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AGRICULTURAL RESEARCH COUNCIL

Soil Survey of Great Britain

Land Use Capability Classification

by

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SUMMARY

A classification to evaluate the soil, site and climatic factors in land use has been developed for Great Britain. Similar systems have already been used successfully to show the distribution of land suitable for arable agriculture, grazing and forestry in two areas of England and Scotland. The time has now come to test the wider usefulness of such maps.

As a first step, the classification is to be agreed with the major user organizations. For an experimental period a series of land capability maps will then be produced, to supplement the standard soil maps already in production. Concurrently, research will be undertaken to develop classifications of soil suitability for specific crops and for specific purposes.

The development will be undertaken by the Surveys of both England and Wales and of Scotland.

INTRODUCTION

The Soil Survey of Great Britain makes maps which are mainly records of the fundamental properties of soil profiles. These maps, in conjunction with interpretations of the influence of soil, site, and climate on management and crop performance, provide a sound basis for evaluating the physical properties of land of significance in farming. Recent examples which follow this approach are the maps of the Church Stretton district of Shropshire (Mackney and Burnham, 1966), and of the Livingstone Hinterland, Scotland (Bibby and Orwell, 1966) where the soil mapping units formed the basis for land capability assessments.

As a development from these maps the Soil Survey of Great Britain has now produced a unified land capability classification to assist governmental planners, the National Agricultural Advisory Service, the Department of Agriculture in Scotland, the Agricultural Land Service and other land users.

This paper describes the classification, which now remains to be agreed with the user organizations. Parallel with the new series of 1:25,000 soil maps in England and Wales and with the present 1:63,360 soil maps in Scotland it is now proposed that a series of land capability maps at the same scales be initiated.

U.S.D.A. LAND CAPABILITY CLASSIFICATION

Of many agricultural interpretations of soil maps the Land Capability Classification (Wingspiel and Montgomery, 1961), developed by the Soil Conservation Service of the U.S.D.A., is widely used and soundly tested and is applicable with some modification in Britain. It assesses land capability from known relationships between the growth and management of crops and physical factors of soil, site and climate. Land is graded according to its potentialities and the severity of its limitations for crop growth into eight capability classes. Land suited to cultivation and other uses is included in classes 1-4, and land not generally suitable for cultivation and of only limited use for other purposes is included in classes 5-8. Class 1 land has a wide range of uses with few limitations, while the remaining seven classes suffer from increasingly severe limitations and are progressively less flexible. Capability subclasses are defined on the physical factor or factors limiting production, each of which is indicated by the use of the letter notation, w, s, e, or c attached to the relevant class number, e.g. 2w, or 7c. The capability unit is the lowest category of the classification, grouping soils capable of growing the same kinds of crops and needing the same management; long term estimates of crop yields for individual soils within a unit should not vary more than about 25 per cent.

MODIFICATIONS FOR USE IN BRITAIN

Kellogg (1961) has noted that the number of classes could well be reduced to seven by deleting Class 5, which allowed mainly for wet soils in level sites poorly adapted for arable crops, and it is intended that this modification be adopted for Britain as has been done in Canada (Canadian Land Inventory Report 2, 1965).

Because of insufficient data by which to recognise capability units, the term "management unit" is adopted (cf. Soil Survey Report U.S.D.A. Lewis County New York 1960) for the British system. A management unit comprises land capable of growing the same kinds of crops and requiring the same management practices. The three units of the classification are thus: class, subclass and management unit.

An additional subclass, indicated by the symbol g, has been introduced for gradient and soil pattern limitation on land use.

The object of the classification is to present the results of soil surveys in a form which may be of more use to advisers, farmers, planners and other land users. It is admittedly an interpretative system and as with all such approaches it will be subject to some degree of arbitrary decision.

