B.C. Certain passages in the Rig Veda have indicated to him the Polar attributes of Vedic Deities and a type of mild climate which prevailed during the Inter-Glacial times at the North Pole. He also believed firmly that the Aryans lived there *before* the last Glacial epoch. Thus, it is upon the Vedic texts and legends examined by him in his notable publication that the author strongly relied in the first instance. (Ref. Rig Veda, I 64, 14. II 33, 2. V 54, 15. VI 48, 8).[5] Credit should be given to him for trying to corroborate these statements with the geological and climatological researches, made during his time. But there are glaring defects left in them. Not satisfied with these, he turned to the sacred books of the Parsees and sought a second-hand information about the original Aryan Home, called Airyana Vaejo, (the seed of the Aryans), given in the Vendidad (Ref. Fargards I and II).

He proudly called the Avesta *"the oldest traditional record preserved by human memory* as an ancient record or tradition", and stated:

"(1) That the Airyana Vaejo had originally a good climate but Anghra Mainyu converted it into a winter of ten and a summer of two months.

(2) That the Airyana Vaejo is so situated that the inhabitants of Yima's Vara therein regarded the year only as a day and saw the sunrise only once a year.

(3) That the happy land was rendered uninhabitable by the advent of a Glacial epoch, which destroyed all life therein".

Thus he was satisfied that, even in the Avesta, there was "a real historical reminiscence of the Arctic cradle of the Iranian or Aryan races and that the Fargard gives us a description of the countries through which the Indo-Iranians had to pass before they settled in the Hapta Hindu or on the floods of the Rangha at the beginning of the Post-Glacial period".[6]

Putting both the Avesta and the Vedic evidences together, Tilak ultimately concluded that the Indo-Iranians did live together near the North Pole, that that home was destroyed by the coming of the Glacial epoch and that they had to migrate through several parts of Asia *southwards*, eventually to settle in the valley of the Indus.[7] These are some of the dates given by him:

B. C.	10,000—8,000	Destruction of the Aryan Home by the last Ice Age and the commencement of the Post-Glacial age.
,,	8,000—5,000	Age of Migration from the Aryan Home.
,,	5,000—3,000	Vedic hymns composed.
,,	3,000—2,500	Separation of the Vedic Aryans from the Persian Aryans.
,,	1,400— 500	Pre-Buddhistic Period and the composition of the Sutras.

REFUTATION OF TILAK'S THEORY

(1) In the first place it should be noted that Tilak wrote his famous book when he was a political prisoner in a jail and therefore he could not have had a proper access to a library, although he has marshalled the data thus collected by him exceedingly well.

(2) Dr. Croll's theory of the Ice Age, on which he relied so much at the time, has been disproved now, so that his main scientific support is gone. Man could not have been much better than other lower animals in that age. The latest geological researches can be summed up in the following words:

"The whole period of man's presence on the earth, which is estimated at 50,000 years, coincides with the later phases of the last Ice Age. Geologists recognise four main stages in the Quarternary (or last) glaciation in Europe and North America. After each glacial onset, when glaciers extended southwards from Scandinavia into the North European Plain, there followed an inter-glacial period of great length, when climate improved, becoming even warmer than to-day and thus provided conditions suitable to human existence. The last stage of the Ice Age, the Würm phase, began about 40,000 B.C. and lasted in Sweden until about 6,500 B.C., but small re-advances of the glaciers occurred in the sixth millenneium (i.e. 6,000—5,000 B.C.). The earliest evidences of human species which were other than the species *Homo sapiens*, the sole survivor to-day, may be dated at least as early as the inter-glacial period which preceded the Würm phase. The more recent periods of history which succeeded the disappearance of the Würm glaciers correspond with yet another inter-glacial period, in which we now live".[8] So the glacial ages come and go, giving opportunities to man to evolve himself more and more. Man has been on the planet for many milleniums. But to put him in the *stage of the Aryan civilisation as early as* 10,000 *years ago and that too in the Arctic region only, is not right.*

(3) The dating of the various archaeological strata is also faulty. Tilak puts the oldest Vedic age at 10,000 to 8,000 B.C. and the continuation of the Aryan Home upto about 2,400 B.C. when the separation started. At the most, man could only be in the Neolithic stage most of the time, while the Aryan civilisation, not mere culture, was much higher in its development and later in its age. The latest archaeological discoveries[9] in many parts of the world have enabled scientists to fix the required dates approximately as under:

B. C. 50,000—Fourth and last Glacial Age (Cave man).
,, 35,000—Early Palaeolithic Age (Unpolished stone implements).
,, 15,000—Later Palaeolithic Age (Reindeer man).
,, 10,000—Neolithic Age (Polished stone culture).
,, 6,000—Chalcolithic Age (Sumerian culture).
,, 4,000—Bronze Age (Creative efforts of man begun).
,, 1,500—Iron Age begins. Age of cultivation, etc.

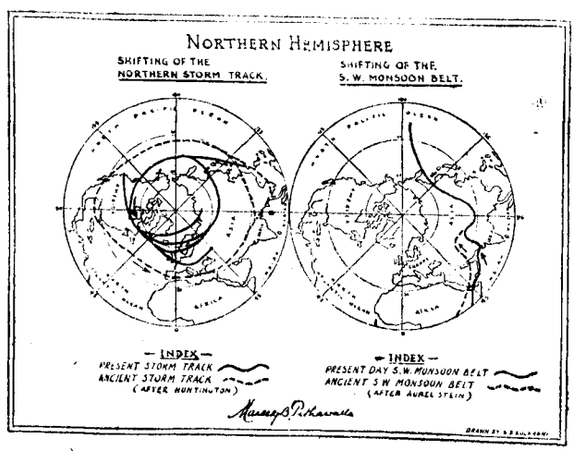
(4) To say that such a high civilisation as that of the Aryans depicted in the Avesta and the Sanskrit literatures could exist near the North Pole during the Inter-Glacial period and that the present Arctic regions had at that time "long summers and short winters" or a "continuous spring time" or "a year as a day" etc., is to belie all scientific truths. Also within the Arctic Circle there are such few masses of land that it is difficult to know which of them was so suitable for the evolution of man. (See Map I) Even Huntington's theory of the shifting of the High Pressure Belt will not help here, as no changes have taken place within the Arctic region (See Diagram). It is true, man did exist then not only in a particular part of the world but wherever nature could give him shelter and opportunity, but he was in a most primitive state of evolution.

(5) There is no doubt that the earth's axis is changing and that where there is the present Polar region there was a tropical climate, as is evidenced by the presence of coal deposits in it; but that was in very old geological times, when even the animal world had not properly evolved e.g. the Permian era, about 50 or 100 million years ago. Besides, the land of Asia had not then evolved to a definite stage with a definite hydrography. The process of such universal changes is *extremely slow*, and in this connection really "a year is as a day" speaking metaphorically. To connect such a strange geological event with an event in the pre-history

of human beings, whose existence started only "yesterday", is ridiculous.

(6) It is true that the author or authors of the Vendidad had some noble recollections of such natural cataclysms as glaciation, approach of ice or flood, etc. But to connect them with the events in the actual Aryan Home in the Arctic region is far-fetched and fantastic. What was very likely was that wherever this Home was located, some kind of advancing glaciers flowed down from the neighbouring mountains or the breaking of a glacial dam, such as the Shyok dam, was forecast in a divine dream dreamt by King Jamshed and he undertook to protect his population by means of a Vara or Cave (Ref. Vend. II).

(7) The list of the 16 chosen lands of Ahura Mazda depicted in the Avesta (See later) is most precious from the point of view of Asia's historical geography. It is not a mere geographical list without a bearing on its history. The author had some definite knowledge of the geography of Aryan migrations through parts of the Iran plateau and neighbouring lands. They follow one another in some regular order from north to south and from east to west, like the order of the rivers mentioned in the Nadisruti, detected by Sir Aurel Stein.[10] If, then, the author of the Vendidad could give a more or less accurate list of localities occupied by the early Aryans in regular succession, one by one, e.g. Locality No. 2 is Sughdha or Sogdiana or Samarkand and No. 3 is Mouru or Margu



or Merv, and we know the actual distance between these two localities is only about 200 miles, how could the distance between locality No. 1 i.e. *Airyana Vaejo*, imagined to be in the Arctic region, and No. 2 be 2,000 to 3,000 miles! How could this very first migration

from locality No. 1 to locality No. 2 take place through miles and miles of iceland or forest land at first and then through an equally long distance of desert land. Tilak would like to quote the Vendidad as it suits him; otherwise, how could the Aryans jump from their favourite Airyana Vaeji (North Pole) to Samarkand area near latitude 40° N.

(8) The passages quoted by Tilak from the Vendidad to prove the nature of the Aryan Home, are unfortunately very obscure, e.g., the picture of King Jamshed's Vara prepared to protect himself and his godly kingdom against the onslaught of the flood. In this underground enclosure, there are some "artificial lights and natural lights". But about the natural lights the passage is made to read thus: "Once only *in the year* the stars and the moon and the sun are seen to set and to rise; and they thought what is a year to be a day". (Vend. II 40, 41).[11] But the translation is not correct. The Avesta words actually are: *Hakêrêt*=but once and no more. *Zi*=verily. *irikhtahê*=of rising (6). (variant *iristahê*=of setting or dying?). *sadayacha*=in setting (7/1). *vaenaitê*=he (Jamshed) sees. *starascha*=of stars. mâoscha=of the moon. *hvarecha*=of the sun. Thus the sentence literally means: "He (Jamshed) indeed sees the rising and the setting of the stars, the moon and the sun *but once*". There are no words in the original Avesta for *"in the year"*. This phrase is deliberately added to the translation to convey the required meaning. One of the scholars, Harlez, translates the passage thus: "(To the people in the Cave) the stars, the moon and the sun all seem to appear together at the time of rising and of setting". Referring to a previous sentence (Vend. II, 38) he says: "On account of the doors and windows made in the Cave, there was natural light during the day and artificial light during the night". Kavasji Kanga also suggests "The stars and the moon and the sun (*daily*) appear to rise and set once, because there were ventilations in the Cave and so light used to come in during the day". Again in the very next sentence Vend. II, 41) the words are: *Taecha*=They. *ayare*=a day. *mainyêintê*=think or consider. *yat*=which (is) *yârê*=a year. The sentence must therefore read as. "They consider a year as a day". Darmesteter has translated the passage: "The one thing *missed* there is the sight of the stars, the moon and the sun, and a year is thought only as a day". Harlez says that "a year appeared to them like a day"! M. P. Madon translating this into Gujarati suggests: "The earth rotates once in one year". Evidently the Vara (Cave) is an underground enclosed cave and the rising and the setting of the heavenly bodies cannot be seen regularly there. It is either a prolonged day with the artificial lights, or a prolonged

night without them. Beyond this, a critical translator would not read more. But to follow Tilak blindly in his arguments with such a doubtful and twisted interpretation of a damaged text is unthinkable. Even the cases of the few nouns in the passage are not clear in the present condition of the manuscripts and several variants are shown. This helps the translator to twist the meaning, as he likes. In fact, "the phraseology of ancient religious literature is not so clear as to suit the requirements of the rigidity and exactness of modern science".

