River.	Estimated annual discharge in acre feet.
B.—Riet and Modder Rivers	376,000
Tributaries of the Orange below its junction with the Vaal	432,000
Gouritz River and tributaries	284,000
Gamtoos River and tributaries, but excluding the Kouga	262,300
Sundays River	189,000
Bushman's River and tributaries	93,000
Great Fish River and tributaries, but exculding the Koona	344,570
Doorn River and Olifants River below the infall of Doorn River	60,300
Total for rivers tabulated under B.	2,041,170

According to the measurements of silt in the water of the Orange River taken at Orange River Station for twelve months, the mean percentage of silt is not in excess of 0·5 per cent. (see Irrigation Department Magazine), while the mean for the Fish River is not under 2·1 per cent. (see paragraph 434). The Fish River, therefore, contains on the average well above four times as much silt as the Orange. Assuming that the Fish River is typical of all the rivers tabulated under letter B in the Table above, we may further assume that they all carry four times as much silt as the Orange River per unit volume of water. In other words, these rivers transport by their annual flow, of roughly 2,000,000 acre feet as much silt as 8,000,000 acre feet of Orange River water. The remaining rivers of South Africa are, comparatively, clear and may be neglected in this rough computation.

503. Now, in the season 1919-1920 (the only season for which data are available) the Orange River transported over 51,000,000 tons of earth past Orange River Station. This, with the conservative assumption made above, would place the amount transported by the other rivers tabulated in the preceding paragraph, at 136,000,000, or a total of 187,000,000 tons of earth, equivalent to 91 square miles of soil one foot deep.

504. *Rough though this estimate is, it serves to indicate the magnitude of the annual loss of soil; but the actual area ruined annually may be much greater, for although much of the portion eroded is gouged out to a depth deeper than one foot, much of the area lying between adjacent sloots is also ruined.*

505. What proportion of this silt comes from the steeper areas of the various catchments, where the velocity of the water is greatest, is unknown, but is doubtless considerable. Afforestation is, therefore, needed in the mountains, and it is in the mountains that the most favourable sites for plantations are to be found. The grassburning areas which it has been suggested should be more extensively used for afforestation, and less for stock-raising than in the past, are mostly these same mountain areas. If they are put down to timber, a great deal of soil erosion will be prevented, and since a considerable proportion of the silt comes from the steeper areas, the various catchments, where the gradient of the water-course is great, this afforestation will appreciably cut down the silt content of our rivers.

506. On the lower slopes, where the gradient is less, the water also does damage, for although its fall is less, the water gains in volume what it loses in gradient, and thereby its velocity, which as a determining factor in its destructive power, still remains high. If forests in the upper slopes regulated the water and prevented the rapid confluence of streamlets, the reduction in volume would immediately result in decreased velocity. The destructive power and the damage done would, therefore, speedily become less. The effect which afforestation would have on the reduction of the loss of our valuable soil is thus evident.

507. The effect of destruction of vegetation and the effect of soil erosion on the variable nature of the flow in South African rivers have already been dealt with at some length, and it is unnecessary, therefore, to deal here with the advantages of afforestation as regulators. The one is merely the obverse of the other.

508. In this connection, however, your Commission wishes to refer again to the question of systematic treatment of the various catchments of the Union rivers. The general control, or direction of work in connection with the preservation of the river catchments should be placed in the hands of the reclamation officer recommended by your Commission (see paragraph 224). But just as he will work with the Sheep Division in small-stock areas in order to obtain the best results, so too will he work with the Forest Department in areas where afforestation is possible and needed to prevent or stop erosion. Similarly, any large afforestation schemes would be submitted to him for remarks before they were embarked upon.

509. It is perhaps necessary to state clearly, to prevent misunderstanding, that the afforestation which your Commission has in view is not the general planting of the Karroo with forest trees. Afforestation, a means to the efficient use of water and reduction of drought losses, will naturally be confined to those districts suitable for afforestation. Other districts must be treated by the preventive or prophylactic means previously described.

510. In the discussion of these preventive methods and the preservation of veld, your Commission has endeavoured to submit the question of soil conservation in a manner not previously done, namely, to show the stock-farmer that by adopting the farming and grazing methods proposed he will benefit not only posterity, but also himself, directly and immediately. Only a corporate body or an individual of the highest culture and sense of duty will respond to the cry of posterity: direct personal, material advantage must also be present to move the average man. So too, in submitting the less tangible, but none the less real advantages of afforestation—advantages which can be realised only in the future, and then in many cases not even on the farm where the plantations were established—the direct and more tangible advantage must be presented at the same time.

511. The experience of the Great War period taught many lessons. Mankind had to pay so high a price for them that we should not fail to make use of the knowledge so gained. One lesson in particular that South Africa should have learned is that even though the sea routes to all countries were kept open and trade maintained with all, except enemy countries, the war occasioned a shortage of many articles. If South Africa should ever be cut off from free communication with other countries for many years, we should be severely handicapped in our progress.

512. In that eventuality, factories of various sorts would certainly spring up, provided always the necessary raw materials were available. With respect to foodstuffs, we would not experience any shortage; but let us examine the position with regard to other raw materials needed for continuous expansion and progress: wool, cotton, copper, zinc, tin, asbestos, coal, iron, lead nitrates, mercury, sulphur, tar, glycerine, hides, paraffin, petrol, rubber, salt, timber. All of these are at present being produced in sufficient quantities, or could be if necessary, to prevent any acute shortage, except perhaps the following major articles: nitrates, mercury, sulphur—or we might make shift with South African pyrites—paraffin, petrol, rubber and timber. For the last five years (1918-1922) the average annual imports for these items were:—

Nitrates	£252,709	
Mercury	40,195	
Sulphur	58,738	
Rubber	749,943	£3,079,134
Wax (Paraffin and Stearin)	428,183	
Paraffin	490,978	
Motor Spirit	1,058,388	
Timber, Wooden Manufactures and Paper		3,045,008

513. From the above it will be seen that *timber and timber products comprise, to all intents and purposes one-half of the necessities imported from overseas.* Man cannot create mineral deposits, but he can establish plantations, and if the South African timber industry can be developed to supply the requirements of the country, the annual importation of necessities will practically be cut in half. These data show that it is necessary from a broad point of view, with the object of making the country self-supporting, to grow more timber. From the more directly materialistic point of view, the saving of some three million pounds yearly is a factor to be considered. It is assuredly unnecessary here to produce evidence that timber-growing pays.

514. Apart from timber production, tree-planting may be practised for other purposes connected with the improvement of the country. The question of ornamentation need not here be touched upon. *The need of shelter for stock has been made sufficiently clear in previous chapters, and your Commission needs, therefore, only to make once more an appeal to stock-farmers, in their own interests, to do all they can to plant shelter trees for stock.* This may be done either, as in many parts of the Orange Free State, in the form of two intersecting lines forming a cross which will afford shelter for stock no matter from what direction the wind comes, or in some other form according to local requirements.

515. Tree-planting may also be desired to reduce wash on slopes without doing away with the use of that area for grazing. For such purposes, that is for the production of " park lands ", trees which do not transpire freely, and which permit sunlight to percolate through their foilage, should be chosen. Camps or paddocks treated in this manner, are of great value to the stock-farmer.

516. There are many bare patches in the Karroo, where the vegetation fails to re-establish itself without artificial aid. On such areas even a few branches pegged down will afford a sufficient wind-break to permit the collection under and around the branch, of sufficient wind blown material to form a seed-bed in which growth of the native vegetation is rendered possible. Wind-breaks established across such an area would result finally in re-vegetating the whole. Unfortunately these areas are usually in localities where it is extremely difficult to get trees to grow, and farmers, however anxious to plant, do not know what to plant. The American aloe (Agave) has been widely tested. It is highly drought-resisting, serves as an

excellent wind-break, and has the additional advantage of furnishing valuable fodder. In certain localities in the Karroo, your Commissioners had their attention drawn to the fact that the American aloe fence acts as a nurse for the mimosa tree. The fence collects a considerable deposit of sandy material on the windward side, and in this the seeds of the mimosa germinate and eventually grow to big trees, which give not only shade from the sun, but also an annual crop of nutritious fodder. There may, however, be other trees or bushes even more suitable than the American aloe. *Your Commission considers that investigations should be carried out to determine what varieties are suitable for these drier areas ; and then provision should be made for establishing nurseries, at which seedlings can be obtained.*

517. To break the force of torrents, a thick layer of decaying vegetable matter is useful. To produce this, broad-leaved deciduous trees are the most efficient. Such trees demand much water, and will remove it from the soil. Mosses and similar growths, which find sanctuary in the shade of the trees, also take their toll of the moisture. The total result, is not only the holding up of large volumes of water temporarily for gradual delivery, but also the permanent removal of a considerable proportion. As a consequence the total runoff or yield of the valley is decreased, but in all probability, the total amount which may be used is increased : for of the torrent, only a small proportion may be put to use, except at a prohibitive cost for storage, while the tamed stream could perhaps be led directly on to cultivated lands. For prevention of soil erosion in other parts, vegetation which stools and trees which readily produce suckers may be more useful.

518. There is a great divergence of opinion among foresters as to whether high or low transpirers should be planted. The difference is largely technical and cannot be discussed here. Your Commission believes, however, that a great deal of the difference of opinion arises from the fact that the different parties have different objects in view. Local conditions render one or other objective of prime importance, causing others to sink relatively into the background. In addition one also finds sentiment and a love for our indigenous hardwood trees (many of them extremely slow-growing) ranged against pure commercialism—the plea for exotic trees as yielders of quick returns. As long as this difference of opinion is not permitted to retard the rapid afforestation of as much of the Union as possible, it can do no harm. Your Commission, however, desires again to point out that in afforesting the catchments of the rivers, which are so important in irrigation, care should be taken to ensure that the species planted are not of too high transpiring power.

519. Both State and private afforestation enterprise should be encouraged. Various suggestions thereanent were laid before your Commission which, however, makes no recommendations concerning the methods of encouragement beyond that mentioned in paragraph 492.