Assumptions and explanations

1. The classification is primarily for agricultural purposes.
2. Land is assessed on its capability under a moderately high level of management and not necessarily on its present use.
3. Flexibility of cropping, whether actual or potential, is given considerable weight but does not outweigh the ability to produce consistently high yields of a somewhat narrower range of crops. (A.L.S. 1966).
4. Land which suffers from limitations which can be removed or reduced at acceptable cost is graded on the severity of continuing limitations.
5. The capability classification may be changed by major reclamation projects (e.g. pump schemes) which permanently change the limitations in use. Minor changes e.g. mole drainage liable to regress in time, will not change the classification.
6. Within capability classes soils may differ in management and fertilizer requirements and detailed cropping, and are only grouped because they have similar degrees of limitations affecting adaptability. The classification however is not necessarily a grouping of soils according to the most profitable use to be made of the land.
7. Within specific subclasses are soils which suffer from the same degree and kind of limitation but which may differ in management requirements; for example in subclass 3w the wetness may result from slow infiltration or from the effects of rising ground-water - each of these conditions will require separate treatment.
8. The system is based not on chemical but on physical limitations for in general these are more permanent and difficult to rectify; severely limiting chemical properties however can be recognised as a soil limitation.
9. Distance to markets, kinds of roads and pattern of land ownership do not influence the grading although these factors will affect decisions about land use.
10. The interpretations try to express current knowledge and as new experience is acquired new interpretations will be necessary.
11. The system is not a soil suitability classification for specific crops or use, e.g. for potatoes or forestry. Interpretations of soil maps for such purposes may require different groupings of the soil mapping units to express the concept of land capability used in the system.

LAND CAPABILITY CLASS DESCRIPTIONS

Class 1. Land with very minor or no physical limitations to use.

Soils are usually well drained, deep, loams, sandy or silty loams, related humic variants or peat, with good reserves of moisture or with suitable access for roots to moisture; they are either well supplied with plant nutrients or responsive to fertilizers. Sites are level or gently sloping and climate favourable. A wide range of crops can be grown and yields are good with moderate input of fertilizer.

Class 2. Land with some limitations that reduce the choice of crops and interfere with cultivations.

Limitations may include, singly or in combination, the effects of 1) moderate or imperfect drainage, 2) less than ideal rooting depth, 3) slightly unfavourable soil structure and texture, 4) moderate slopes, 5) slight erosion, 6) favourable or only slightly unfavourable climate.

A wide range of crops can be grown though some root crops may not be ideal choices because of difficulties in harvesting.

Class 3. Land with moderately severe limitations that restrict the choice of crops and/or demand careful management.

Limitations may result from the effects of one or more of the following 1) imperfect or poor drainage, 2) restrictions in rooting depth, 3) unfavourable structure and texture, 4) strongly sloping ground, 5) slight erosion, 6) slightly unfavourable to moderately severe climate.

The limitations affect the timing of cultivations and range of crops which are restricted mainly to grass, cereal and forage crops. Whilst good yields are possible limitations are more difficult to overcome.

Class 4. Land with severe limitations that restrict the choice of crops and/or require very careful management practices.

Limitations are due to the effects of one or more of the following 1) poor or very poor drainage difficult to remedy, 2) occasional damaging floods, 3) shallow and/or very stony soils, 4) moderately steep gradient, 5) slight erosion, 6) moderately severe to severe climate.

Climatic disadvantages combine with other limitations to restrict the choice and yield of crops and increase risks. The main crop is grass, with cereals and forage crops as possible alternatives where the increased hazards can be accepted.

Class 5. Land with very severe limitations that restrict its use to pasture, forestry and recreation.

Limitations are due to the one or more of the following defects which cannot be corrected: 1) poor or very poor drainage, 2) frequent damaging floods, 3) steep slopes, 4) severe risk of erosion, 5) moderately severe to severe climate.

High rainfall, exposure, and a restricted growing season, prohibit arable cropping though mechanised pasture improvements are feasible. The land has a wide range of capability for forestry and recreation.