(9) Another very doubtful passage from the Vendidad quoted by Tilak as a pillar passage to serve his purpose of proving a congenial climate for the Polar Aryan Home is Vend. I, 1·4 viz. "10 months of winter and 2 months of summer". But in some editions and in all Pahlavi versions this sentence is immediately followed by another, stating, there were "seven months of summer and five months of winter". Westergaard in his Avestan text actually gives this second sentence, while Speigel and Geldner do not. Kanga also gives it and adds his own comments thereon thus: "But here, (that is, where the Vendidad was written) seven months of summer and five months of winter". Darmesteter does not give this sentence in the translation of the text but makes a footnote thus: "Vendidad Sâda: 'It is known that (in the ordinary course of nature) there are seven months of summer and five months of winter'. (See Bund. XXV)". How this double statement appears in the avestan texts is a mystery. It cannot be said with certainty as to which one is the original and which the interpolation. Tilak goes a step further and states that before the advent of Ahriman (Evil Sprit) there were in *Airyana Vaejo*, "10 months of summer and 2 months of winter", but the condition of the climate was *reversed* by him! All this appears to us as an *a priori* argument. The Ice Age had to be brought in somehow and the climatic conditions purposely reversed. It means vast orographical and meteorological changes which are quite unwarranted, even supposing that the Aryan Home flourished in one of the Inter-Glacial periods, which it really did not.[12]

It is possible that even in lower latitudes, where there are high mountain chains such as the Pamirs and settlements are located at high altitudes, the climate resembles that of "Ten months of winter and only two months of summer", as on hill stations it is generally found that *what is lost in latitude is gained in altitude*. But, in any case, the argument, advanced by Tilak from the Vendidad in this connection, of a *radical* change in climate, is untenable.

(10) It is distinctly written in the Vendidad that Airyana Vaejo (the Aryan Home) was in the valley of the Vanghu Daitya river (Veh-Daiti river in Pahlavi). But on the authority of one translator Tilak would have his readers believe that there was no such river but the word Ven-Daiti or Vanghu Daitya merely meant "of the good creation" literally. Mr. N. M. N. Kanga translating the Pahlavi Vendidad at Fargard I, 2, says: "It is called 'of Vehdaiti river' because the Daiti river in the country flows through this place of Iran Vej and agriculture is carried on by the waters of the canals cut from it. Or others say—There is no river Daiti but only canals cut from it pass through the country of the writer". Abundant references to the river or rivers however have been found also in the *Bundahishn* another Zoroastrian book.

OTHER THEORIES EQUALLY UNACCEPTABLE

So the theory of the Arctic Home cannot be accepted by geographers. Among the other theories, that of Prof. Max Muller, suggesting the Pamir region to be the Home, seems very near the mark. But even here a civilisation to take place and flourish on such high mountain tops, covered with snow for the greater part of the year, is impossible, nor could the 'seven rivers' falling into the Balkhash Lake according to Dr. Sardesai be the Home we are searching for, for the simple reason that they are so small, falling into a small lake and the whole plain is exposed and unprotected, such as the whole of Siberia is, and is not in any way safe from the onslaughts of wild and wandering tribes, which were so dreaded by the people of Iran Vej. Our Home must have been well protected from all nomads, who were living in the surrounding low lands. Both Asia Minor and the Sapta Sindhu are so far removed from the Original Aryan Home that geographers are wondering as to how such a high culture as that of the Aryans could develop simultaneously in both these localities, how and where the different branches of the Aryan race could at first stay and mingle sufficiently to have both their languages and literatures so amazingly alike and how the physical features and climatic conditions depicted in them could be correlated to those of the regions identified. Even Azarbaijan is out of the question, because there is no great river there found, like the mighty Veh Daiti, and the climate of this side of the Iran plateau differs from that of the Aryan Home. Sir J. J. Modi and Henri Rawlinson also thought Azarbaijan to be Airan-vej; but they depended too much upon Pahlavi and foreign writings. Very likely this province was a second Iran-vej. If a scholar in the past was however, nearly successful in solving the problem it was Baron Bunsen who suggested some uncertain place between

the Syr Darya and the Amu Darya (See the map given by Sir J. J. Modi in his "*Geography of the Avestan Age*" on page 123).[13]

AID OF GEOGRAPHICAL SCIENCE

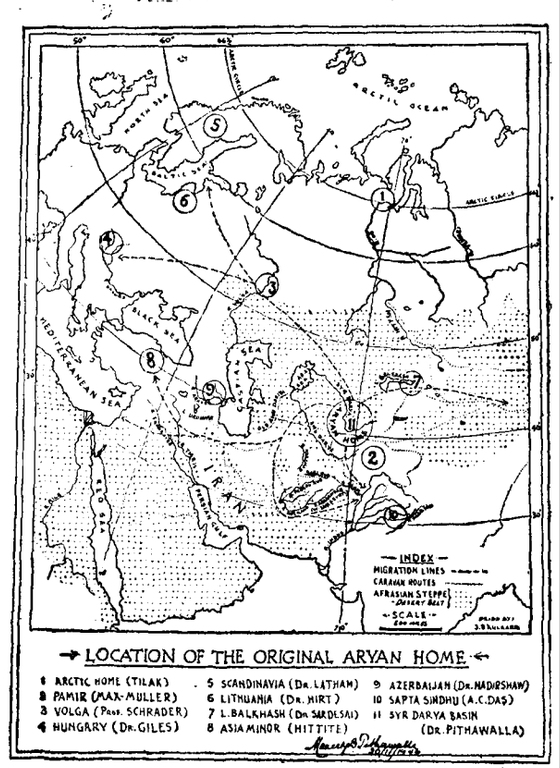
Not satisfied with any of these theories propounded by the Orientalists, I have sought the aid of Geography for the solution. As hinted above, the scholars in the past have relied too much on the written word, its philology, palaeontology etc., but not on the main element of *the geography behind history*. There is no doubt that Geography is the most reliable document of Nature to be utilized for the solution of all problems of ancient history. If Aryan civilisation with its proverbial greatness is to be emphasised, the *physical* surroundings, in which the civilisation grew, can never be ignored. Again the physical factor does not always remain the same in all ages. It also changes with the times and hence the history. History was *ninety-nine per cent* geography in the Aryan Home as it was then so powerfully controlled by nature. Even in the Vendidad, quoted above, references have been made to certain natural obstacles which man had to encounter, *viz.*, the terrible cold brought by the Devil with him and Airyana Vaejo suffered from it, the movements of glaciers down the great mountain chains, the coming of the flood, the wants of food and water, the creation of the serpent in the waters of the Vehdaiti river, also the wind storms, the soil erosion etc. Very small adjustments to the physical environment could be then made by man at such an early age. Therefore, the *place* factor along with the factors of time and man must come in at any cost and all the physical elements such as the rocks, metals, waters, plants, and animals, affecting man's activities within the region wherever it was, and even his religious dogmas whatever they were, must be corelated. Thus geography must be recognised "as the common denominator to history", especially the history of the Aryan age when man was trying to control nature *for the first time*. Nothing of the kind was possible in the region of the North Pole, for instance, the environment being so monotonous for the greater part of the year. At the most, man could only hibernate in it without a rhythm of life, without any stimulus which is the most necessary concommitant of a civilised life. "The greater the ease of the environment", says the geographer Toynbee, "the weaker the stimulus towards civilisation".

SEARCH FOR A BETTER AND MORE LIKELY LOCALITY

Since the old Aryan civilisation has its hold even today on such far-off countries such as Ireland in the west and China in the

east, Scandinavia in the north and the East Indies towards the south, *geographically* the chosen land must be *centrally* situated somewhere in Asia, as some of the scholars like Max Muller and Bunsen have rightly surmised. There cannot be any lobsidedness allowed in such large-scale migrations of the Aryan race.

Working upon the principles of Science that the axis of the earth has not turned round appreciably during the past 10,000 years or so, that the civilisation of the early Aryans was a protected river-valley civilisation, that the life of the people was securely settled and was of a pastoral character with the best possible use made of the plant and animal life found in the region and that for producing a high civilisation, there must be some natural obstacles serving as stimulants to man, I have searched for a suitable Home between the latitudes of 66½° N (the Arctic Circle) and 40° N., leaving off the Tundras and other northern parts quite out of the question, as only lichens and mosses could grow in such areas.[14] **(See Map I).**



In front of us there is the vast plain of Siberia, the largest and flattest in the whole world, "too unwieldy for any real coherence

for a sufficiently large population, inaccessible from the north due to the polar ice-cap and also from the south due to the dry desert belt". There is no high snow-capped mountain here except the Urals, only about 5.000 feet in altitude. It is a plain sloping towards the north, and therefore not receiving the direct rays of the sun and is also exposed to the cold winds from the north and deprived of the warm moisture-laden winds from the south due to the tremendous mountain chains intervening. Siberia is more suitable for a penal colony than an Aryan home even now after the mighty nation of U.S.S.R. has done its best for the land so far. Transport problem is the worst here. Any movements that have taken place during the pre-historic and historic periods are mostly east-west or west-east and not north-south, e.g. the modern caravan routes, or the trans-Siberian railway. This land is largely covered in the north by a belt of temperate coniferous forests even upto the latitude of 55° N. This could never be the homeland of the Aryans, who definitely lived in a *grassland* with their favourite herds of cattle, sheep and goats, and doing mixed-farming besides. Within this forest belt, human life could only depend upon hunting and fruit gathering, which stage the real Aryans had already passed. These are the words from the Avesta worth quoting: "Hormuzd (the Almighty) created Iran Vej (Aryan Home) better than the remaining places and districts, and its goodness was this, that man's life is three hundred years and cattle and sheep are a hundred and fifty years and their pain and sickness are little". But these Siberian localities were very thickly forested even upto the close of the Palaeolithic age and hitherto man had not gone further north than the latitude of the Baltic sea even in Europe. His growth in these parts was stunted and his life monotonous at its best.

Below the forest belt of Siberia, there is a small belt of temperate grassland and of black earth, between Lat. 55° N and 50° N, particularly in Central Asia, which is worth consideration. But the conditions of the few rivers found in it are not suitable again. They do not issue from great snow-covered mountain chains as the Pamirs or the Himalayas, to ensure a perennial water supply. They lie largely within the permanently frozen subsoil, not good for agriculture all the year round. There is, for example, the Ob with its tributary the Irtish, one of the greatest river-systems in the world, being some 3,300 miles long; but it is mostly ice-bound for as many as 200 days of the year, especially in its lower reaches within the Arctic circle. It covers in its upper valley a tremendous

area, quite unprotected, with no great centres of national homeland. It is now inhabited by ubiquitous nomads, preferring the tent to the house, with vigorous climate of the continental type and long ranges of temperature with little rain. The Yenisei valley further towards the east is even inferior to the Ob from the points of view of its narrowness, old rock-bed, poor soil, rougher surface, heavier snowfall and more forests, which are so dense that there are no chances of cultivation, irrigation, cattle-grazing etc. Extensions towards the *south* are not at all possible as is required by the history of the Indo-Aryan migrations. The Volga towards the west is another possible river valley on this side of Russia. It flows the other way round from the north to the south and falls into the Caspian sea. Consequently its upper valley is covered with dense forests, while the lower and deltaic parts, which Dr. Schrader suspected to be the locality of the Aryan Home, is a marshland upto the brink of the Caspian sea. And if the theory of the shrinking Caspian basin be true, the chances of the Volga being the Homeland would be fewer still. The smaller Ural river is still worse off in this respect. The climate of these valleys is also very rigorous, the temperature being over 70° F in July and—20° F in January with only one or two inches of rainfall. Here, too, the much needed *southward* extension of the Home is impossible. The Don, the Dneiper and the Dneister are valleys more suitable for permanent settlements, but they are far removd from other Aryan Asiatic settlements and are also archaeologically poor and backward.