520. Your Commission finds that :—

(i) Afforestation (with suitable trees) will greatly assist in reducing soil erosion and in making the flow of rivers more uniform.

(ii) Afforestation, where practicable, should be carried on systematically for the preservation of river catchments, particularly those which yield water for irrigation.

(iii) Irrespective of the gain to the country in general, the valuable harvests returned by plantations will make them good investments.

(iv) Timber and timber products make up one-half of the value of the absolute necessaries imported from overseas which are not produceable in South Africa under present conditions. In fostering the timber industry South Africa would become much more self-supporting.

(v) Investigation should be carried out to determine what varieties are the most suitable for the drier areas, and then provision should be made for establishing nurseries, at which seedlings can be obtained.

XXIX. Indigency and Migrations between 1918 and 1921.

521. That section of the Terms of Reference which bears on indigency was touched upon in the Interim Report and it was explained (see Chapter IX) that it was extremely difficult to separate the indigency arising out of drought losses from that caused by other factors. It was also stated (in paragraph 159) that an attempt was being made to trace the migrations of the population, to see whether that would throw any light upon the problem.

522. One result of an analysis of the census figures for the last 56 years has been the revealing of the retrogression of the Cape Midlands, described in Chapter XVII, where evidence was submitted, pointing to the fact that, through veld deterioration, the capacity of those districts to support stock and people had decreased.

523. Besides that analysis, another was made to endeavour to trace the relationship which might exist between the drought losses of 1919 and the migrations of the people between the years 1918 and 1921. While your Commission fully realises that not every man who leaves a district does so because it has become financially impossible for him to continue to live there, it

is of the opinion that the number of emigrants may be taken as an indication of the number of indigents produced in a district, that is, the number of persons who have succumbed financially in the economic struggle for existence, or have felt that economic conditions there are such that satisfactory progress cannot be made.

524. Your Commission accordingly, with the help of data supplied by the Census Department, which was ever ready to help in this respect, computed the number of emigrants from, and the number of immigrants to, each district. In computing these numbers your Commission took the changes in the population for each district shown by the censuses of 1918 and 1921, and subtracted from those changes the natural increase, that is, the excess of births over deaths. The results of course show not the actual numbers of emigrants, but the excess of emigrants over immigrants or vice-versa.

525. The data thas obtained were plotted on maps, but cases in which the migration has affected less than 100 souls, or less than 2½ per cent. of the population of the district, where discarded. Owing to the variations in density of population in different parts of the Union, it was found necessary to construct one map showing the actual migration in numbers of souls, and another showing the migration calculated as a percentage of the population of the district, (see Maps No. XVII and XVIII.) Other maps showing the destinations of these emigrants were also drawn up (see Maps XIX and XX).

526. A study of the emigration maps reveals the fact that Namaqualand, Potchefstroom, Pietermaritzburg, and Fauresmith have lost many emigrants, losses mainly due to mining and military causes. Map No. XVIII, which gives the percentages of emigration from the different districts, shows that the severest emigration was from the Midlands and North West of the Cape Province. Roughly, excluding the four districts mentioned above, the area most affected lies within the lines joining up the following districts : Calvinia, Smithfield, Albany, Montagu and Calvinia. In the midst of this area, however, are some nine districts which show no emigration at all.

527. Map No. XXI. shows losses for 1919. It will be seen that they were very general. Even the coastal districts did not entirely escape. The heaviest losses are included in the area formed by the lines joining up the districts of Calvinia, Smithfield, Albany, Laingsburg and Calvinia, an area almost identical with that described in the preceding paragraph, as including those districts which show the heaviest emigration. There the similarity ceases. To the south, the districts of Montagu, Ladysmith, Oudtshoorn and Uniondale (where stock losses were low) show a large emigration. The districts of Victoria West, Richmond, Hanover, Murraysburg and Graaff-Reinet (where the losses were very high) show no emigration, while the emigration from Aberdeen, Willowmore and Steytlerville is out of all proportion to the drought losses of those districts. These last three districts, however, together with Jansenville, Pearston and Somerset East constitute the premier angora-goat country of the Union. It is, therefore, probable that the collapse of the mohair market had much to do with the excessive migration noted.

528. Noteworthy is the fact that the main stock-losses occurred in those districts which have shown a steady decrease in European population (see Chapter XVIII), and in several to the West thereof. It is also noteworthy that in the central portion of the retrogressive area there was no excess of emigration over immigration for the 1918-21 period, notwithstanding the severe stock losses of the 1919 drought. Is it that stock losses have never been the cause of emigration from these districts, or is it that losses due to drought have come to be regarded as normal, and are looked upon with equanimity ?

529. The above described investigation has led to no definite conclusion, for the relationship between stock losses and emigration has not been very marked, except in so far as emigration and stock losses have both been largest in the semi-arid districts. During this short period of three years even, which included a severe period of drought, it would therefore appear that casuses, other than drought losses, have been principally responsible for emigration. The analysis, therefore, if it has done anything, has merely confirmed the opinion recorded in the Interim Report, that it is difficult if not impossible to separate indigency caused by drought from that brought about by other factors.

530. *This being the case, your Commission can do no more than repeat that education and better marketing facilities are needed ; that education will mean improved methods of farming, and increased production ; that the provision of better marketing facilities, better roads and better railway and harbour facilities will make the increased production worth while.*

531. Drought and jackals, as a cause of indigency, have been discussed at length, and it is sufficiently evident that improvement of the conditions in any of these directions will tend to diminish poverty and indigency among the rural community. In subsequent paragraphs agricultural education, within and without schools, will be discussed, as well as the improvement of transport facilities and markets.

532. Your Commission desires, in this connection, to add another word of warning against paying too big a price for land. Many a farmer is crippled at the very commencement of his activities through this indiscretion. All his available capital, and perhps all he could borrow, is locked up in land, so that fencing, dam-making, boring for water and improvement of stock

become impossible. In a frantic endeavour to keep his head above water he allows his farm to become overstocked, with the evil effects already described, and ends up frequently in the bankruptcy court.

533. Overstocking, brought about by the causes mentioned in the previous paragraph, is done with the hope, in the case of the sheep farmer, of increasing the yield of wool, which could be done equally well by improving the flock. Unfortunately, in the cases being discussed, the capital necessary for such improvement of the flock is not available, and time is against the farmer who lives from hand to mouth, pressed by creditors from all sides.

534. In addition to the high price of land as a cause of indigency, is the too minute subdividing of estates. The small sub-division is all too frequently incapable of supporting a family. Another cause brought to the notice of your Commissioners by land-surveyors, is the practice of incorrectly subdividing an estate by cutting it into portions whose configuration makes farming difficult: or again, there may not be proper apportionment of the various kinds of veld.

535. In the case of farmers sending their sheep away by rail in times of drought, it has been the custom to demand from the sender the full single fare, and to refund one half thereof when the sheep are brought back. The farmer finds this deposit irksome. It may generally be presumed that when the drought has so far advanced as to force the farmer to trek, he has little or no cash available. Since the object of the reduction in railway charges is to assist the farmer and prevent stock losses, needless deposits should not be demanded. The action of the Minister for Agriculture during the 1922 drought in arranging for the acceptance by the Railways of promissory notes, should serve as a precedent.

536. Your Commission considers, however, that if farmers desire assistance of this kind they, on their part, should be prepared to do something. For instance, they could organise so that those who want grazing for their stock, and those who have veld to lease, may readily be brought into communication with one another. *Your Commission again emphasises the necessity for organisation for coping with the movement of stock in droughts.*

537. In the preceding paragraphs, attention was directed to the prevalent practice of sending sheep away during drought, and means of facilitating this were discussed. This sending away of stock, however, is not the only solution of the fodder problem which confronts the farmer in times of drought. Instead of moving the animal to fodder, it is possible, and may be better, to bring the fodder to the animal. Usually a farmer does not decide to "trek" until the situation on his farm has become hopeless, by which time his animals have become very low in condition. In this state the fatigue of the journey alone may cause considerable losses. Wherever economically possible, therefore, the fodder should be brought to the starving animal, and in order to encourage this, the Railways should be prepared, not only to move stock at a reduced charge, but also to move fodder at emergency rates during droughts. At present there is not the co-operation between the fodder-producer and the stock-farmer that there should be; and the production of fodder and the storing thereof, have not received the attention they deserve. As a result there are no large stocks of hay or other fodder which may be drawn upon in times of drought; but this is a fault which will probably be remedied. It should be borne in mind that the trekking of animals in times of drought usually results in the temporary overstocking of some portion of the country to its detriment, so that transporting the fodder rather than the animals is to be recommended from national considerations.

538. Regarding the treatment of the indigent who has been ejected from the farm through the inexorable working of economic laws, your Commission (if it be permitted to do so) would suggest, since afforestation will to a large extent be carried out by the State, that as many of these indigents as possible be employed on afforestation works. Your Commission feels that employment of these persons on this national work is particularly suitable, and is of opinion that such a policy would lead to a reduced rate of production of this unfortunate class. The experience already gained in this direction is, moreover, sufficiently gratifying to warrant the continuance of the policy.

539. It also suggests that the State might develop the iron industry as a means of absorbing unemployed whites. The State might also employ poor whites in developing new industries which would find markets only if a minimum annual production be assured. As an example may be mentioned the Beet Sugar Industry. Unless a sufficient tonnage of beets is guaranteed, it would not pay to start a sugar factory. For individual farmers to commence such an industry is difficult, if not impossible. The State therefore, should show the way and provide the minimum of raw material necessary for the establishing of the factory. Private enterprise can, and will, do the rest. The time will come when the State can withdraw and turn its efforts to establishing similar industries, such as for example, cotton growing or perhaps the same industry in other parts of the country.

540. Another suggestion which your Commission desires to make is that in the establishment of labour colonies, due regard should be given to climate and genetics. The indigent European "ceteris paribus" may be looked upon as a weaker member of the race. It is very necessary to add the words "ceteris paribus," for many a poor white is to-day the physical or mental equal, or superior, of his richer fellow-citizen who has been "nurtured"

better. Granted, however, "ceteris paribus," that the poor white is the weaker member whom we desire to reclaim, we must see that all his surroundings are as near ideal as possible to permit of his sound and healthy development. For this reason the geneticist should be consulted. As Professor Duerden says in his evidence (Appendix No. 16) :—

> "Indeed, had the question been one concerned with the improvement of domestic stock, it would have been submitted to the geneticist forthwith."