THE AFRASIAN STEPPE-DESERT BELT

Between the latitudes of 30° N and 50°N, there lies today the Steppe-desert belt, which now remains to be considered. Though at present lying dry and desiccated, it is within these latitudes that there are some chances of locating the original Aryan Home. It extends from the Sahara in North Africa to the Gobi in China and lies mostly upon old crust blocks, with high plateau levels except for certain depressions now occupied by some of the most prominent alluvial rivers of the Old World. It is now generally recognised by geographers[15] that the climate of this belt was at one time more favourable than it is today. The ancient storm belt extended southwards and rainstorms were frequent. The present arid tracts were then grasslands with moderate rainfall well distributed throughout the year. At that time, it is natural, that the river valleys in the lower latitudes were not fit to be occupied by civilised races, "being overgrown with dense jungle and

About 6,000 B.C. when ice withdrew completely northward and also the storm-belt shifted northward, these Afrasian grasslands were deprived of the Atlantic storms and there was a gradual diminution of rainfall. Hence the *food-producing necessities* and the age of cultivation and animal husbandry were established on a grand scale. Even upto the middle of the 2nd millenium B.C. there was higher rainfall in these parts, until a state of want and scarcity arose, resulting in the separation of the clans and their migration *southwards*. Here, then, Nature challenged man, so to say, and he had to make a proper response, or go under. The spark of civilisation is rightly kindled here *for the first time* in the history of the Aryan race.

It must be clearly stated that, although such climatic pulsations or variations have been accepted by geographers for these latitudes, due to the shifting of the high-pressure belt and due to recession of ice of the last Glacial age, a long period of steppe or prairie-like condition arose and later still a warmer period suitable for forest growth, and then again a period of dryness have followed in Asia, we cannot advocate a radical alteration of climate, such as a tropical climate in the Polar regions and polar conditions in the tropics.

In a previous paper, I had hinted that the probable Home of Aryan civilisation might be found in the region of the Gobi desert.[16] Since then, many geological, geographical and archaeological investigations have been carried out and the result is unconvincing. Besides, the theory of a wholesale desiccation in Asia is in the melting pot. The general opinion now held is :—

"The prophecy, that the Gobi would be proved to be the home of Man, assumes that the *environment* of the terrestrial dinosaurian reptiles—such as flourished in all the continents during the Jurassic and Cretaceous periods,—was a suitable one for the evolution of arboreal primates or even of birds !"[17]

But even if such an Aryan centre is suspected in this area of the Gobi, it is so far removed, like the far-off Polar centre, from the second best land created by Ahura Mazda according to the Vendidad viz. Sughdha or Sacarkand, that it is unbelievable that the writer could not recollect any intermediate halting place between the first, the Gobi, and this second settlement lying some 2,000 to 3,000 miles apart. Assuming, again, that the climate of the Gobi region was congenial in the age of the early Aryans, it is likely that it was itself a *halting* place between the Central Home and

the green river valleys of China and lay across the great caravan route to the east.

The theory of the Gobi desert region was subsequently revised by me and other desiccated areas nearer the Iran plateau were also suggested viz., the Turfan, the Tarim and even the Caspian—Aral basins.[18] This opinion is corroborated by the British geographer, Mrs. Skeat : "In the Old World, the higher cultures were practically confined to the North Temperate zone approximately 24° N to 50° N latitudes".[19]

In fact, geographically as well as historically, the Caspian-Aral province is one of the most important regions within this Afrasian Steppe-Desert belt. It is really very dry today but it could not have been so in early pre-historic times. "Even if the basin was not the scene of the first fully developed human society, it was of immense importance in pre-historic times ; and so we must pay much more attention to it, especially to some details which must have been of prime importance to early Man. For the fundamental control here must have been in the climate and not, as on the Armenian Crown, in the relief ; and the climate does not seem to have changed materially in kind. The key to it is persistent drought in middle latitudes, with special relation to three factors—heavy snow on the mountain region, marked inversions of temperature on the piedmonts and the seasonal rain on the wide plains".[20] The geographical conditions in prehistoric times must have been favourable to man in this basin, viz., good grassland, good water supply, good food, animal transport, facilities for irrigation and agriculture, and the most important of all things, shelter and lower temperatures higher up the rivers, which flowed into this vast inland sea. Here Nature must have held man on trial, by putting hindrances in his path and progress, but when he tried to conquer nature in such conditions, evolution was assured and civilisation advanced as it would have advanced no where else. The conditions in this part of Asia "suggest that it had more advantages than any other area—except perhaps Egypt,—that has any claim whatever to be the nursery of human civilisation and again "the intrinsic importance of the cases must not be judged from their chequered story during the past millenium. In the dawn of history their natural security, their unfailing fertility, their adequate minimum area made them a—if not *the*—Home of civilisation".[21] Migrations from such a Central Home were unlimited and it is possible that some of the earliest were towards the fertile valley of the Nile, the island of Crete, the Tigris-Euphrates valley and even the Indus. Far from being dogmatic in our view that civilisation could grow and

develop only in one single locality as the original Aryan Home in Central Asia and then diffuse itself on all sides, I am inclined to believe that man did live also in other suitable parts of the World and his culture there was autochthonous. But what we are here concerned is *the birth and growth of the Indo-European or Aryan civilisation* as depicted in Oriental literature. From such a Central Home it could spread to other congenial parts of Asia and Europe, such as Azarbaijan, China, Asia Minor, South Russia, Lithuania and even Scandinavia and get *specialised* in them according to the peculiar natural environment found in them. Not only this but long after this specialisation in these early Aryan cradles situated in different parts of the Old World, there has been a certain Inter-regional exchange of cultures along suitable lines of communication. e.g. the exchanges of Sumerian culture between the Indus valley and Mesopotamia.

THE SYR-AMU DARYA DOAB THE MOST LIKELY LOCALITY

Hunting, therefore, for the most suitable river valley within this Afrasian Steppe-desert Belt, I have hit upon the Syr-Amu Darya Doab as the most likely Home Region of the ancient Aryan family, before they separated and migrated to other river valleys. At first the Syr Darya upper valley was most probably occupied and later on the Amu Darya with its tributary the Zarafshan protected by the highlands, became the homeland of the Aryans. This is the *Airyna vaejo* of the Zoroastrian scriptures. '*Nemô airyanê vaêjahi*'=Homage to the land of the original Aryans!—is the prayer even now recited by the Parsees from the Avesta (Ref. Yasht I, 21).

Correlations between the Geographical Aspects and the Literary Description of the Aryan Home Located

As stated above, the real Home of the Aryans, called *Airyna vaejo* was, according to the *Vendidad,* situated on a bank of the Vehdaiti river, with a mountain called Hara-berezaiti in the middle. It was the first best land created by Ahura Mazda, but Anghra mainyu the Devil caused severe cold (winter) there and also the 'serpent' in the river. It was so very cold that even the summer months "were cold to the water, the earth and the trees". This land was of high renown, a *meeting place* of celestial Powers and also the best of mortals. Yima (Jamshed) the King was the good shepherd of the place, where animals lived in the wilderness on top of the mountains and also in the bosom of the dale. Before the winter, the country could bear plenty of grass for cattle, sheep,

oxen, etc., and it was inhabited by good men, dogs, and birds. Red and blazing fires were also the characteristics. There were birds on the green that never faded and floods came down the mountains and flowed down to lower levels. The actual words are worth quoting: "Yiya the good shepherd says: "I will make the world grow. While I am the King, there shall be neither cold nor hot wind blowing". Then the earth was replenished with flocks and herds of cattle men, dogs, birds and with same red blazing fire. There was no room for more of them. Then Yima again stepped forward in light *southwards* and the earth was thus extended three times towards the *south*". (Vend. II § 1-16).

Again in the 2nd Fargard, this land of *Airyana vaeji* is referred to in connection with King Jashed and the boundaries of his kingdom. He was such a good king at first and the people were so happy and prosperous that for three times he had to extend the boundaries and every time he did so, the people migrated *southwards* towards other fertile river valleys. Had he not done so, all the inhabitants would have rushed into the original Airyna vaejo. This expansion of the kingdom went on for 900 years. But at the end of this period, a warning came to Yima the King from Ahura Mazda that a great flood was to visit his land and he was advised to prepare a Vara in which to preserve the best of human beings, the best of animals, cattle, birds etc. These are the exact words uttered by the Almighty: "O fair Yima, son of Vivangha! Upon the material world the evil winters are about to fall that shall bring the fierce deadly snow; upon the material world the evil winters are about to fall that shall make the snow creep downwards from high mountains to the valleys of the river Ardui Sura". (Vend. II §§ 22-26)[22] Notice the picture of the land before and after the Flood: "Before that winter the country would bear plenty of grass for cattle, before the waters had flooded it. Now after the melting of the snow, O Yima, a place wherein the foot-prints of a sheep may be seen would be a wonder of the world". (Vend. II, 24) Parts of the land needed water, while others needed drying—an indication of the earliest use of the system of irrigation. The Avesta passage runs thus: The place where the earth is most happy is the place where one of the faithful sows most corn, grass and fruit. O Spitama Zarthushtra! where he waters the ground that is dry and drains the ground that is too wet; where there is most increase of flocks, herds and yield most dung". (Vend. III, 4, 5, 6, translated by James Darmesteters, B.E. Vol. IV). The Vara (cave) made by Yima had some unique openings resembling ventilations and there

were both kinds of light in it, natural and artificial; the stars, the moon and the sun shone in it, otherwise where was the need of the openings in the cave and which natural light fell inside and when ?

Here then is a description of a grassland, occupied by a pastoral people, possessing animals as their chief wealth, practising irrigation and agriculture to their best advantage and very anxious to save themselves from natural calamities and to accommodate the whole community within the limits of their Home and without. The most suitable locality that can be found in the Steppe-desert belt, resembling this description is the Syr Darya valley, in my opinion. It is really a protected river valley, specially the upper part, well-defined in the higher reaches, with grasslands on both sides, forested only on the mountain tops with the snow covered Pamir Knot in the middle of the region and with a delightful climate. Cattle, sheep, goats and birds live safely within its limits and the rhythm of human life is more or less perfect. There are again, invigorating pulses of climate rarely found in other parts of Asia.

The following passages from the *Bundahishn*, another very valuable part of the Zend-Avesta, in which the spirit of the original 21 Avestan Nusks is fortunately preserved, confirm the picture of *Airyna vaeji* given in the Vendidad. They are worth quoting here especially from the point of view of the climate of the locality.

"As from the auspicious day Auharmazd of the month of Farvardin to the auspicious day of Aniran of the month Mitro is the summer of seven months, so from the auspicious day Auharmazd of the month Avan to the auspicious month of Spendarmad on to the end of the five supplementary days is the winter of five months. (Bund. Ch. XXV, 7).

"In those seven months of summer, the periods (gahs) of the days and nights are five; in winter are four periods (gahs)". (Bund. Ch. XXV, 9 and 10).

"And on the auspicious day Arro of the month Din, the winter arrives with much cold at Airanvej and until the end, in the auspicious month of Spendarmad, winter advances through the whole world; on this account they kindle a fire everywhere on the day Arro of the month Din and it forms an indication that winter has come". (Bund. Ch. XXV, 11).

"In those five months the water of springs and conduits is all warm, for Rapithwin keeps warmth and moisture there". (Bund. Ch. XXV, 12).

"And yet in the direction of Hindustan there where the original dwelling of summer is near, it is neither cold nor hot, for in the season which is the dominion of summer, the rain always dispels most of the heat and it does not become perceptible; and in the winter rain does not fall and the cold does not become very perceptible".

"In the northern direction where the preparation of winter is, it is always cold; for in the summer mostly on account of the more oppresive winter there, it is not possible so to dispel the cold that one might feel it quite warm.

"In the middle localities, the cold of winter and heat of summer both come on vehemently". (Bund. Ch. XXV, 15, 16, 17, translated by E. W. West S.B.E. Vol. V).

Even supposing that the Iranvej of the Pahlavi writers was not the same as the original Home but it was a second Airyana Vaejo established in lower latitudes somewhere on the Iran plateau itself and given the same name sentimentally out of the love of the Homeland, we can say with certainty that it did not differ much from the Original *Airyna Vaejo* at least from the point of view of the winter season. There must have been some resemblance between the climates of the two regions, being not very far from each other.

Among the Avesta scholars there is a difference of opinion about the identification of some place names. Conjectures are made even about the name *Vanghu daitya* or Vehdaiti. Some translate it literally as meaning only "Of good creation" and not take it as the name of a great river, as it suits them (See above). But others have actually identified it not with the Syr Darya but with the Amu Darya lower down. Geiger has taken it to be the Zarafshan, just near the mark. The mythical river *Ardui sura* arises from Mt. Hukere (identified as the Elburz) and falls into the sea Vourukasha (the Caspian). Very likely this Ardui sura is a later Avesta name for the original Veh-daiti, and Sura is still marvellously retained in the name Syr or Sir. The Greek name Jaxartes can be with some difficulty traced to Vehdaitik. It is possible that the river Oxus, named so from its tributary Aksu (ardvieu?), received the old title out of sentiment when the Aryans occupied it after leaving the original Home on the Syr Darya. Again, if the first part of the name Vehdaiti is taken to

mean "good" as an epithet, then the Daitya of the Vendidad can be taken as the Daitik of the later Pahlavi times. According to the *Bundhishn* again, the Daitik "is a river which comes from Airanvej and goes out through the hill-country. Of all rivers, the noxious creatures in it are most, as it says that the Daitik river is full of noxious creatures. (Bund. XX, 13) Clearly there is here a reference to the "serpent" created in the Vehdaiti river by Ahriman. (Venfl I, 3) Another valuable passage in the *Bundahishn* suggests similar comparison. In it the two principal rivers mentioned are the Arag, flowing towards the west and the Veh flowing towards the east, circulating through the two extremities of the earth. The Veh (meaning good=Av. Vanghu) is also called the Meheran (the Indus is actually named so by the Arab geographers). The Oxus (Amu Darya) was sometimes considered to be a part of the Veh and sometimes of the Arag or Araxes or Jaxartes. This shows that the tendency of the writers was to name all *good* rivers as the Veh, after the original Vehdaiti river of the Aryan Home, and all subsequent settlements as Aryan countries (airyanām dakhyunam) belonging to greater Iran.

It is no doubt true that down the great Pamirs, glaciers flowed to much lower levels in pre-historic times and the climate of the Jaxartes valley was far wetter and better in many respects. Even ten months of winter and two months of summer were possible here and when the glaciers receded, the climatic conditions might have changed to those of seven months of summer and five months of winter. Caves and fortifications were easily built in the rocks. There were oxen, cows, even horses (so famous in the Kyanian times about the 2nd millenium B.C.). Gardening could be done; in fact, gardening preceded the art of agriculture in the Aryan Home. Metals, especially gold, silver, iron and copper could be extracted from the mountains, outcrops of metalliferous rocks being prominent in them. Wild animal life was there, a creation of Anghra mainyu, against whom the faithful Aryans had also to struggle hard to extirpate them.

Settlements made on the slopes of the mountains could be easily destroyed by glaciers, floods, and heavy snow-fall frequently and caves could be made in the rocks for the safety of the people within the limits of the kingdom. The area being within the storm tract of the north, it was also possible to have prolonged cold or prolonged heat. At the same time, we are told that there were 'blazing fires' in Airya vaejo, possibly volcanic eruptions and bursting of natural oil in the Tertiary rocks round about the Iran plateau.

PRESENT CONDITIONS OF THE LOCALITY

This great river, the Syr (the mythical Ardui Sura) has its hydrography changed today. But it must have been mightier, extremely snow-fed and silt carrying, and at the same time navigable to some extent. Issuing from the high mountains it flowed down the northern slopes and across the whole plain of Turkestan, not into the Aral sea as at present but perhaps into the Caspian sea. Due to the excessive silting, not only the Syr Daria but also the Zarafshan, the Amu and other rivers have changed their courses in their lower deltaic areas. The levels of the plain are rising no doubt, the present depth of the Aral sea being 158 feet, but that of the Caspian still being 84 feet below the Black sea level. Withal the landscape is awe-inspiring. The glories of the sun, the moon and the stars found in the clear sky, of the giant mountains in the background, the numerous streams and waterfalls, the luxuriant vegetation and green farms,—these proved to be the foundation stone of the theology of the Aryans. All the notions of the Avesta cosmogony and angelology were derived from this magnificent environment, rarely to be found in other parts of Asia, least of all in the monotonous Polar geography (See later).

A writer in the *Quarterly Review* (October 1865) described this happy region as under:

"Watering, with its numerous affluents in the upper part of its basin, one of the most fertile and delightful countries in the world and fringed throughout its course with the richest cultivation, it debouches below the town of Turkesten upon a saline steppe and its character becomes entirely altered. Where the banks are high, a thin belt of jungle alone separates the river from the desert; where they are low, inundations forming reedy lagoons and impassable morasses spread for hundreds of miles over the face of the plain; in the intermediate portions alone where the banks admit the river over adjacent lands at the time of flood, but cut off the supply of water at other seasons, is there much cultivation or pasture. In such portions, the lands are said to be exceedingly fertile, the irrigating waters overlaying the surface with a rich alluvial loam, which in combination with the saline soil, is found to be peculiarly favourable to agriculture".[23] Some of these parts Soviet Russia has greatly transformed today.

No doubt this river valley with its numerous *wadis* is now drier than it was before. This is due, as we have noted above, to the recession of glaciers, the shifting of the northern storm-belt, the accumulation of wind-blown sand and the destruction caused by enemy action, as the whole history of the region is full of

struggles between the settlers in the valley and the wandering tribes in the plains,—hosts of marauders even mentioned in the earliest hymns composed by the Prophet Zarathushtra as the enemies of *settled life* of the faithful.

(To be continued)

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The Scope of Land Utilisation Survey in India

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The problem of a Land Utilisation Survey is growingly attracting the attention of all who wish that land in any country should be used by the inhabitants in the most scientific and economic way. This consciousness is a new one and in a country like India the meaning and scope of the subject needs elucidation.

Technically speaking, the survey aims at studying how the inhabitants of a certain area are using, or, for the matter of that, misusing the land at their disposal. The survey is interested not only in those parts of the land which are positively being used but also in those portions which are negatively utilized being left unproductive or unheeded. The chief aim in the survey is to get a precise picture of the local terrestrial environment. The question of land utilization is one directly arising from the growing consciousness in man to be scientifically informed of his immediate environment so that he may make adjustment between himself and the physical setting for a proper security and progress. Naturally, therefore, being a problem of human adjustment to the natural environment, land utilization is predominantly a geographical problem and deserves the special attention of geographers.

Land utilisation survey involves a threefold process. Primarily it requires a survey of any area on the spot with the minutest details as regards land use and secondly the mapping of the details on large scale maps with such cartographical methods as may render their study easy and interesting, and thirdly a geographical interpretation of the maps correlating the present nature of land use to the physical setting and human conditions of the area: viz, relief, structural, hydrographic, climatic, soil, social and cultural conditions. The interpretation will emphasize the proportion of land devoted to various uses and will dilate on the possibility and advantage of altering the proportions in order "to secure a due balancing of the varied needs of all sections of the community".[1]

1. The Land Utilization Survey of Britain, Dr. L. D. Stamp, pamphlet.

The Importance and advantages of such a survey in India.

1. There is a growing desire for the rationalization of Indian agriculture so that every acre of land should be properly utilized. By agricultural rationalization we mean the scientific cultivation of land. Certain areas may be continuing to grow food crops but it may be more economic and profitable to grow cash crops on them. Again, there may be fields devoted to coarse grains with poor yields. The same may profitably be devoted to grazing grounds supporting a healthy animal population and bringing a better livelihood to the people inhabiting the area. Likewise, certain cultivated areas may be devoted to market or fruit gardens. But a haphazard reorganization may prove risky. Unless we have land utilization maps giving an exact knowledge of the variety of uses to which the land is devoted, we cannot adopt a safe agricultural reorganization.

If we look at the superintending Qanungo's Area Statement of any District we come across certain details about land use, but it is rather pathetic that such facts are a mere undistinguishable jumble of items. The facts are too generalized and do give no exact or specific information ; for instance under the head 'Barren Land' we have a column 'otherwise barren'. This is hopelessly uninformative. In the column 'culturable land' we have a sub column 'groves' which is too inadequate to give the necessary information whether they are orchards, market gardens, or any other tree growth. They give no idea of land use. Under the same head we have a column of 'culturable waste'. This is hopelessly inexpressive. Unless we have land use maps we have no idea of exactness, or location. Consequently, even if these facts in the Area Statement were elaborated, the purpose of agricultural reorganization remains unserved, unless they are shown specifically on maps of land use.

2. The government is making a country wide propaganda of the 'grow more food campaign'. The ignorant agriculturist is baffled by such a catch word. He asks the question, "I am cultivating every piece of land, how to grow more?" And he is not at fault. To start such a campaign without making a survey of the present utilization of land (and then being able to conclude precisely the upper limit of cultivation) is like putting the cart before the horse.