With the desire of directing attention to this phase of the problem, Professor Duerden's evidence is printed in full.

541. This brief mention of labour colonies, brings one to the question of establishing schools for the youth of such colonies. Everywhere witnesses asked for industrial schools to arm youths with sufficient education to enable them to compete with skilled workers from overseas, and to keep them from sinking into the sea of unemployed, unskilled poor whites. The evidence of the Rev. Pienaar of Uitenhage, who has long been closely connected with industrial schools in South Africa, forms Appendix No. 26.

542. Home industries should also be of great assistance in reducing indigency. Inter alia, the manufacture of karosses, cushion-covers and so on, made of the hides of domestic or wild animals, may be suggested.

543. Your Commission finds that :—

(i) Although the migration from a district may be taken as a rough indication of the number of indigents produced in that district, there is very little relationship between the migrations for the period 1918-21 and the drought losses for 1919.

(ii) The problem, therefore, of ascertaining to what degree indigency is due to drought losses, remains unsolved.

(iii) The whole position admits only of general solution. All measures which aid farmers by improving generally their condition, will reduce the number that succumb during droughts.

(iv) Under these circumstances, the extension of agricultural education, improved transport and marketing facilities are to be recommended.

544. While it may be just beyond the limits of the Terms of Reference to treat of the handling of indigents once they have left the farm, your Commission desires to urge three points in connection with the establishing of labour colonies for them :—

(i) The indigents should be employed in afforestation or in starting new industries which, from their nature, are difficult for the individual to establish.

(ii) The advice of geneticists should be obtained before choosing a site for such a colony.

(iii) Industrial education should be provided for the children of the colonists.

XXX. Roads.

545. Bad roads adversely affect the farmer, not only in matters directly concerned with drought losses, but also as regards his general progress. It is not necessary here to dwell on how these bad roads interfere with the dairy and fruit industries, and even with the transport of the less perishable products of other branches of farming : but a brief discussion of roads in relation to soil-erosion is necessary.

546. Dongas and sloots often indicate the original route of some road or other, "road" being here used in the South African sense of a right-of-way, possibly macadamised. The bared track, usually worn somewhat lower that the neighbouring veld, catches up during a shower the water dropping over its upper edge, collects and concentrates it until a change of grade occurs, or the road, now a canal, overflows. A well made and well maintained road does not behave in this manner, for the camber or convexity of the road surface throws the water off.

547. The usual result of the occurrence described in the preceding paragraph, is a sloot or donga along the greater part of the sloping road, and an impassable bed of loose sand or earth at the foot of the slope. In any case the "road" sooner or later becomes so bad that it is abandoned. Very frequently the first abandonemnt takes place during a rainstorm. For psychological and other reasons a driver almost invariably, in turning out of a flooded road, chooses the upper side. Almost invariably too, subsequent travellers follow the spoor of the first and before long a new track has been brought into use parallel with, and lying above the old one.

548. Had the new track been below the old, the latter would have served to a considerable extent, as a catch drain protecting the new, and prolonging its life. Unfortunately, this rarely happens, but instead these tracks are multiplied into parallel series, frequently hundreds of feet wide. Thus do unmade roads continuously destroy veld and deprive it of water.

549. Where roads are *made*, the roadmaker is faced with the problem of draining them, and frequently of transferring water from one side of the road to the other. Like the railroad builder, he is concerned merely with the removal of the water from the area under his control. Neither his instructions nor his funds permit him to consider the possible destruction of areas outside the right-of-way. The result is, as was to be expected, damage to surrounding property.

550. Of the damage done to surrounding property it is unnecessary to say much here, for that is a matter which may be left in the hands of the reclamation officer recommended by your Commission, but it is obvious that the fewer the number of roads, the less will be the damage done. With a reduced mileage the funds available for construction and maintenance will go further.

551. It should, therefore, be the policy of the road authorities to take steps to reduce the mileage of roads to minimum. It has ever been the policy to hasten slowly in the closing of roads and in this South Africa has followed European custom. In many parts of the Union, particularly in the more level portions, roads have been duplicated and multiplied beyond all reason. In mountainous country, where passes or, in other parts, fords and bridges determine the position of the road, roads are not too numerous ; but in the unfenced level plains, where each could ride where he would, an uneconomic development of tracks took place. In many parts of the Union witnesses complained of the cumbersomeness of the process of road-closing, and even of a want of sympathy on the part of the central authority for the farmer. All these witnesses suggested that a simplification of the law is necessary.

552. Your Commission realises that a certain stability must exist in the road-system of a district, and moreover that the system which has grown up and appears cumbersome to the layman, is one based on sound reason and years of experience ; yet, where it is possible by making a small change in the law to minimise greatly the effect of one of the most potent causes of donga formation, your Commission thinks that that action would be justified and therefore recommends that the laws relating to roads be altered for a fixed number of years so as to simplify the procedure, and permit of the easy closing of roads.

553. Another recommendation which your Commission would urge road authorities to adopt, is that final sanction for the closing or deviation of a road be not given until the road closed, or deviated from, has been properly protected from further scouring.

554. In the North-West of the Cape Province, witnesses complained very bitterly of trek-paths. It would appear that there are persons, farmers who own no farm and pay no rent but who graze their stock along the trek-paths, raising large families the while. The eradication of scab and the fencing and paddocking of farms is greatly hindered by these trek-paths.

555. Your Commission finds that :—

(i) It would be to the benefit of farmers if the roads of the Union were improved.

(ii) Unmade roads are a very fruitful cause of dongas, and are continuously ruining the veld.

(iii) The roadmaker does not generally pay much attention to what happens to the water, once it has left the road area, and much damage to property is occasioned by the water discharged.

(iv) Reduction in the mileage of roads is possible in many parts of the country, and should result in better roads and less damage to property.

(iv) Steps should therefore be taken to reduce the mileage where possible.

XXXI. Agricultural Education.

556. The whole of the Report of your Commission bristles with examples of the necessity for the farmer to help if he wishes to escape or minimise drought losses. The State too has its duties, among which are leading and encouraging the farmer ; but the State cannot take the farmer by the hand day by day and prescribe what he must do. The farmer must act alone. Farming is the practical application of a large number of intricate Natural Sciences, and it is on the correct application of these sciences that greatest success in production depends.

557. Unfortunately the bulk of the present generation of farmers had little schooling, and even the most elementary facts of science are unknown to them. In the absence, therefore, of any foundation of simple fundamental scientific fact the practical farmer of to-day finds it difficult thoroughly to realise the object of all methods advocated by the expert or specialist.

558. If an example may be given to elucidate the above paragraph, the case may be cited of a man who attends a lecture on dry-farming methods and learns, without understanding, the why and the wherefore of deep-ploughing, that it is in many cases essential for the incorporation of organic matter with the lighter soils, not only from a fertilising point of view, but also with a view to increasing, to some depth, their waterholding capacity. Filled with this information and a spirit of progress, he returns to the farm with the idea that deep-ploughing is the whole secret of dry-farming, having forgotten, or not having understood, that climatic and soil conditions, time of ploughing and sowing, proper and timely preparation of the seed-bed, water-

holding capacity and natural fertility, drought or rust resistant varieties, time of maturity, etc., are also important factors. Had the farmer fully appreciated all of the principles underlying the system of dryland-farming, he would not merely have avoided many a crop failure, but would also have saved himself much time and trouble. Had he, in his school days, received instruction in the elementary principles of science, or had he been given lessons in Nature Study, he would doubtless have been in a much better position to assimilate all that the dry-farming expert had told him.

559. Similar examples could be culled by the hundred from the experience of any agricultural expert in dealing with a certain type of farmer ; and they would all point to the necessity for an agricultural bias in education, and for more attention to the simple facts of natural science.

560. Your Commission consulted the educational authorities of many parts of the world on this matter. While the objective is clear, the attainment thereof is a matter which is largely technical, and, as such, must be left to education experts. Briefly, the gist of the matter is summed up in a paragraph contained in a letter received from Mr. W. S. Latrobe, Superintendent of Technical Education, Wellington, New Zealand, who says :—

> " It cannot be said that any particular subjects have been dropped out of the primary school syllabus in order to make room for nature study, agriculture, etc. It is rather that the teachers have in recent years been given such freedom in the construction of schemes of work for their schools as has enabled them to build their courses, where desirable, in such a way as to include naturally a treatment from the rural point of view of all the subjects of instruction which have a direct bearing on farmers' problems."

561. Your Commission, in this connection, desires to draw attention to paragraph 18 of the recommendations contained in the report of the Committee on Agricultural Education, 1922 :—

> " While agriculture, as such, cannot be taught in rural primary schools, the course followed in such schools should be brought into closer touch with the pupil's environment, especially through the medium of nature study and, where possible, school gardens."

562. As has been stated in the introduction, necessity for economy has made it impossible to print all the evidence submitted in connection with this, among other important questions ; but this report would be of considerably less value if the able and concise memorandum drawn up by Dr. W. J. Viljoen, Superintendent-General of Education for the Cape Province, were omitted. Not only is he a high educational authority, but his experience as Chairman of the Committee on Agricultural Education places him in a still better position to judge. The memorandum referred to is printed in the Appendix No. 25. Attention is also directed to the memorandum submitted by the Rev. W. G. Dowsley, which is printed as Appendix No. 27.

563. Your Commission finds that, taking into account that so many scholars will, in later life, be directly or indirectly dependent on agriculture for their livelihood, the courses of instruction followed, particularly in rural schools, should have a strong agricultural bias.