3. The present position of India *vis-a-vis* population is unique. Unlike other countries involved in war, where there is a fear of decrease of population, this country, not being an actual war

theatre, has her population on the increase. And in India, the standard of living being very low, the population problem is closely related with food problem. If we are able to grow more food, there can be no menace of a growing population.

4. The country has another very important problem concerning the cattle and fodder crops. The inevitability of a healthy cattle population for a sound economic basis is being repeatedly emphasized. The cattle in India, however, have in general no permanent grazing grounds allotted to them. The farmer is uninclined to realize that those plots which yield a poor food crop can more profitably be devoted to fodder crops or grazing grounds for his cattle, which may in turn produce better means for his livelihood. Certain semi-barren areas with irregular grass cover may be exploited for the growth of fodder crops, or be devoted to permanent grass. But such an exploitation is difficult, unless we make a survey and get a record of present land use on paper and on maps.

5. The problem of afforestation as a step towards the improvement of our environment and for economic uses is engaging general attention. But without a land use survey, it will not be possible to estimate the proportion of such areas which can be brought under afforestation schemes. Such areas as village wastes, abandoned river beds and hilly slopes may be given to afforestation, but we have no idea of such land unless we make a land use survey.

6. As a measure of changing environment the land-use maps have a great historical value. In my geographical survey of the Mirzapur District, I came across records which surmised that the entire tableland from the Ganges valley to the Son, was once covered with thick forest. We maintain no actual evidence of such a forest, nor the nature of the vegetation. If we had a land use map it might be possible to get details of the vegetation and the geographical setting and afforestation would have been an easier and surer step in the proper portions of the area. So, if we make a land utilization survey now, the maps will be a sort of 'snapshot' picture of an area of a particular time. Say, twenty years hence, we can have another 'snapshot' picture of the same area. By comparison we shall be able to know how and where changes in land use have occurred. This comparative study of maps supplemented by an examination of the geographical phenomena viz relief, geology, climate and soil will give a correlated study of change in our local environment and proper readjustments can be made in the future utilisation of land. Thus with land use maps at our disposal "we shall not have

to depend only upon statistics, sometimes difficult to interpret, but shall have definite information as to any alteration which may, have taken place in each parcel of ground".[2]

A good deal has been said above about the need and importance of a land utilization survey in our country. It remains to be suggested how this should be achieved. A land utilization committee appointed by the government has met in Delhi in February last, and great things are expected of the discussions that have taken place. But a humble suggestion regarding the purpose, scope and methods seems necessary here.

Scope and Methods :

In one of his lectures[3] delivered in Madras Dr. Stamp pointed out that the methods of the Land Utilization Survey of Britain may with necessary modifications be applied to India. This suggestion is only partially sound. Conditions in our country are so widely different from those in Britain that there will have to be great departures from the methods employed and lines of approach. The differences between conditions obtaining in Britain and India, *vis-a-vis* a land use survey may be summarised as follows :—

1. India is a vast country as compared to Britain, she being about 20 times the latter in area.

2. In Britain the agricultural, pastoral and cultural land uses are all very important, but in our country agricultural use is the most dominant.

3. In an advanced country like Britain with high education and a patriotic interest and voluntary co-operation of the public together with collaboration of the Ordnance Survey, an intensive survey has been achieved within 3 years (1930-1932). In India, technical hands will be difficult to get, while financial difficulties and lack of voluntary co-operation will retard the survey. So, here, it will be the government which will play the most important role.

4. In Britain "the primary purpose of the Survey is to make a complete record over the whole of Britain, of the uses to which

2. Land Utilization Maps of Great Britain, Sir C. Close, Geographical Journal, LXXXI, 1933.

3: The Land Utilization Maps of India, Journal of Madras Geographical Association, XIII, 1938.

the land is put at the present time.[4] This is all right in a country where agriculture is already highly rationalized. But conditions are widely different here. India may be regarded in several respects a 'land of the future' considering the unrationalized agricultural or non-agricultural land use. So we shall be compelled to depart from the purposes aimed at in Britain. We shall have to go further, considering as in U.S. "the use for which the land is apparently best suited by natural character and environment".[5]

Inspite of the difficulties in our way mentioned above, it may be suggested a land utilization survey similar to that carried out in China (1929-1933) can be achieved as a first attempt. Conditions in India are more similar to those in China than in Britain. In the Land Utilization Survey of China, data were collected in 16786 farms, in 168 localities, 154 hsein (counties or districts) spreading over 22 provinces. It is evident that studies were made in localities typical of a larger area and thus a generalized land use picture was obtained. The agricultural problems, as is expected in an agricultural country, were predominantly emphasized and a number of geographical and sociological problems were studied side by side, the study consisting of farm, agricultural population, food, locality and hsien surveys. In areas of densest population the surveys were most numerous. Along with the agricultural information the regional investigations collected information regarding floods, droughts, climatic conditions, forested areas, classification of land, tenancy, cattle, manurial and labour conditions. In the agricultural survey of Land Utilization study, county or hsien was regarded as a unit.

It may be realized that the Land Utilization Survey of China is, though of necessity, a very generalized study. Under a land utilization study we must get an entire picture of the landscape without leaving any parcel of the ground. Nevertheless, considering the geographical and social conditions in that country, China has done much. In our country the circumstances seem more favourable for a more intensive survey. If the Land Utilization personnel of China took up hsien (or county) as a unit we can start with a smaller political unit e.g. tahsil. If the government takes interest, as it does in census and other operations, in the use of land which is the greatest heritage of an agricultural country, the survey will not be impossible. Educational institutions must take interest in

4. G. J. Vol. LXXVIII, 1931, p. 41.

5. G. J. Vol. LXXXI, 1933, p. 543.

such a survey but the assistance of Qanungos, Ameens, and Patwaris will be indispensable. A central land use committee, keeping before them the examples of other countries where such surveys have been carried out, should draft methods and processes to be adopted. This done, organized information can be gathered on large scale maps by these officials under the supervision of trained geographers in collaboration with a deputy magistrate, or a settlement officer in each district. Thus the survey will primarily be a work of trained geographers who will need the co-operation of the settlement officers and collaboration of the survey department as well.

Statistical information like the yield of crops, the average dates of sowing and harvesting, the cattle and manurial strength, the number of ploughs and carts, the number of inhabitants and man equivalents and enquiries regarding soil and silt erosion will be given special attention.

But all is like a fool's prattle unless those in power turn their attention to the problem and realize that "land is a country's greatest asset, and if a country does not make the best use of this asset it is not in a healthy state".[6]

6. G. J. Vol. LXXXI, 1933, p. 542.

The Physiography of the River Sutlej

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While all the five rivers, from which the Punjab takes its name, rise in the Himalayas, the Sutlej[1] alone has its source[2] beyond the Himalayan range in the Kanglung glaciers,[3] east of Manasarowar, 65 miles from Barkha.[4] The height of the neighbouring mountains is estimated at 22,000 feet. Abul Fazal, writing in 1582, says that its ancient name was Shetuder and that its source lay in the peaked mountains of Ghablore, in Chinese empire.

Starting from its mountain elevation the Sutlej flows in a north-westerly direction along the southern slopes of the Kailas mountains and first enters the vast alluvial tract of Goge cutting

1. The Hesudrus of the ancients, the Hupanis of Megasthenese, the Saranges of Arrian, the Zaradrus, or Zapadpos of Ptolemy, the Sydrus or Kesidrus of Pliny, the Hypanis of Strabo, the Sheturder and Seteluj of the Ain-i-Akbari, and the Sittoda, Satadru of Sanskrit.

A short distance below Ling the river is called by the natives Lanying or Langzhing Kampa (Khampa or Kampa signifying river in general); lower down it is called Muksung; again Sanpur; then again Zeungti or Zagti; lower still Samidrang; yet lower down in Bashahr, Satudra or Satadru (or hundred channeled); and lower still the Sutlej, by which name it is known upto its junction with the Indus.

2. The source of Sutlej as of many other great rivers are matters of dispute, since the exact point of origin of what is to be regarded as the principal tributary varies materially with the point of view adopted by the different observers, particularly if the river in question has a multiple number of head streams, as is the case with Sutlej. Is the head tributary with the largest volume of water, or the tributary with the greatest length of course from the watershed, or the melting end of glacier that is to be regarded as the source-stream? Or, is local tradition, or immemorial belief of the people of the surrounding country to determine the source? It is only in rare cases that all the three factors combine to give the same result; usually it is one of the three that is of prepondering importance in deciding the issue.

3. Pranavananda, Swami, Explorations in Tibet, Univ. of Calcutta Publication, 1939.

4. Barkha or Parkha is a post stage and official Tibetan transport agency station situated one mile north of the north end of Rakas Tal (Rakshas Tal).

through the alluvium with a gully 4,000 feet deep[5] close to Dahla. At about 188 miles from its source it receives from the north-west of Leh the Spiti, a stream larger than the Sutlej itself, at 8,592 ft. above the sea. Below the point of junction, the river is so deep and rapid that, even with a ten-pound sounding lead, no bottom could be found.[6]

Below Shipki the river is obstructed by rocks, and the torrent being confined in a narrow Channel, is rapid and tortuous. Turning with a great velocity it takes a north-westerly direction for about 150 miles through a mountain region almost inaccessible to man, after which turning south-west and skirting the outer Himalayas, it bursts into many streams, which unite in one channel as the river approaches the Siwaliks. It winds among the hills in a succession of rapids till it drops to Rampur in Bilaspur.

Throughout its upper course, the river is confined to the depths of a mountain trough, steep sided and flanked by bare rocky precipices, hurling its turbid waters over its broken boulder bed with such terrific force as occasionally to grind into matchwood the huge logs of timber which are carried to the plains. Into these gloomy depths no human being can penetrate. The fall from Shipki to Rampur (Bilaspur State) is, with little exception, nearly uniform about 60 feet in the mile. By the time it reaches Bilaspur it drops to 1,000 feet above sea level.

A little below Bilaspur, the Sutlej takes a north-westerly swing, after which it turns again to the south-west and then flows south-east. A few miles above Rupar, in 30° 58′ N, and 76° 29′ E, it breaks through the mountain rampart of the Himalayas in the low sandstone range of Jhejwan, and emerges at Rupar; and for hundreds of miles flows in the plains of the Punjab, as a broad, turbid stream, no more retaining its blue mountain tinge. At Rupar it is tapped by the Sirhind Canal.

From Rupar it turns west to Talwan (Jullundur) and from Philour, where its breadth is 2,100 ft. it is navigable for small crafts at all seasons. From Talwan it bends a little south to Sidhwan Khas (Ludhiana) and thence swinging north-west meets the Beas at Shahwala, after a course in the plain of about 570 miles. The united streams below their confluence receive the name

5. I.G., 1907, Vol. I, p. 31.
6. Latif, Syed Mohd. Hist. of the Punjab, 1891 p. 10.

of Ghara. At Harike ferry, a little below the junction of the Beas, it again turns and flows to the south-west till joined by the Chenab, which brings to it the contributions of the Jhelum and Ravi, at the southern corner of Multan.

Of all the great Punjab rivers the Sutlej has the most uniform slope in its way down the plains. 240 miles from its source, at a place a few miles above Shipki, its height above the sea is 8,400 ft., the descent per mile to this place being 32 ft., and it has the same average fall in the next 300 miles to Rupar. In the plain area it has a fall of about 18 inches per mile only.

It seldom exceeds 20 feet in its deepest part, and during its highest flood does not rise more than 10 feet above the lowest surface level.

The Sutlej is an antecedent river. The very fact that it rises on the northern side of the main chain of the Himalayas, through which it cuts great gorges to reach the plains, is enough proof of its existence before the birth of the mountains. For, it is impossible to account for its present relations to its mountains on any other hypothesis. In this case the rise of the mountain-chain was so slow that it was able to keep open its former channel during the uplift of very many thousands of feet.

The Sutlej has a total catchment area at Rupar of 18,500 square miles,[7] i.e. about four times that of the Jumna, which is 4,500 square miles. Of this about 8,000 square miles lie in the shadow of the Inner Himalayas which in places rise to over 25,000 ft., 5,000 square miles between this and the Outer Himalayas, 2,500 square miles to the limit of the Siwalik foot hills and the remaining 3,000 square miles is below Rupar, in a flat plain, 1,000 to 650 ft., above the sea.

The river acquires great volume and considerable velocity in its mountain stages. As such, it has in this part a maximum of erosive capacity, but due to the resistant bed rocks, is not loaded to its full capacity. The rapid decrease in velocity consequent upon the diminution of slope after the river leaves the hills, checks the transport of larger and heavier material which is deposited on the base and some distance further ahead.

7. Burrard, S.G., and Hayden, H.H., Geog. and Geol. of the Himalaya Mountains and Tibet, 1933, p. 175.

The diminution of velocity also reduces down-cutting and the current is thrown from side to side and cuts deeply into the valley sides. Thus valley widening is more pronounced than valley deepening. The softness of the bed-rocks have further helped this process, with the result that it has carved out for itself a valley 2 to 4 miles in width, through which it flows lustily, the width thus acquired being several times the width of its meander, from which it appears that the river is passing through its old age. Consequently, the meander belt may now shift freely over the broad flood plain, the valley may widen indefinitely, the valley walls may become more gently sloping, the shifting stream may continue slowly to consume its flood plain and to reduce the level of its valley floor, at the same time depositing alluvium at the new levels.

Beyond Ludhiana it passes through an almost arid country. Here the decreasing low rainfall and the increasing high evaporation and seepage combine to considerably diminish its volume and increase deposition of the debris. Both volume and velocity are further reduced by the numerous canals which take off from the river.

The destructive and constructive changes are worked by the river in a peculiar manner. It cuts away its banks and builds others. It has two ways of destroying its banks; in the flood season by direct force of the stream at a high level, and softening of soil submerged, and in the low season by quiet undercutting at the water-level, which brings down enormous masses of high bank that fall forward one after another into the stream, with loud and repeated roar. The soil thus carried away is in part laid down on shelving banks on the other side, part in the bed, forming shoals and shifting islands, part settling down across the mouths of branch channels; it closes them up and cuts off their supply of water, till another turn of events lets water into them again; and part is swept down the stream to the sea. Where the fall is slight and the flow languid the deposition sometimes even chokes up the channel with alluvium, when it overflows and cuts new channels, which also in turn become choked. This process has developed an intricate network of unstable, shallow braided channels forming a complex pattern.

Thus, throughout its course in the plains the river is found flowing with tortuous windings of interlocking channels enclosing islands, marshes, sandbars, forests, farmlands and habitations. This

'anastomotic'[8] drainage pattern besides a definite slope control reflects a uniform resistance in horizontal direction of the flat lying beds of the plain.

In the plain, the valley is everywhere enclosed by consolidated walls 6 to 80 feet high. An examination of topographical maps[9] shows these high, almost continuous steep stream banks with broken grounds lying 1/8 to 6 miles on either side of the river throughout its course. On the northern bank the scarp starts from Mahmudpur (Hoshiarpur) and continues upto Talwandi (Jullundur). Then, after a little break of 10 to 12 miles it appears again across the Beas and continues upto the headworks of the Lower Sohag Canal. The part, beyond the Beas is not, however, so conspicuous. On the southern bank the ridge commences from Kotli (Ambala), but is more continuous from Kiri Afghanan (Patiala State) and continues upto Tutgarh (30° 59′ N and 75° 19′ E). Thereafter it is broken, but on the north bank it proceeds much beyond this point. These high banks on either side lead to the table-lands that form the watersheds of the Ravi to the North and the Jumna to the south. The northern bank is generally higher than the southern one and both are badly dissected in some parts.

These high stream banks, many miles beyond the river on either side, mark the extent of its ancient flood plain.[10] The still extant Budha Nala parallel to the river, oxbow lakes of Miani (Ludhiana), Budh Mahiwali, Musa Bohta and Gul Shah (Wahawalpur) and marshlands lying within the scarp are reminiscent of the old river course,[11] which it is not improbable lay through them more to the east.

Between the Beas and the Chenab no affluent, however insignificant, joins it. Above the Beas too the only tributaries meeting it are the White and Black Beins. This conspicuous absence of contributory streams in these vast regions reflects a deficiency of rainfall,[12] intense evaporation and seepage. This conclusion is further supported by a network of canals existing in the area. Of

8. Drainage Patterns and their Significance, Emilie R. Zernitz, The Journal of Geol., Vol. XL, 1932, p. 514.
9. Survey of India Maps No. 53A/SW; B/NW; 44 1/SE, SW; J/NW; M/SE, SW & N/NE, NW.
10. I.G., Prov. Series, Punjab, Vol. I, 1908, pp. 424 and 438.
1. Ibid. p. 424 and 425.
12. Longwell, Chester R., Knopf and Adolph and Flint, Richard F., Outlines of Physical Geol., 1934, p. 61.

the small amount of rain that falls in its basin, whatever finds its way to the river is by nalahs only.

Notwithstanding the heavy toll—about half[13] of its waters—taken by the Sirhind Canal, the Sutlej is not fordable anywhere and in any season upto the south-east corner of Jullundur. Thereafter it becomes so, being fordable at a few places only during November to March, and at several others throughout the year. After the junction with the Beas it again swells and it is not possible to ford it for about 30 miles down. But after the taking off of the Dipalpur, Bikaner and Eastern Canals at the Ferozpore Headworks, its minor branches may be forded all round the year. Again after taking off of the Pakpattan, Ford Wah and the Eastern Sadiqia Canals at the Sulaimanke Headworks even the principal stream is fordable every few miles. For about 25 miles below Qasimka (Bahawalpur) it cannot be forded anywhere. Thereafter it is fordable from January to March at a few points. Below Islam Headworks, wherefrom Mailsi and Bahawal Canals are tapped to long. 70° E. it becomes fordable at several points from November to March. West of this at some places it is fordable only during November to March and at numerous others throughout the year. Beyond Abdullahpur (Bahawalpur) to its junction with the Chenab it is not fordable at all.

The Volume of water in the Sutlej varies from season to season and it is also subject to sudden swells and freshes. The ordinary rises are due first to the melting of the snows and then to the periodical rains. The rise from the melting of the snow, which begins in March, is slow and regular, but not uniform. Snow-melting on the high hills is checked by frost during the night and early morning, and goes on again during the day. The fluctuations in rise thus caused, which sensibly affect the river in the upper part of its course are hardly felt when it comes out as a broad stream in the plains.

Most of its rises are ordinarily from rainfall in its catchment area in the hills, the upper 8,000 square miles of which comprises a tract with an average annual rainfall of 80 inches. 70 inches of this comes in the rainy season (June to October), of course with the exception of the far eastern extremity and the high peaks

13. I.G., Prov. Ser., Punjab, Vol. I, 1908, p. 187; Khan, Dr. I. R., Historical Geog. of the Punjab, Muslim University Jour. Vol. I., No. I., p. 16.

which get their precipitation in the form of snowfall, mostly during winter. Apart from the heavier rains of the hill region, the gradient there being steep, water rushes quickly through the little mountain torrents to flood the river.

The local rain in its catchment in the plains, where the gradient is gentle, with the rainfall being less and generally decreasing downstream, as the figures below illustrate, affects its rise in a comparatively small degree. It does, however, add to its volume and may sometimes cause serious flooding of the level land with poor drainage.

Rupar	..	28·32 inches
Samrala	..	29·38 „
Ludhiana	..	26·57 „
Phillaur	..	27·16 „
Jagraon	..	24·37 „
Zira	..	18·98 „
Nakodar	..	21·11 „
Sultanpur	..	18·2 „
Ferozepore	..	17·17 „
Fazilka	..	11·09 „
Kasur	..	14·19 „
Mianwali	..	14·75 „

Occasional floods are also caused by some major obstruction in the course of the river such as glacier and land slides etc. But such spates are few and far between. One due to a landslip is said to have occurred in 1762.

It is worthy of note in this connection that the Sutlej, while its volume is largely increased in the flood season, because of its wide, open, channel in the plains, the rise is told in more moderate figures, the maximum between 10 and 15 feet. It is also rare to find either any very old building or tree of great age on the banks of the Sutlej and in its whole course of 900 miles there are even no towns or places of any size in its immediate vicinity. The nearest town Phillaur too is about a mile distant from it. This absence of towns on its banks is due to the annual swells which render life less secure. The network of inundation canals now in existence, besides irrigating the distant areas act as a safety-valve for regulating the height of the stream. But even then, destructive floods do sometimes occur.

Rice in India

By

George Kuriyan

(*Continued from Vol. XX No.* 1, *Page* 36)

Soil:—As regards soil requirements, rice is probably more cosmopolitan than any other crop. In the case of upland rice grown on hills, as in the '*modan*' lands of Malabar, the crop does not appear to make any great demand on the soil while in the case of lowland rice, as in the deltas, it is a plant adapted to heavy soils.[21]

With suitable use of water and fertilisers, and choice of variety, any soil which will produce anything will produce rice. Dr. B. Viswanath, however, suggests that at least nine years must elapse before fresh lands could give satisfactory yields. The soil which will produce the best crop at the least cost is rich, smooth, mellow and easily worked. Lowland irrigated rice is a very permanent culture and the important question is not whether the soils will produce an excellent crop, but whether they are capable of producing a long succession of tolerably good crops; the permanency of the crop is of more fundamental significance than the yield.

Being a semi-aquatic plant, it can thrive without much oxygen. As a result of puddling, the heavy soils in which it is grown not merely retain moisture but also form an impervious substratum. A most favourable condition is found when a loam overlies a heavy clay. The loam permits root development while the clay prevents drainage and retains both the water as well as the salts which would otherwise be leeched out. Such soils are found along river valleys and on coastal lowlands, particularly in the deltas of big rivers, where the nearly level surface is ideally suited to irrigation, and hence the concentration of rice culture in the deltas.

21. It is worth noting that a typical variety of dry or upland rice will grow under lowland conditions while the lowland variety will not thrive on the uplands. This suggests that the original habitat was the lowland, where the upland variety even after its adaptation to a different environment will thrive.