XXXII. Agricultural Extension Work and Demonstrations.

564. It is now some considerable time since political economists first brought the following facts prominently to the notice of all civilized nations, viz :—

(*a*) That the proper development and husbanding of the resources of the soil have a more immediate bearing upon life and living than most other human interests.
(*b*) That there is a world-need for increased production, since the difficulty of acquiring sufficient food is even now being experienced throughout the world.
(*c*) That the resources of the soil, in many parts of the world, are already failing to keep pace with the increase of the world's population.
(*d*) That the pressure of increase in the population of Europe was mostly balanced by the supply of food from the virgin soils of America.
(*e*) That a surplus of cereals for export from America is now available only when the harvest is very favourable.
(*f*) That Europe, hitherto dependent mainly on North America, Russia and some of the Balkan States for her grain supply, is becoming more and more dependent on food supplies from South America, Australia and South Africa.
(*g*) That South American supplies are being increasingly diverted to the United States and that, while South Africa is in a more favourable position to supply Europe than is Australia, it requires no prophet to foretell an approaching world-interest in our sub-Continent such as that which was evinced last century in North America.

(*h*) That the main pre-occupation of South Africans should, therefore, be to put their house in order, to fit themselves to hold their own, and to profit by the fast approaching turn of fortune's wheel, rather than be destroyed by it, as has been the fate of others who were in a similar position.

565. Experience has taught progressive countries that a knowledge of the principles of good farming should not be confined to a handful of highly educated scientists, but should also be disseminated throughout the farming world. Knowledge given to the one section may gradually percolate to the other, but too much valuable time would be lost in this way. In the Interim Report (see paragraph 165) your Commission strongly urged that there should be created an organisation similar to that of the County Agent organisation of the United States of America, so as to provide a link between the expert and the farmer, and thus facilitate the passing to the farmer of those results of scientific research, with which it is to his advantage he should be familiar. Your Commissioners are gratified to learn that a Division of Extension has now been created as a branch of the Department of Agriculture, for that is certainly a step in the right direction, in that the sphere of activity of the Division includes the bridging of the gap between the farmer and the expert. Your Commissioners are further heartened by hearing that the organisation of the Division of Extension will include District Agents, and they trust that these posts will be filled by the right type of man.

566. *An Agricultural Demonstration Train* which will carry lecturers, Government exhibits, bioscopes, etc., is already being constructed under supervision of the Division of Extension. This train will, in a small way, bring the Agricultural Faculty of the University, and the School of Agriculture to the farmhouse door.

567. **Your Commission finds that the Department of Agriculture, by creating a Division of Extension, has taken a great step forward in the direction of bringing the expert knowledge of that Department to the farmhouse door, and is of the opinion that if this Division be adequately supported, it can do much to minimise the bad effects of recurrent droughts.**

XXXIII. Railways and Agriculture.

568. Agricultural development is very closely associated with Railway development. The direction in which agriculture will develop in any locality, is determined by several factors, among which the market is frequently the most important. In the neighbourhood of a large town or centre, milk production, cultivation of vegetables and similar perishable commodities, are usually paying industries. In areas further distant from such centres, these commodities cannot be produced profitably. But the word "neighbourhood" is nowadays a relative term, it can no longer be defined in miles: transport facilities must be taken into account, and one would now rather define the distance from a market in terms of the time taken by available transport. Railway development thus tends to bring the producer nearer the market, and thus increases the area which may be used for producing perishables.

569. It is, however, not only the production of perishables that is affected by railway development. The cost of a commodity is roughly proportional to the cost of production, plus the cost of transport to the market. In competition on an open market, therefore, those goods, the cost of production of which has been high, or of which the cost of transport has been high, cannot compete with a similar article produced or transported more cheaply. It is, therefore, evident that there is a limit to the amount which may be paid for cost of transportation, and therefore, a limit to the distance from a market at which certain commodities may be profitably produced. Railways, by cheapening and facilitating transport, increase this maximum limit and increase the area in which, taking into account only the transport factor, such commodities may be economically raised.

570. It is evident, therefore, that the railways of a country are a very important factor in its agricultural development, and your Commission would like to see even greater co-operation between the Departments of Agriculture and Railways than has obtained in the past, in the discussion not only of railways proposed for dealing with commodities already being produced, but also of railways intended to develop the potentialities of backward districts.

571. This co-operation between the two departments should also operate in connection with existing lines, for not only is it necessary that railways be built to develop backward districts, but the rates should be adjusted to assist in development. It is conceivable that railway rates may be adverse to the development of an industry, and unless these are adjusted that industry may be throttled.

572. Again, it may be the policy of the Department of Agriculture to introduce a new industry into the country, an industry which needs to be nursed. The Railway Department should be prepared to do its best to help in such a contingency, as for instance, by adjusting freight rates as far as possible. It is not suggested that the railways should be run so as to lose permanently on these items; all that is pleaded for are special rates for development purposes. Once the industry has been properly established, there would result an increased volume of

business to the Railway Department which, in this way, would be recouped for its developmental outlay.

573. In paragraphs 535 and 537, the question of reduced rates for fodder and reduced rates for stock which are being moved to escape droughts, was raised. The matter is mentioned here again in this chapter dealing with railroads, because these rates constitute an important service rendered by the railways in times of drought.

574. Railroads cause much soil-erosion, and although evidence is not wanting that the Railway Authorities are becoming more conscious of their responsibilities in this connection, there is still room for great improvement.

575. **Your Commission recommends that, since agricultural development is to a great degree dependent on railway development, there should be the greatest possible co-operation between the respective departments, and is certain that such co-operation cannot but reduce losses in times of drought.**

XXXIV. Fodder Reserves.

576. Paragraph four of the Terms of Reference instructed your Commissioners to investigate the production of feeding by the cultivation of grasses—and this has been done—but it is not proposed to separate this particular aspect of preventing drought losses from the production of feeding in general.

577. The improvement of the natural grazing yield has already been discussed at length and the value of fodder reserves in preventing harmful grazing at the critical period following the coming of rain after long months of absence, during which the fodder on the veld has been reduced to almost nothing, has been indicated. Apart from this aspect, there is not the least doubt that in an *adequate* reserve of fodder, is a most effective insurance against stock losses in droughts.

578. The general lack of foresight in this connection is deplorable (see paragraph 49), Your Commissioners invariably enquired of witnesses how frequently droughts occurred, explaining very fully to them that by drought was meant such a time that, owing to lack of grazing or water, stock losses resulted. Almost invariably the answer was that three out of every five were drought years, and just as invariably was the reply that they made no special provision for droughts, replies typical of the state of mind of the South African farmer. Obviously the phenomenon which occurs three times out of five is more normal than that which occurs only twice : yet the optimism of the farmer refuses to permit of that point of view. The good year, though rare, is what he looks upon as the normal one ; the year of inadequate rainfall, as the abnormal. This attitude of mind is a cause which leads to overstocking, and to the failure to provide reserves of fodder for bad seasons (see paragraphs 54 and 241.).

579. To the general rule there are exceptions, but unfortunately economic reasons sometimes drive even these more provident farmers to turn their hay into money. Then, again, the farmers' optimism regarding the prospects for the season does not extend to market prices, and fearing that such prices will fall, not again to rise, he rushes his accumulated fodder to market.

580. All too frequently do subsequent events show that both his optimism and pessimism were misplaced ; the expected good season did not eventuate, nor did the expected slump in the fodder market. In fact, owing to the scarcity of feeding, there was actually a marked rise, and the miscalculating farmer had to buy food for his animals in a soaring market. Herein is a reason why ensilage is highly to be recommended as a reserve for drought times. While it keeps good indefinitely in the silo, it goes bad shortly after removal therefrom and must therefore, if at all, be consumed on the spot. (See Appendix No. 48).

581. If the farmer would logically act on what he freely admits, namely, that drought conditions will certainly, though not so regularly, recur as the rising of the sun, a considerable step in the right direction will have been made. The first and simplest of fodder reserves is that of the " spare-camp " or reserve paddock. A further wise precaution is a discreetly stocked farm. This plan is applicable to all farms, but particularly to such as those which have a low rainfall, and on which there is little or no opportunity for irrigation.

582. The development of an increased grazing yield of the veld was indirectly discussed in the Interim Report, when the negative sides of overstocking, overgrazing and deterioration of the vegetal cover was dealt with. In this connection your Commission desires to quote a paragraph from the evidence of Professor Crompton, Director of the National Botanical Gardens at Kirstenbosch :—

> " The vegetation of the Karroo—I speak particularly of the Western portions—has a very characteristic ' hottentots head ' aspect. There is in general an ' open ' formation of low bushes, a foot or two high and a few feet apart, the spacing being often exceedingly regular. These bushes are of a great variety of species, no one species being dominant. In general, the individual bushes are *old* ; they have gnarled, stunted and distorted stems, a dense growth of short twiggy branches, and a deep root system. The scarcity of seedlings, and especially of young plants, is most noteworthy and

points to the fact that Karroo bushes are not regenerating fast under present conditions."

"Between the bushes the soil is bare and stony, and often shows marked signs of erosion by reavy rains. Herds of sheep and goats roam among the bushes, trampling the soil hard, and biting off every green shoot and seedling within reach. They thus keep open the bare ground between the bushes, reduce the natural vegetation cover to the ground, and thereby favour evaporation and prevent regeneration."

583. The belief that this state of affairs, as described by Professor Compton, is normal, is far too general and needs attacking on every opportunity and in every possible way. The kind of thing that will do much to assist in this connection is what Mr. Phillip Weyer, owner of the farm "De Toekomst" on the border of the Somerset East and the Jansenville districts, calls the "seed-camp." A "seed-camp" is a small area, to which access is possible only by climbing over or through the wire fence. Here the veld is untouched by stock year in and year out, and thus the various plants have the fullest opportunity to grow naturally and produce seed. Quite apart from furnishing occular evidence of the destruction wrought by stock they furnish centres from which the seeds of the palatable plants are spread to other parts of the farm. Mr. Weyer also uses these "seed-camps" as nurseries for useful indigenous plants, which are in danger of extermination.

584. It is not given to all to have that full practical knowledge of Karroo flora which is possessed by Mr. Weyer, nor can all take the same deep interest therein; but surely to the stock-farmer the vegetation of the veld must always be of interest. *Your Commission therefore recommends as a matter of general interest and educative value that every Karroo farmer should have at least one "seed-camp" on his farm. One morgen or even less would be sufficient, and access by gates or other easy means, should not be possible, in order to diminish the temptation to drive stock into it.*

585. Before leaving Mr. Weyer's "seed-camp," your Commissioners would express the opinion that the department of Agriculture, if it has not already done so, should undertake the study of the principal Karroo and other indigenous plants, with a view to improving and spreading those that are useful and to restricting the spread of those that are useless or noxious since, owing to limitations of rainfall, it is highly desirable that the veld should consist, as far as possible, of fodder plants only and, further, only of those fodder plants, whose efficiency in utilising rainfall, is high. Your Commissioners recommend that every endeavour be made to improve on indigenous species rather than, as appears to have been the custom in the past, to look exclusively to exotics for betterment.

586. The second method of creating a fodder reserve is to make hay from veld grass. This of course, is practicable on a large scale, only in the grassveld, and then only provided that the absence of boulders and irregularities of surface permits of the use of machinery.

587. Many witnesses complained of the high cost of machinery, particularly of that used in haymaking which, in the drier parts, cannot be used every year through want of favourable rains, and must, therefore, be kept idle often for long periods. In this way capital, a commodity which the farmer usually lacks, would be locked up, and that doubtless often deters him from investing in such machinery. On the other hand, the scythe costs little but is not to be despised as a mowing implement where labour is available.

588. The third method of getting together a fodder reserve, is to grow "artificial" fodder crops. In this connection must be considered the rainfall and temperature factors, the possibility of irrigation, the purpose for which feeding is needed, and so on. There is, for example, the Mesquite Bean, a tree which furnishes valuable fodder, grows readily under extremely arid conditions and does not require protection from stock, owing to its formidable thorns. Then there is Lucerne, the king of fodder plants, which requires good and deep soil for the best results, as well as a bountiful water supply. Rye is hardy, does well on poor soils even, and furnishes excellent winter grazing where there is winter rain, where Autumn rains are sufficient, or where irrigation is possible. "Emmer" wheat falls more or less into the same class as Rye. Of grasses, Paspalum thrives even on our soils; Kikuyu tolerates a moderate amount of brak and furnishes excellent fodder, but is nipped by frost in Winter; Soudan grass, a species of sorghum, is a free grower and gives a fairly good hay or ensilage when properly treated. Maize can be grown for grain in all parts where the rainfall is favourable both as to season and quantity. The stalks, remaining after the cobs have been removed, furnish excellent and palatable roughage, especially if they are cut off and stacked. Maize, moreover is the king of ensilage crops and, not only can it be grown for this purpose wherever it can be grown for grain, but also in many districts, where the rainy season is too late to permit of maturation before frost comes. Besides these there are the American Aloe (Agava americana) and the Prickly Pear (of which there are spineless varieties). Both of these grow well in dry climates and are frost-resistant. Unless looked after like ordinary crops these cultures cannot be counted on to make rapid growth; especially does this apply to the former; but both have the advantage over other crops that they are available for fodder purposes at any time and are therefore pre-eminently a standby in times of drought. *Your Commission does not propose to deal with*

the practical aspects of growing and utilising the above-mentioned crops, but recommends that if pamphlets have not already been published in connection with them, the Department of Agriculture should see that this is done.

589. It would appear that the stock farmer has already paid some attention to, and derived some benefit from, exotic fodder shrubs, grasses, and so on ; but too little attention, from a stock-feeding point of view, has been devoted to indigenous varieties. It is, however, gratifying to know that the Department of Agriculture, through its Division of Botany and Chemistry, and its Veterinary Research Laboratories at Onderstepoort, have for some years been actively engaged in investigating the feeding value and other properties of certain South African fodder plants. Some of our Schools of Agriculture and Universities have also been working in the same direction with, in some cases, valuable results. Actual feeding values have, up to the present, been determined in a limited number of cases only. Species of Karroo vegetation, for example, provide not only excellent drought fodder, but are known to be good and palatable feed for normal times. What their actual food value is, does nor appear to be known ; which is a pity.

590. It is also encouraging to note that private individuals have started "Karroo Gardens," with a view ultimately to establishing the best varieties on the veld, where only useless species now grow. If this objective be attained, it is obvious that the stock-carrying capacity of such veld will be increased. Controlled grazing will also probably result, and with it the re-establishment of the vegetal cover and the retarding or stopping of soil erosion.

591. In addition to the species mentioned in Dr. Phillip's article on "Native Drought Hardy Fodder Plants" (see Appendix 47), the following have also been highly commended to your Commissioners (by farmers and others) as being both drought-resistant and edible, namely : "*Appelbos*" ; "*Brosdoring*" ; "*Beesbos*" ; "*Beesporselein*" (Portulacca oelracea); "*Blinkblaar*" (Rhamnus prinoides also Zizyphus mucronata) ; "*Driedoring*" (Rhigozum trichototum and R. obovatum) ; "*Gemsbok Bean*" which comes from South-West Africa and appears to be a promising plant, but has not yet been sufficiently tried in Union areas to warrant a definite recommendation ; "*Gacia*" (Cytisus stenopetalus), a robust shrub from South-West Africa which does well at the dry-land station at Pietersburg ; "*Inkbos*" (Suæda fruticosa) ; "*Kortbeen-Harpuis* (a species of Euryops) ; "*Skulpadbos*" (Zygophyllum-morgsana also Grubbis rosmarinifolia) ; "*Wilde-Grannaat*" (Burchellia capensis) ; "*Kriedoring*" (Lycium arenicolum) ; "*Wolwedoring*" (Scolopia zeyheri) ; "*Ysterbos*" (Dodonœa thumbergiana) ; and "*Rosyntjiebos*" (Grawia cana).

592. *Exotic drought-resisting fodder plants* have from time to time been imported and the following are some of those which have been experimented with in a greater or lesser degree. (1) *American Aloe* (Agave americana). Many farmers assert that this plant is an excellent standby in times of drought and that all classes of stock will eat it; others again aver that it causes a deadly paralysis. It is highly important that this latter assertion be investigated thoroughly. (2) *Carob Tree* (Ceratonia siliqua). The beans borne by this tree contain a sweet pulp and are used in Southern Europe for feeding horses, mules and pigs. They have also been used in England as an ingredient of concentrated cattle food. In its native habitat it is usually a shrubby undersized tree 12 to 20 feet high, but sometimes it attains a height of 30 to 40 feet. A large mature tree may yield as much as 4–5 cwt. of pods. The tree is usually dioecious (*i.e.*. male and female flowers on different trees) but it is usual to graft a branch from the male on the female tree. This species has not been extensively cultivated in South Africa, but since it is said to be suited to hot, dry districts with stony soil, it should be given an extensive trial. (3) Mesquite or *Algaroba Tree* (Prosopis joliflora) is widely distributed in India and North America, where it is found as far South as Mexico. The nutritious pods are relished by cattle horses, sheep and pigs. The tree grows well near Britstown and in South-West Africa. Mr. Robertson of the Forest Department writes . . . "well worth while trying in the drier parts of the interior, especially in districts in which ordinary fodder crops cannot be grown with certainty, and on poor soils or eroded ground not suitable for better crops" (4) *Kudza* (Pueraria thumbergu) is largely grown for stock feed in Japan and America. This twining plant has been successfully grown by some farmers in the Low Veld of the Transvaal. Full particulars concerning this plant are given in the Journal of the Department of Agriculture of September 20th, 1920. (5) *Soap Weed* (Yucca Elata). This is an American plant with succulent leaves and stem belonging to the family *Liliaceæ*. In Mexico it has been found an excellent standby in times of drought. The leaves and stems are machine chopped, hand chopping having been found unsatisfactory because a greedy animal is liable to choke through attempting to swallow the occasional large pieces inseparable from hand preparation. South Africans who have seen and studied this plant in America are of opinion that it will do very well in the drier parts of the Union. *Acacia anema* and *Jacsonia cupulifers* are drought-hardy stock plants well worth trying in the drier parts of this country.

593. In this paragraph a few particulars concerning certain grasses (exotic and indigenous) are given :

Marram Grass (Psamma arenaris) is a very good standby in times of drought and is fairly frost-resistant. It is, however, usually planted as a binder for drifting sand.

Pipe Grass (Ehrharta gigantea) is another sand binder as well as a very useful pasture grass.

Olifant Grass or *Napier Fodder* (Pennisetum purpureum) is excellent for pasture and for silage, but not much good for hay. It stands drought and is more frost-resistant than maize.

Molasses (Melinis minutiflora). There seems to be much diversity of opinion with regard to general characteristics of this grass. Most well-informed people describe it as a good pasture and hay grass ; but it does not stand frost, is difficult to establish from seed, and is not a good drought resister.

Kikuyu (Pennisetum clandestinum) is an excellent pasture grass. It stands drought but is not very frost-resistant.

Pennisetum.—There are six or seven South African and other species, all of which are more or less drought and frost-resistant.

(*a*) *Natal Grass* (*Tricholaena rosea*) is one of the best.

(*b*) *P.cenchroides* does very well on sandy soils.

(*c*) *Paspalum* does well on sour soils.

(*d*) *Broom Corn Millet* (*Panicum miliaceum*) is a very excellent hay and pasture grass. The defunct Division of Agronomy distributed seed of this grass to hundreds of farmers in the summer rainfall areas of the Union for co-operative experimental purposes. The results obtained by the Division as well as by the farmer-experimentalists were so excellent that stock farmers are building great hopes on this variety.

594. Where fodder for times of drought has been grown on the farm, it may be argued that the stockowner alone is to blame if, in time of need, he has none. There are doubtless many instances of the kind where the stock farmer, pressed for cash, has deliberately sold fodder, which he could not but have known would be needed sooner or later to save his stock from dying of starvation. There are also doubtless cases in which the farmer, for a less sound reason has done the same ; but usually where stock losses are heaviest in droughts, crops are not easily grown, owing to want of sufficient or favourable rain. Even when the crop-raising capacity of the farm has been fully developed, it may be quite impossible for the farmer to accumulate a reserve sufficient to feed all his stock through all droughts, especially if the latter follow one another closely.