Heavy soils retentive of water are soils composed of very fine particles. Most crops growing in dry soils develop root hairs which present a great surface for the absorption of water and the dissolved salts, but the roots of rice form under water no such hairs. Rice has very fine apparently absorbing roots, but these develop no such area of surface as a good system of root hairs. The surfaces of the finest roots are not plastic like the walls of root hairs, and consequently, the rice roots do not fit against the particles of the soil, but instead, merely touch them. In the case of rice then, the actual contact between root and soil is far less extensive than in the case of most plants; but the extreme fineness of particle of really heavy soils makes this contact much more ample in area than it could be, if the soil were coarser and lighter.[22] This fact also accounts for the preponderance of rice in the deltas.

Typical rice soils contain a good proportion of the finer particles, clay and silt, about 40 to 60%, and generally speaking, rice yields better on heavy soils than on light ones. With sufficient water, good crops can be grown in loamy and slightly open soils, but the relative seepage of water would result in leeching the soil of the soluble plant foods. A succession of rice crops in such soils leads to their rapid impoverishment. The use of light soils for rice is generally uneconomical. Generations of good crops are being obtained from regions of heavy soils without the application of manure; e.g. West Godavari, where the yield may be as high as 3,000 lbs. per acre. The heavy soils of the Sheikhpura District of the Punjab give an average yield of 1,637 lbs. per acre, while in the sandy soils of Muzaffargarh, it is only 788 lbs. per acre.

Rice thrives best in soils rich in organic matter with an almost unlimited amount of humus and hence the general response to the application of green manures. It can tolerate a certain amount of soil acidity and in the heavy soils where the supply of oxygen is not abundant, the ploughing-in of organic matter and its decomposition in situ, result in making the soils slightly acidic. Some varieties of rice also thrive on decidedly alkaline soils where nothing else will grow.

In the United Provinces, is a fairly extensive tract of alkaline lands (*usar*) which could be brought under the plough by the cultivation of these special types of rice which can withstand alkalinity. If rice is cultivated, because of the flooding that will be resorted to, it will incidentally result in the diminution of alkanity, thus serving the dual purpose of mitigating the evils of

22. Copeland, p. 45-46.

alkalinity and obtaining a crop of rice in these days of food scarcity. But this presupposes the availability of water for irrigation. The *jhils* of the United Provinces, if properly harnessed, would give all the amenities of tank irrigation. Further, there is ample scope for the expansion of well irrigation.[23]

Irrigation :—Alone, among the world's great crops, rice grows typically in a field of standing water. Whatever is unique in rice culture, centres naturally around this basic fact. Ideally, and on a vast scale in practice, this water is regulated and provided by the grower; irrigation is the technique of rice culture. Where water can be applied and the cold does not prevent the growth of rice, other climatic factors at best determine how water must be used, or what varieties may be grown. And irrigation is not merely adapted to climate and variety ; on the scale on which it is practised with rice, it modifies the climate. Water so dominates other climatic factors, that with good irrigation facilities, rice must be recognised as the safest of the world's great crops.[24]

Of all the crops grown under irrigation in India, rice is by far the largest, occupying nearly 1/3 of the total irrigated area. The main areas of irrigated rice are in Madras, Bihar, Bengal and Sind. There is no hard and fast rule about the method of irrigation. In the case of swamp rice, once the flooding of the fields has commenced, they should not be allowed to crack and dry till the grain commences to ripen. After the transplanting is over, the field is usually kept drained for some time to hasten the seedlings striking root. When they are established, water is let into the field and kept there, the only precaution being not to let in too much of water to drown the crop. Most rices, however, can stand a certain amount of submersion, provided it is not continued too long. The water will have to be changed and ryots prefer to do it as frequently as possible, because of the fertilising silt which a fresh supply of water often brings with it. Besides the silt, there is also the advantage of aereation to the roots. It is found that the root development is greatly influenced by aereation which is brought about by a frequent change of irrigation water. Well drained land may not require too frequent a change, but heavy and badly drained land, and land inclined to be alkaline, requires frequent changes of water.[25]

23. G. Kuriyan, *Irrigation in India*. Journal of the Madras University. Vol. XV, No. 2, pp. 167 et seq.

24. Copeland Op. cit. p. 43.

25. In well drained land the roots go down to a depth of 14" where as in alkaline land, it is practically confined to a few inches from the surface.

In India, water is always kept in the field throughout the growth of the crop, but in Italy and Spain, it is the practice to drain the water off completely, now and then. This is supposed to make the plants grow more vigorously, but it will also encourage the growth of weeds, and their removal is one of the most expensive items of cultivation in the countries which adopt this practice.[26] Flooding effectively keeps the weeds under check. If the water is drained periodically it has to be done before the plants start forming ears. Once the plants enter this phase, water must be supplied in plenty to promote the transpiration that is then most active and intense.

To sum up, the requirements of the rice plant are an abundant supply of fresh water (rain or irrigation) during the growing season, a high temperature and level tract of rather heavy soil, underlain by a subsoil that is largely impervious to water. The crop is partly submerged for about three months of its existence so that the volume of water required for maturation is very considerable. Being an aquatic plant, it differs fundamentally from most of the other cultivated crops of India. It is generally grown in fields susceptible of being flooded at certain stages of its growth. Hence the greatest areas under rice are in river deltas, in lowlying coastal districts and in tracts subject to inundation during the summer rains. Where the water supply is abundant and the summers sufficiently warm, rice may also be grown in terraces in the hill tracts up to an elevation of even 5,000′ as in the Jhelum valley of Kashmir and the Kangra valley of the Punjab and in many of the lower slopes of the Himalayas in U.P., Bihar and Bengal.

Rice is the principal food crop of the plains in the tropical and sub-tropical parts of South East Asia and is the main staple food of half the world's population. It is raised wholly by manual labour and is the only useful food grain that can be grown under swampy conditions. Its rival wheat, on the other hand, is a crop of the relatively sparsely peopled temperate lands and its cultivation is highly mechanised in all the main exporting countries.

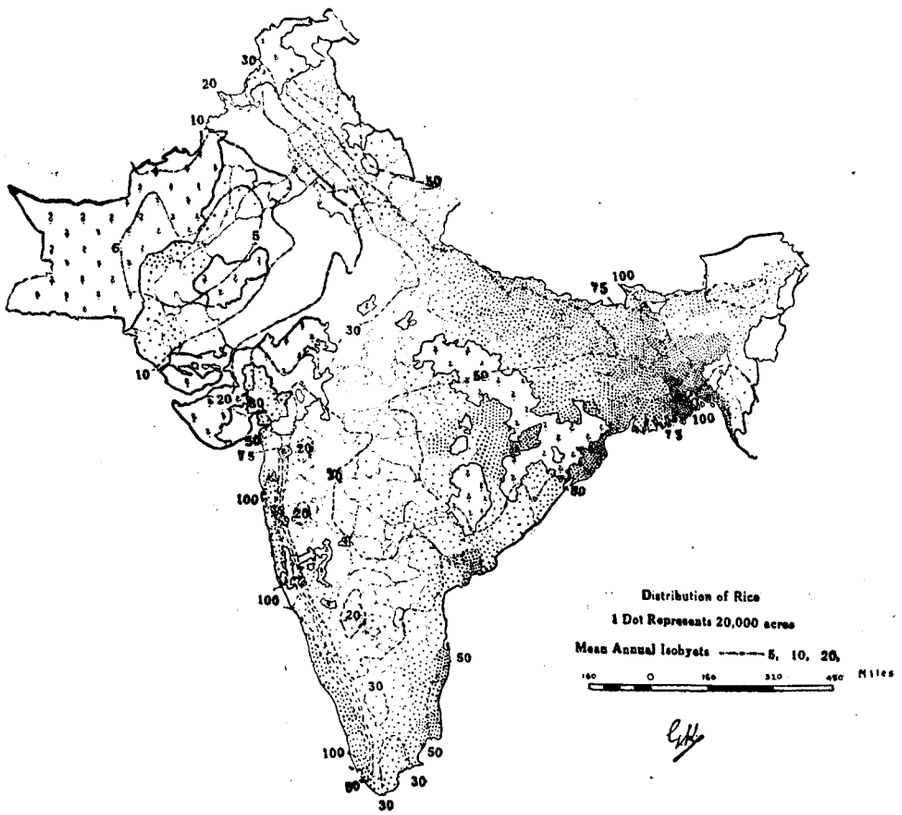
Distribution :—The area under rice in India in 1938 was nearly 74 million acres,[27] about 2 million acres more than what it was in 1928. The changes in the acreage from year to year are relatively insignificant and there is no evidence of any definite or consistent

26. It is probably true to say that in the deltas of Godavari and Kistna too much water is supplied to the plant, but the problem of the weeds will have to be faced when water is supplied at intervals, without flooding.

27. If to this is added the supposed underestimation of 6½ million acres, the total area under rice is in excess of 80 million acres. See footnote 8.

trend, either towards expansion, or contraction of the area. Such variations as have taken place can be attributed to the effect of seasonal conditions.[28] Rice is of unique importance in Bengal (22 million acres,[29] Madras (11·5 million acres), Bihar (10 million acres), Orissa (5 million acres), the Central Provinces (6 million acres) and Assam (5 million acres). It is also a very large and important crop in the United Provinces (7 million acres) where it is second only to wheat (8 million acres). In Sind, (1·2 million acres) both rice and wheat are of equal importance, each covering an area larger than any other crop. The most important crop in Travancore and Cochin is rice. In Bombay, Jowar, Cotton and Bajra all occupy larger areas, but yet, the area under rice is over 2 million acres. Bengal, Madras and Bihar together have about 60% of the total Indian acreage.