595. While the stock farmer occasionally can, and should, raise and store fodder for drought times, one must not overlook the fact that stock farming and crop raising are, in the main, carried on apart. The farmer to whom the country looks to provide fodder for stock is not he who owns the latter and, further, there is no organisation knitting together the interests of these two main branches of farming industry. A good season for the stock farmer means a glutted fodder market, while a really bad drought so puts up the price of fodder that its purchase to save ordinary stock is out of the question.

596. The necessity for the bridge between the fodder producer and the stock farmer is obvious. While a stock farmer will perhaps store fodder which he has grown himself, he will not, even it he has the capital, purchase fodder with the view to storing it for use in future droughts ; nor will the crop raiser produce fodder in years of plenty, with the hope of selling to the stock farmer during the next drought. In fact, the crop producer does not consider the stock farmer a possible customer : he looks rather to export to solve his market difficulties.

597. That the crop producer will come to the assistance of the stock farmer, therefore, is unlikely and it would seem that this will become more and more so unless something is done to bring the interest of both into line. Alternations between famine and plenty have for ages been experienced in Africa. Years of food shortage interspersed with years of abundance were experienced even in Biblical times, and so acute were the days of famine that special steps were taken to tide the people through the lean years, steps which, with but little amendment, could be applied to our farming industry to-day. In Genisis, Chapter XLI, it is written :—

> " Let Pharoah . . . . appoint officers over the land, and take up the fifth part of the land of Egypt in the seven plenteous years. And let them gather all the food of those good years that come, and lay up corn under the hand of Pharaoh, and let them keep food in the cities. And that food shall be for store to the land against the seven years of famine, which shall be in the land of Egypt : that the land perish not through the famine."

If, in this quotation, one substitutes " the State " for Pharaoh, " the Union " for Egypt and " fodder " for food and corn, a good picture is obtained of the type of organisation that would do much to bring prosperity to the crop raiser and ensure the stock farmer against drought losses. Such an organisation was proposed in Australia and named the Fodder Bank.

598. The principle underlying the Fodder Bank is simply the accumulation of fodder during good years and holding it in bond until the next drought, when the Bank would sell to the stock farmer at a basic price, plus interest and other charges, which price would be much lower than the famine prices paid at present because there would be no scarcity. Once

a reasonable price is assured the crop raiser, he will doubtless find it advantageous to produce more fodder than at present.

599. In the days of Ancient Egypt, it was the state, in the person of Pharaoh, which took the lead and stored the corn. There is the same need again for the State to lead but the people are in all probability more enlightened now and, moreover, are governed by their chosen representatives. Such an autocratic decree as that of Pharaoh would, therefore, be out of the question. It should, however, be possible to work out a scheme, on the Rural Credit plan that would appeal to the people, and which would perhaps prove equally efficient, yet less expensive than one owned and controlled by the State.

600. Whether the country is ripe for the institution of the Fodder Bank or other equivalent organisation, Your Commissioners do not say, but they find that :

(1) *Such an institution is needed, even as in the days of Pharaoh* ;
(2) *The State should take the lead and discover the Joseph necessary for the organisation of such a venture.*

601. In the course of their studies your Commissioners had a series of maps prepared which will assist the novice in the choice of fodder crops, and will give a better bird's eye view of the agricultural and pastoral industry of the Union than anything hitherto published. It would have been possible, by increasing the number of maps, to present the position even more clearly ; but, in order to reduce the cost of printing, a system of superimposing colours and hatchings was adopted, for this procedure permitted the recording of a large amount of information on a small number of maps.

602. Since the method of superimposing colours and hatchings does not appear to have been employed before to represent statistics graphically, a few words of explanation are necessary. A certain colour, or a single hatching, is chosen to represent a certain statement or fact ; and similarly, certain other colours and hatchings are taken to represent other single facts. In order to express graphically that a statement or a fact is applicable to a particular district, that district is tinted with the relative colour, or is covered with the corresponding hatching. If, at a subsequent stage, it be desired to represent on the same map other statements or facts concerning the same district, the colours or hatchings, corresponding with the additional facts, are superimposed. In the case of hatchings, the result is merely to produce a more or less complicated cross-hatching which, by the aid of the table attached to the map, can easily be analysed into its constituent parts ; but the superimposing of colours gives results, which are not so easily understood, excepting by the experienced. Fuller particulars than could be given in legendary form, therefore, follow. The colours chosen to represent single facts are the primary colours (red, yellow and blue). The colours resulting from the superimposition of the primary colours are :

From Red and Yellow	Orange.
From Red and Blue	Purple.
From Yellow and Blue	Green.
From Red, Yellow and Blue	Gray.

and each compound colour, represents two or more facts.

603. Reference to Map No. XXII, will make this perfectly plain. In this map the main points illustrated are crop-raising, wool-producing and dairying. Yellow represents crop-raising ; blue, wool-production ; and red, dairy produce. Wherever yellow appears on the map, either pure or in combination (Orange, green or grey), it is indicated that the district, so tinted, is a crop raising district. (The extent to which this is so will be defined later). Likewise where blue, or any of its derivatives (green, purple or grey) appears, the district produces wool ; while red, or any of its derivatives (purple, orange or grey) indicates dairy produce. Hatching, in addition to colouring, modifies the latter in the following way : Yellow, or a derivative colour without hatching, indicates that crop raising is practically confined to vegetables, but yellow, with vertical hatching, means that the district produces grain or fodder. Likewise, if the hatching be diagonally downwards from left to right (the so-called south-east hatching) tobacco is grown ; if diagonally, upwards from left to right (north-east hatching), fruit, other than grapes ; if horizontal, viticulture is carried on ; and if wavy, cane sugar is produced. Any hatching may be superimposed upon any other, or others, to indicate that a district produces more than one crop. Thus a grain and a wine producing district would be indicated by yellow colouring and a combination of vertical and horizontal hatchings.

604. All the particulars, necessary to the interpretation of the maps, have now been given and the application of these to map, No. XXII, furnishes the following information. Beaufort West, coloured blue, is essentially a wool-producing district ; Klipriver, (red), directs its energies mainly to dairying ; Knysna, (yellow), produces, among the items represented on this map, vegetables ; Maraisburg (purple), that is, red and blue superimposed), is a wool-producing and dairying district ; Glen Grey, (green), produces wool and vegetables, and Newcastle, (orange), vegetables and dairy products. Rustenburg with its orange colour, a ver-

tical, a north-east and, south-east hatching, affords a more complicated case, but there should be no difficulty in interpreting it. Orange is made up of red, (dairy produce) and yellow (crops generally and vegetables in particular), while the hatchings indicate grain, fruit and tobacco respectively. Another complicated example is to be found in the district of Malmesbury which is coloured gray and has vertical and horizontal hatchings. The analysis follows in tabular form :—

Colour on Map.	Superimposed Constituent Colours.	Hatching.	Interpretation of Colour and Hatchings.
Gray	Yellow, Blue, Red..	Horizontal, Vertical	Vegetables, Wool, Dairy Products, Grapes, Grain.

605. The make-up of the maps and their interpretation having been explained it remains to point out the significance of the data on which the maps are based. There are rather more than two hundred districts in the Union. If, therefore, a district produces one half of one per cent. of the total quantity of a commodity produced in the whole country, its production is greater than that of the average district. The criterion that a district produces a commodity, adopted for the purpose of making these maps, is that its production thereof is more than one-two-hundredth part of the total production of that commodity for the whole of the Union.

606. An objection to this method of representation is that it does not take into account the size of the district. For example, a large district producing, say five-eighths of one per cent. of the total output of a certain commodity gains representation on the map as a producer of that commodity ; yet a similar area, made up of four districts, none of which produces the criterion for representation, but all of which, taken together, produce no less than one and a half per cent. of the total output, fails to gain notice on the map, simply because each district, considered separately, fails. Another objection, and one which is perhaps to be described as serious, is that such smaller districts may gain title as producers of a commodity, simply because the total output thereof is very small. Thus a district may produce far and away more maize than tobacco ; yet, because the total output of tobacco for the Union is very low and that of maize very high, such a small district might figure as tobacco-producing, and not, as it really is, a maize-producing district. By the use of the " dot " method of representation these and similar objections could have been overcome, but fifty-three maps, in place of eleven, would have been required. A weak point in these maps, caused by the presentation of the data on which the maps are based, is clearly illustrated by the cases of Gordonia and Kenhardt, which are crop-raising with respect to a very narrow strip along the Orange River only ; yet because they produce more than the average quantities of grapes and other fruit, the maps described them as grape and fruit producing districts. Without additional information one would assume that grapes and fruit are produced more or less evenly over the whole district, just as one assumes—and rightly so—that the district of Beaufort West produces wool in all its parts. The data supplied by the Agricultural Census would, generally speaking, be of greater use if the districts, especially in cases so glaring as those of Gordonia and Kenhardt, were divided for purposes of presentation of such data.

607. Map No. XXII, presents a bird's eye view of the Union in relation to agricultural and pastoral production. Owing to the weaknesses inherent to the method of presentation of census data described in the preceding paragraph, Kenhardt and Gordonia loom unduly as crop-raising areas, while districts such as, for example, De Aar and Pearston, which are quite as good small-stock districts as those bordering them, remain untinted since, through their small size, they are not able to raise the quota of wool required for recognition on the map. Apart from these details the map shows very clearly that crop raising in the summer rainfall area is practically confined to districts where rainfall exceeds 20 inches per annum ; while in the area of winter rainfall the minimum limit appears to be in the neighbourhood of 10 inches. Where the rainfall is less than the stated minima, the country is purely small-stock country. If the summer rainfall crop-raising belt be divided roughly into three, one sees that although the whole is devoted to cattle-raising, only the southermost two-thirds is at present also used for small stock. The concentration of viticulture in the South West of the Union, of tobacco in the Transvaal and of sugar cane culture on the Natal Coast, are also brought out clearly by this map.

608. Map No. XXIII gives an analysis of the production of vegetables in the Union. It is not necessary to enter into details ; the map is self explanatory. Much useful information as to the availability of water—rain or irrigation—during the different seasons can be gathered from it by studying the type of vegetable produced. Pumpkins, for example, can be raised only where a sufficiency of water is available in summer. The warning against being led astray by the information concerning Gordonia, to which reference was made in paragraph 606, must again be sounded here.

609. Map No. XXIV, an analysis of orchards, is based on numbers of trees. It needs no explanation beyond the general remarks made above.

610. Map No. XXV, is based on the quantities of the various grape products produced annually. With the exception of the districts of Gordonia and Kenhardt, where viticulture is practised on the banks of the Orange, viticulture in the Union is seen to be confined to the south-west corner. There are slight differences between the " vine " districts of Map XXII, and the districts here shown, which is due to the fact that Map No. XXII is based on the number of vines, while this Map (XXV) is based on the products of the vines.

611. Map No. XXVI, based on quantities produced, gives the distribution of what may be termed the more tropical crops of the Union.

612. Map XXVII, presents an analysis of the production of grain. The maize and kaffir corn belt is seen to lie in the summer rainfall area while in the winter rainfall area lie wheat, oats and barley. Cases such as Britstown, where wheat is grown under irrigation, furnish exceptions to the general rule.

613. Map XXVIII, and more particularly Map No. XXIX, deserve study in connection with Fodder Banks (see paragraphs 594 to 600). Map XXVIII is plotted in conformity with other maps of the series ; but Map No. XXIX shows only the chief of the fodder producing districts which, together, furnish one-half of all the total fodder output of the Union.

614. Map No. XXX is based on numbers of animals. Cattle, Ostrich, Mule and Donkey zones are clearly seen.

615. Map No. XXXI, showing the distribution of small stock, brings out very clearly the great preponderance of wooled over other sheep in the Orange Free State. The further west the locality, the greater is the proportion of non-wooled sheep, while in the longitude of Prieska, goats form an appreciable proportion of the small stock. Still further west, the flocks consist of non-wooled sheep and goats. North of Prieska there appears to be a few wooled sheep. Angora-goats are shown to be confined almost exclusively to a central strip running from south to north,

616. The last map of the series, No. XXXII, needs no special comment.

617. The Frost Maps XXXIII, XXXIV and XXXV (which were prepared for the Commission by the Chief Meteorologist, to whom thanks are due), should be of great value to agriculturists, particularly in connection with fodder production, growing of crops for ensilage and so on. It should, however, be observed that according as a farm is sheltered or exposed, so the incidence of frost may be less or more severe than is indicated by the map, which shows the average for the district.

618. During the course of its labours the Commission became more and more impressed with the economic importance attaching to the study of succession in plant communities. In this connection special attention is directed to the contribution by Prof. Bews, of Natal (see Appendix No. 7), who has already done valuable work in this field.

619. The factors determining what species are present in a community and their relative numbers are no doubt many and complicated, chief among them being the climatic factor and, while one or more members of a community may dominate the rest, the very existence of some is traceable to the beneficent presence of others.

620. Given very favourable climatic conditions, Professor Bews records the following plant succession as taking place, namely :

(1) Wiregrass grassveld,
(2) Rooigras grassveld,
(3) Tamboekie grass grassveld,
(4) Scrub,
(5) Low Forest,
(6) High Forest.

This means that grass veld, in which Wiregrass is dominant, is a more primitive type than grassveld in which Rooigras is dominant, and so on. If then, Wiregrass becomes dominant where Rooigras had been supreme, retrogression has taken place, denoting less favourable climatic conditions or their equivalent. Your Commissioners have pointed out that overstocking and overgrazing lead to effects similar to those produced by less favourable climatic conditions ; if, therefore, the proportion of Wiregrass (which includes varieties locally known as steekgras) is increasing, it may be presumed with confidence that there is overstocking. In this way wiregrass acts as an indicator of retrogression.

621. In America the spread of prickly pear in grassveld is regarded as a sure indicator of overstocking ; and there is no reason to doubt that the case is otherwise in the Union. Now, the Karroo veld contains types much more primitive than wire grasses. If, therefore, in Karroo veld the proportion of grasses increases, better conditions are indicated. On the other hand, if inedible or unliked growths, as for instance, bitter-bos (*Chrysocoma tenuifolia*) are crowding out, say, the true sheep Karroo bush (*Pentzia virgata*) it is a sure indication that the effects of overstocking have become chronic. If Tamboekie Grass increases in Rooigras grassveld, it is an indicator of progression, of increasingly favourable climatic factors. This, nevertheless, from

a stock farming point of view is retrogression, for the Rooigras is the more valuable of the two. The farmer should therefore stock more heavily or take other means—Professor Bews suggests occasional burning—to cause retrogression.

662. Enough has been said to indicate the tremendous practical importance of plant succession, and to show that the study of such phenomena may be expected to point out indicators of what is happening to the veld. Besides showing retrogression or progression, plant indicators may also be used to give information as to climate and quality of soil. It would be of great assistance to farmers if it were once established, that where a particular indigenous plant grows, there certain exotic crops may be sown with profit, and so on.

623. Your Commission finds that :—

(i) **Farmers as a general rule do not make provision for droughts, even though they quite realise that droughts must be expected.**

(ii) **All methods of laying by reserves of fodder for droughts fall into three classes : sparing and improving of veld, gathering of native grasses for hay, and planting of exotic fodder-crops.**

(iii) **With reference to the cultivation of exotic fodder-crops, the fodder-producer and the cattle-raiser have as yet no common interest. The welfare of the country demands their co-operation and this can best be effected by establishing Fodder Banks.**

(iv) **With reference to indigenous fodder plants there is much information with regard to methods of propagation, food values, and so forth, that has yet to be obtained.**

624. Your Commission recommends that :—

(i) **Farmers should make such fodder reserves as may be possible under existing conditions.**

(ii) **The State should cause such investigation of indigenous plants to be undertaken as will enable its experts to advise farmers on matters of veld management and improvement.**

XXXV. Organisation of Farmers.

625. In Chapter XI your Commissioners dealt with the necessity for organising farmers, the difficulties in attaining that most necessary and desirable objective, and the benefits to be derived therefrom. Most of the difficulties of farmers are magnified by the lack of organisation among them, which prevents them from working together with that perfect combination so necessary to their welfare.

626. Even where some degree of organisation has been effected and a local Farmers' Association or Agricultural Society formed, there is frequently a lack of organisation or cohesion between the different Associations, and the united front which is essential to give weight to their resolutions or acts is wanting. Following on the trail of Organisation comes controlled markets and eventually co-operation. Through lack of organisation, a non-regulated supply of farm produce frequently leads to flooded markets and a resulting slump in prices. Through lack of organisation co-operation is delayed and the wily speculator, playing the one producer against the other, takes the cream of the business. It is not necessary to reiterate the advantages of the organisation of farmers to the State ; that has already been done in Chapter XI. A few features of the case from the viewpoint of the farmer, however, still need our attention.

627. The difficulties besetting the path leading to organisation are numerous. The sparseness of population, the great distance which many farmers have to travel, prevent that regular attendance at meetings which is needed to keep up interest in the association. Personal envy and political enmity also tend to prevent smooth working ; but a most potent factor is that lack of agricultural education among members—and this is even more pronounced among farmer non-members—which blinds them to their own interests—and as a result matters are too often judged by the farmer not from a farmer's, but from a party-politicians' point of view. It would be well if the farmer could put aside party-politics when attempting to work for the general good of his brother farmers.

628. Such organisation as has already been achieved has not been entirely satisfactory, from the point of view of efficiency or economy. To obtain satisfaction in this direction the system of organisation should be more on the lines of organisation which have been adopted by political parties. There should be, say, one Farmer's Association in every polling area outside the towns. Such Associations would be affiliated under what might be called a District Committee, whose headquarters would be in the principal town of the neighbourhood. As many districts as have identical agricultural interests would then combine and form a Circle Union or Association, which in turn would be affiliated with the other Circle Organisations of its Province, forming the Provincial Union. The South African Agricultural Union would furnish the final bond tying the whole organisation together.

629. An organisation constituted in this manner would permit of matters being properly thrashed out ; each body would deal with such matters as it was competent to deal with, and the work done by the local bodies would do away with the necessity for central committees or congresses having to waste their time with purely local affairs. Not only would such an organisation function as a channel from the farmer to the Government, by means of which farmers as a whole could speak with one voice to the authorities ; but it would also be a channel for the dissemination of information, enabling the Government to speak once and yet be heard by tens of thousands of farmers.

630. Among the benefits to be derived by such organisations are :—

(1) The saving of the time and the expenses of office-bearers.
(2) The establishing of a body which is the formal representative of the farming profession and which can act as the mouth-piece of the farmer in corresponding with Government or with other organisations, or on any occasion whatsoever.
(3) The educating of the farmer in the control of his own affairs.
(4) The assisiting of the Department of Agriculture in the dissemination of information, in combating stock diseases and locusts and in the eradication of scab.
(5) The establishing of local Farmers' Loan Banks.
(6) The controlling and regulating of markets.
(7) The more economical purchasing of farming requisites.
(8) The arranging for the distribution of fodder and the apportioning of grazing during periods of drought.

631. It has often been argued that farmers should organise themselves, and this argument is theoretically quite sound ; but it has proved a total failure in practice. It is, however, unnecessary to dwell any longer on this matter for it was sufficiently clear in Chapter XI why the organising should be undertaken by the State.

632. **Your Commission considers that the organising of farmers on the lines described in this Chapter will be of the greatest possible advantage to them and to the State, and re-iterates its recommendation that the State should assist in bringing about their organisation.**

XXXVI. Miscellaneous.

633. During the course of its investigations the Commission conducted meetings throughout the Union, at which all kinds of topics appertaining to farming were discussed. That this was so is due to the fact that the investigation of the matters embodied in the Terms of Reference, covering as they did practically the whole gamut of farming, was impossible without touching on all and sundry difficulties experienced by farmers. No attempt was made to stop a witness who wandered from the path as, in this way, your Commissioners obtained an insight into many matters of which they would otherwise have remained ignorant.