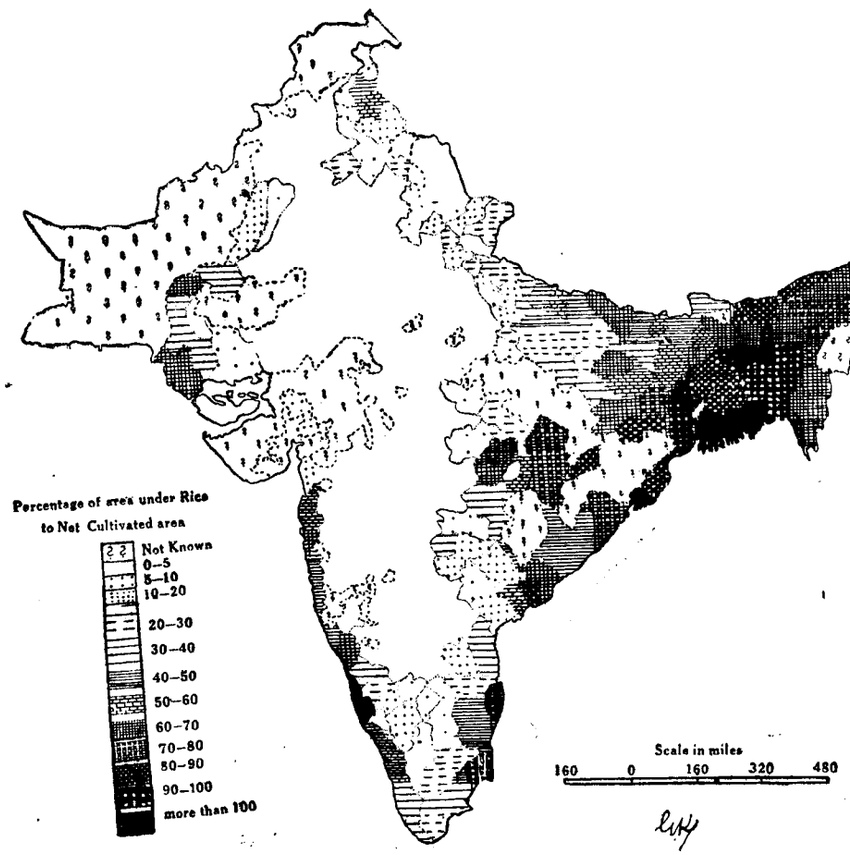
Map No. I



28. Report on the marketing of rice. Op. cit. p. 24.
29. c.f. Burma with 12·7 million acres.

In Bengal, though the cultivation of rice is well distributed the greatest concentration occurs in the southern and south eastern parts of the province in the districts of Faridpur, Noakhali, Bakkarganj, Midnapur, Chittagong, Tipperah and Dacca which together account for more than 40% of the total area of the Province. Irrigation, however, plays but a minor role in the cultivation of

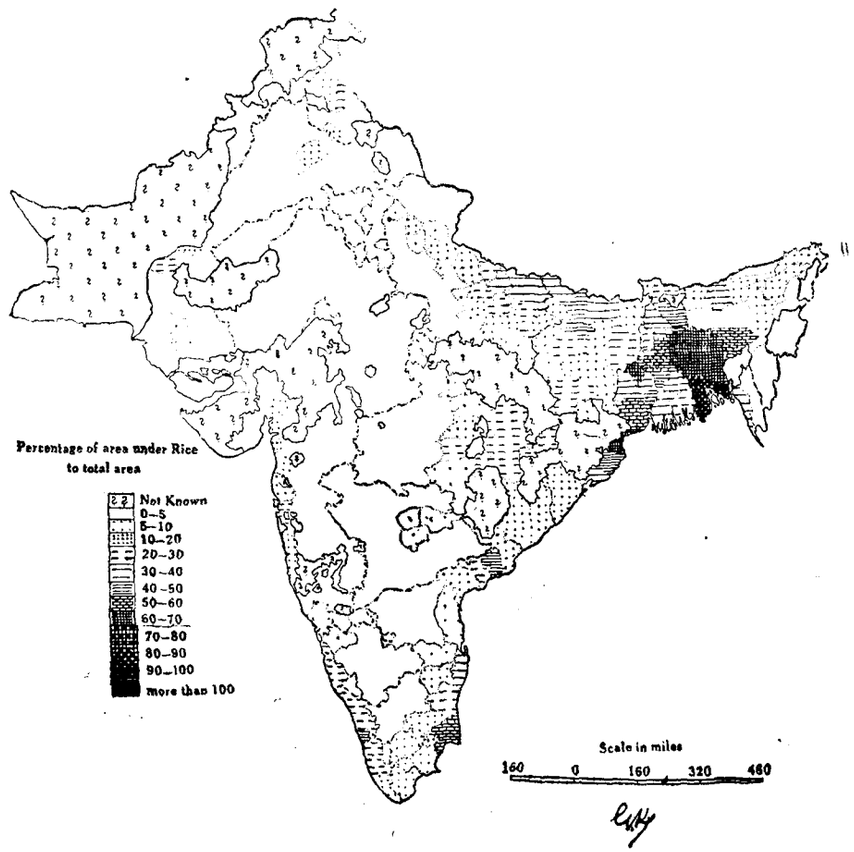
Map No. II



rice and the total area under irrigation in Bengal is only 1·5 million acres, which is about 7% of the gross area under rice, but it is 90% of the total irrigated area of the Province. Thus, although irrigation is not important for the cultivation of rice, yet rice is the premier crop grown under irrigation. Tanks are the most important source of irrigation. The irrigated area, however, is steadily increasing due to the opening of new canal works e.g. the Damodar Canal in the Burdwan District.

The largest tracts under irrigated rice occur in Madras, mainly in the southern and eastern districts, where out of a total of about 11·5 million acres, on an average, more than 8 millions acres are irrigated by tanks, or reservoirs. This area is likely to be further augmented when more than 1·25 million acres — a portion of which is likely to be given over to rice ultimately—will be brought under irrigation after the completion of the Tungabhadra and Bhavani projects. In Madras, the areas of maximum concentration are in the river deltas; 30% in the Godavari, 15% in the Kistna and 25% in the Cauveri, the three deltas together accounting for more than 70% of the total production of the Province.

Map No. III



Irrigation is not generally resorted to in Travancore (except in Nanjinad in the south), Cochin, Malabar and S. Kanara which together have about 2·2 million acres under rice. 50% of the rice area in Vizagapatam is unirrigated. In Chingleput, Chittoor and

Ramnad, a major portion the rice in its initial stages is rainfed. 75% of the total irrigated area of the Province is devoted to rice. It must, however, be noted that even the irrigated areas are not free from the vicissitudes of the seasons. Out of the total 8 million acres of irrigated rice, 5½ million acres i.e., more than two thirds owe their source of water supply to tanks and wells, both of which are to a very large extent dependent upon the two monsoons. They are often inadequate in the central districts and sometimes untimely and excessive in the coastal districts. The actual quantity of rice produced in any year in Madras is, therefore, mainly dependent on the strength and distribution of the two monsoons.

Though the majority of the rice area in Madras consists of single crop lands, where a variety of 5 to 6 months duration is grown, it is usual in portions of the area with better water facilities as in parts of Tinnevelly, Tanjore, Madura, Trichy and Godavari districts, to grow two crops of rice in the same season, one followed by the other. These areas generally get the benefit of both the monsoons with an annual rainfall of 40 to 50 inches, or they have special irrigational facilities. The first crop is mainly dependent on river irrigation and the second, partly on irrigation and partly on the north east monsoon. In the West Coast however, both the crops, wherever they are grown, depend exclusively on the rains and the springs activated by them. In small areas, there is even a third crop raised by lift irrigation from springs and wells, but this cultivation is rather precarious. There are facilities for growing three crops of rice in the same land in certain limited areas commanded by the Cauveri irrigation system in parts of Trichinopoly district.[30]

In Bihar, rice is widely distributed, the main areas lie north of the Ganges in the districts of Champaran, Muzzaffarpur and Darbhanga, which together account for more than a quarter of the total provincial acreage. Rice is both directly sown and transplanted, the varieties being different. Bihar has a total of 3 million acres of irrigated area under rice, which constitutes about 29% of the total rice acreage of the Province. Wells and tanks are the chief means by which the crop is watered.

30. In Godavari district, however, though the water supply in the canals is available for nearly 11 months—June to April—the first rice crop is raised from June to November and the cultivation of the second crop does not begin immediately, but is postponed to somewhere between the middle of January to the middle of April, no use being made of the canal water between November to January.

In Orissa, rice is concentrated largely on the coastal districts of Balasore, Cuttack, Ganjam and Puri and further inland in Sambalpur. These account for 72% of the total area. 50% of the rice area of Ganjam is unirrigated.

In the United Provinces, the north eastern districts of Gorakhpur, Basti and Gonda constitute the main centres of rice cultivation, having nearly 33% of the rice area.

In Assam, the Sylhet and Kamrup districts represent the most important rice growing tracts with about 50% of the total provincial acreage. A good proportion of the area is under deep water rices.

In the C.P., rice cultivation is largely centred on the eastern parts of the Province in the Chattisgarh division, embracing the districts of Raipur, Bilaspur and Drug which together account for two thirds of the area.

The rice producing tracts of the Punjab are mainly located in the northern districts of Kangra, Gujranwala, Sialkot and Shiekhpura with about 46% of the total acreage of the Province. The remainder is evenly distributed over the eastern and south western districts.

More than 50% of the total rice acreage in Bombay lies in the four districts of Kolaba, Ratnagiri, Thana and Kanara. In Bombay and Sind, rice is mainly a *kharif* crop depending upon rainfall.

Most districts in Sind contain some acreage under rice which is not generally large, but the heaviest concentration occurs in Larkana and Hyderabad which together have more than 50% of the total provincial area. Owing to the seasonal inundations caused by the Indus, conditions are favourable for growing rice in small plots in many riverine tracts. The entire crop of Sind is irrigated. While rice is not necessarily the staple food throughout Sind, it forms a not unimportant item in the dietary of the inhabitants of the Indus valley, where the greater part of the population of Sind is to be found.

(To be continued)

Reviews

The British Colonies by Vincent Harlow. (Oxford pamphlets on World Affairs No. 68) Price annas 6.

An outline of the history and policy of the British Colonial Empire which is a collection of more than fifty different dependencies spread over the whole world is given in the pamphlet under review. The author begins with the old conception of a colony which meant settlements of peoples who originally migrated from the parent state. This is not true of the modern Colonial Empire which is predominantly non-European . The colonies proper in British North America, Australia, New Zealand and South Africa have attained the status of independent nations. This was achieved by slow process. From an empire of colonies developed an empire of oceanic trade-routes, providing a net-work of commercial and strategic bases dotted about the oceans. The author explains with ease why the British went into West and East Africa and the Far East, incidentally discussing the question of exploitations. It is concluded by showing how Britain has gradually been promoting the progress of backward peoples in the colonies socially, morally and economically.

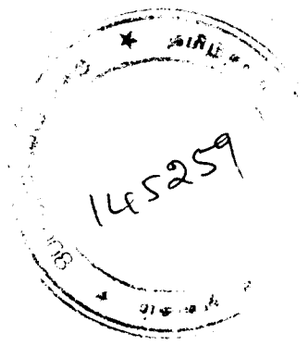
V. R. R. DIKSHITAR

French Foreign Policy by David Thompson. (Oxford Pamphlets on World Affairs No. 67) Price annas 6.

This pamphlet aims to describe the development of French foreign policy especially in recent times. The geographical position of France makes her occupy an important place in European politics. There are two great landmarks in French history, one was the French Revolution which ended the *ancient regime* and the second was the Franco-Prussian War of 1870. These two influenced the whole of the French foreign policy. The President of the Republic was vested with some powers to deal directly with foreign affairs, which however soon lapsed to the Chamber of Deputies. It was the Council of Ministers who really controlled foreign policy. In other words, there was little parliamentary control over foreign relations. In the meantime, some efforts were being made for friendly co-operation between France and Britain, though real

alliance was achieved only in 1914. The author takes the history through the Great War, the Versailles Settlement, the place of France in the League and its repurcussions, down to the outbreak of the War in 1939. The German defeat of France in 1940 shows the failure of French policy. Being one of the big powers it is hoped that France is bound to evolve, in the near future, a new and more effective foreign policy.

V. R. R. DIKSHITAR



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