634. Thus, many points raised at these meetings were of purely local, and at times, even purely personal interest. Such matters the Chairman of the Commission would take up from time to time with the Government Department or official concerned. Points of a more general nature not falling under the Terms of Reference, were similarly dealt with, as were also other matters which could not wait the publication of this Report.

XXXVII. Final Summary.

635. Owing to the nature of the instructions embraced by the Terms of Reference, it would have been very difficult, if not impossible, to deal with the various subjects in the order therein laid down. Your Commissioners, therefore, adopted a more convenient and perhaps a more natural sequence in drawing up their report ; but in order that there should be a minimum of difficulty in correlating the report with the Terms of Reference, they have included the epitome which follows, and in which the Roman numerals refer to Chapters of the Report.

636. Paragraph 1 of the Terms of Reference :

> *The methods by which losses to farmers, owing to periodic droughts in the drier parts of the Union may be prevented, either by public or private action ; and in particular whether any changes in farming methods are necessary for this purpose.*

The most pressing and necessary change in farming methods is the abolition of the usually practised kraaling of stock and its substitution by the paddocking system. Kraaling is detrimental to the veld as well as to stock (III) ; it leads to a diminished efficiency of rainfall which is a much greater menace then a decreased rainfall. Complete grazing control through an efficient system of paddocks should be the goal : but an efficient paddock system demands

the provision of an adequate and pure water supply (V, VI, and XX). The reduction of drought losses should lead to improvement in the breed of animals (XXII). Overstocking is bad farming (IV and XXII). Farmers should accumulate fodder reserves for drought periods (XXXIV). Windbreaks and shade do much to assist in maintaining stock (III and XXVIII). It is calculated that the income of the Union from wool alone, would be doubled if the paddock system were generally adopted, while if all phases of the small stock industry be taken into account the annual increased return, capitalised at even 10 per cent., would very nearly equal the fixed property valuation of the Cape Province (XIX). There is room for much improvement in the economic use of water (XXVI).

637. Paragraph 2 of the Terms of Reference :

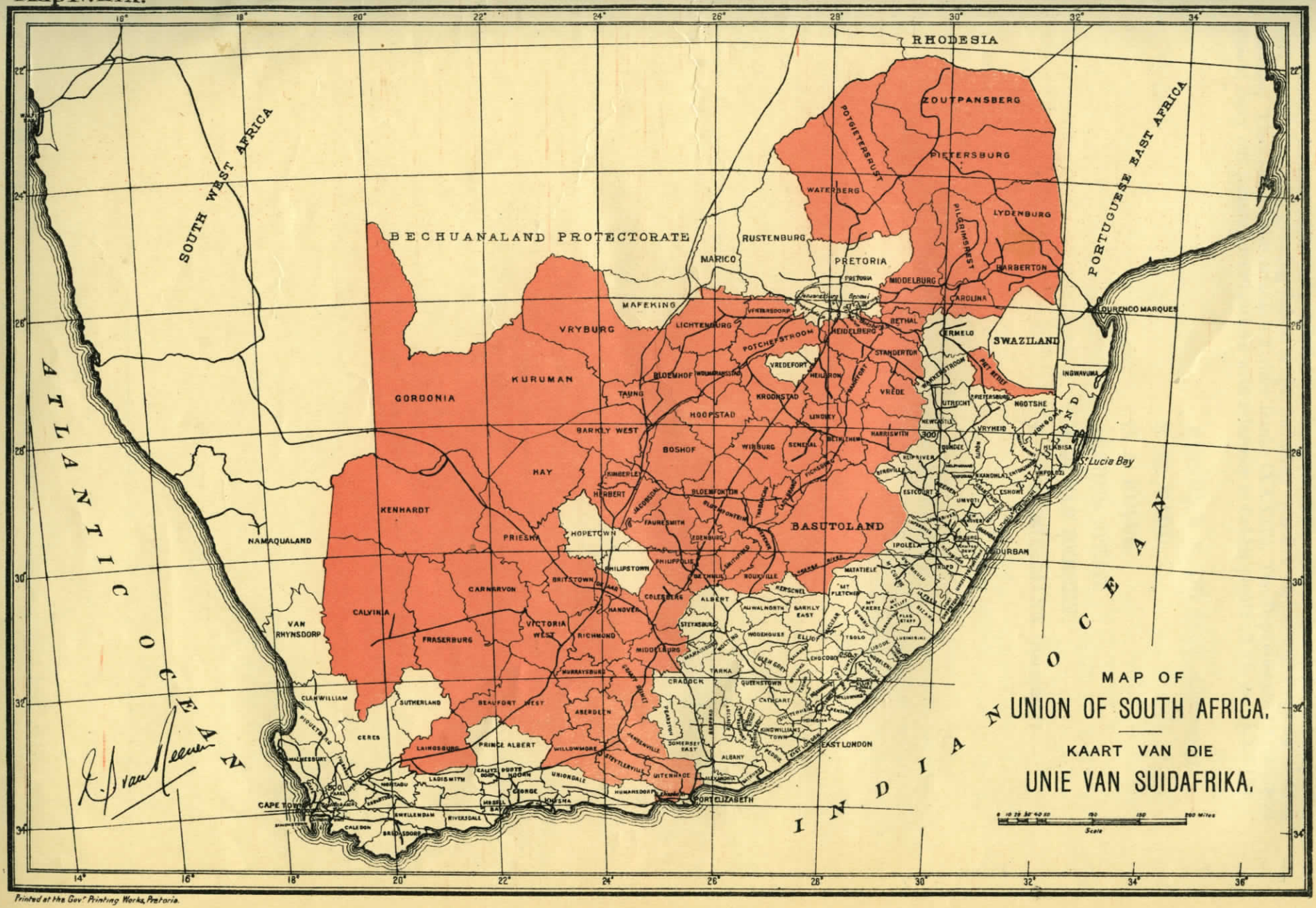
Any improvement in farming conditions generally, such as the provision of more water, prevention of soil-erosion and any other matters which may have a close bearing on point 1.

The improvements outlined in the previous paragraph, require the alteration of certain general conditions, to bring about which is beyond the powers of the individual farmer. For example, the jackal is responsible for much of the faulty small-stock farming (VIII), and he must be got under control or even be exterminated (XII and XX). The rapid adoption of the paddock system would be facilitated by making cheap fencing material available (XIII and XX) and by minor alterations in the fencing law (XII). The farmer should be encouraged to develop the water resources of his farm (V, XIV and XX). Stock thefts should be discouraged (XX). The failure to realise the benefits that would accrue from the better methods of farming is a reason preventing their adoption, an obstacle which educational effort would do much to remove (VIII, XVI, XXVI, XXVII, XXXI and XXXII). In this the organisation of farmers would greatly assist, and for the achievement of this end, the State should detail suitable officers (IX, XI and XXV). Farmers' organisations will ease matters during droughts (XXIX). Improvements of transport facilities (XXIX, XXX and XXXI), and generally improved market facilities (IX, XXIX and XXXV) will greatly ameliorate the farming conditions. Drought losses could be diminished if reliable seasonal forecasts were possible : the Government should appoint a committee of experts to determine what steps should be taken to obtain such forecasts (XVII). The provision of cold storage and of factories for making meat products would assist in the more economical use of the veld by enabling the farmer to dispose of his stock when in good condition (XXI). Deterioration of the vegetal cover and the resulting soil erosion are doing much damage and seem to be main causes of the decreasing European population In the Cape Midlands (XVIII). The soil is an irreplaceable National Asset. The State should, therefore, actively assume its responsibilities in connection with the conservation thereof by appointing a reclamation officer (VII, XV, XXIV and XXV). Veld burning as practised, is detrimental to the country but cannot be stopped by legislation. In most cases education will be the only deterrent ; but your Commissioners consider that in certain areas of high value as catchments feeding irrigation works, the prohibition of grazing would lead to the cessation of veld fires (XXVII). Evaporation plays a very important role in the social economy of the Union : probably many times the quantity of water which finds its way to the sea by rivers, is lost in unproductive evaporation, which would be reduced by the maintenance of an efficient vegetal cover, and through that, the prevention of soil-erosion (XXIII). Irrigation, though definitely limited in extent by the run-off of rainfall, topography, soil and financial factors, will always be an important aid to crop-raising and stock-farming. Through deterioration of the vegetal cover and soil-erosion, the efficiency of the catchments of most rivers used for irrigation is decreasing. The State should direct the preservation and reclamation of those catchments, which relatively and luckily are small (XXIV). Since the silting up of dams is beyond the control of the irrigator, the State should assist, *inter alia*, by aiding farmers to paddock and by preventing soil-erosion (XXV). Afforestation with suitable species for improving the head-waters of our rivers and their tributaries, and for other reasons, is to be recommended (XVIII). The study of insect and other pests and of weeds which reduce the grazing yield, should be undertaken by the State (XX). The State should also make preparations to establish Fodder Banks (XXXIV).

638. Paragraph 3 of the Terms of Reference :

The methods by which indigency arising among the farming community in consequence of such losses could best be dealt with.

Drought and other causes work together in producing indigency. The general improvement of conditions will decrease poverty, which is most intense after droughts (IX and XIX). Education and the improvement of transport and market facilities are needed (IX, XXIX, XXX, XXXI, XXXII and XXXIII). Climatic and genetic conditions should also be considered (IX and XIX).



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639. Paragraph 4 of the Terms of Reference :

The production of feeding by the cultivation of various grasses.

Usually farmers make no provision for droughts (IV). They should do so by sparing veld, making hay, by growing fodder crops. including spineless cactus, and crops for making ensilage. They should also establish Fodder Banks (XXXIV). The Department of Agriculture should carry out certain investigations with reference to fodder plants (XVI. and XXXIV).

HEINRICH S. DU TOIT (Chairman).

S. M. GADD.

G. A. KOLBE.

ARTHUR STEAD.

R. J. VAN REENEN.

R. A. B. MUSSMANN (Secretary).

[U.G. 49—'23.]