Class 6. Land with very severe limitations that restrict use to rough grazing, forestry and recreation.

Of the following limitations one or more cannot be corrected, 1) very poor drainage, 2) liability to frequent damaging floods, 3) shallow soil, 4) stones or boulders, 5) very steep slopes, 6) severe erosion, 7) unfavourable climate.

The land has limitations which are sufficiently severe to prevent the use of machinery for pasture improvement. Very steep ground which has some sustained grazing value is included. On level or gently sloping upland sites wetness is closely correlated with peat or peaty or humose flush soils.

Class 7. Land with extremely severe limitations that cannot be rectified.

Limitations result from one or more of the following defects:

- 1) very poorly drained boggy soils, 2) extremely stony, rocky or boulder strewn soils, bare rock, scree, or beach sands and gravels,
- 3) untreated waste tips, 4) very steep gradients, 5) severe erosion,
- 6) very severe climate.

Exposed situations, protracted snow cover and a short growing season preclude forestry though a poor type of rough grazing may be available for a few months.

LAND CAPABILITY SUBCLASSES

Capability subclasses are divisions within capability classes based on the kinds of limitation affecting land use; these are:

- | | |
|---|---------------------------------------|
| w | Wetness |
| s | Soil limitations |
| g | Gradient and soil pattern limitations |
| e | Liability to erosion |
| c | Climatic limitations |

Soil, site and climate are involved in complex interactions which affect land use, and the separation of dominant limiting factors is merely seen as a necessary, if arbitrary simplification.

Wetness

Hydrologic conditions result from interactions between soil properties, relief and climate, and influence both management and crops. Coarsely structured, fine textured, slowly permeable soils may delay cultivations in spring and autumn, and badly timed operations can cause compaction and puddling which may have serious long term consequences. The lower temperatures associated with wet soils during spring may delay germination, and waterlogging restricts the depth of rooting and causes poor root development or asphyxiation. Poor aeration together with low temperatures is a cause of denitrification. Wetness in autumn can cause difficulty in harvesting and limit the range of possible crops. Wet land needs capital and maintenance expenditure on drainage.

Wetness may result from the following causes which may each require different remedial measures.

- (i) slowly permeable materials of fine texture
- (ii) impermeable layers (a) indurated layers difficult to break, (b) iron and other pans relatively easily broken
- (iii) high ground-water table
- (iv) flushing by springs
- (v) flooding from streams and rivers
- (vi) high rainfall and low temperature

Soil limitations

Soil limitations can be a) shallowness, b) stoniness, c) soil texture and structure, d) inherent low fertility.

Shallowness: Shallow soils have detrimental effects on crops which are usually expressed through low available water capacity, restricted rooting range and inadequate nutrient uptake. However, the limiting effects of some of these properties depend on such external factors as rainfall. Shallow soils present problems of management and the use of certain farm implements may be impracticable where rock is near the surface.

Stoniness: Stones affect both plant growth and farm operations more or less severely depending upon their size and number. Small stones hinder cultivations and the mechanised harvesting of root crops, whilst boulders may be too large and/or too numerous to move so that cultivations are precluded. Stones also diminish available-water capacity and nutrient supply depending on their volume, mineralogical composition and porosity and on the scale and frequency of soil moisture deficits. Flints and similar hard stones also increase implement wear and mole drainage becomes impracticable in very stony soils.

Soil Texture and Structure: The "cappings" associated with weakly-structured soils, usually silty or fine sandy loams, can hinder plant emergence, may indirectly damage seedlings through frost heaving, and through wetness affect the timing of cultivations and quality of seedbeds. Fine-textured soils are usually coarsely structured, slowly permeable, and retain large quantities of moisture. Available-water capacity is broadly correlated with texture; sands have low, clays medium, and silty and fine sandy loams high amounts of water at tensions available to plants.

The effects of both structure and texture on crop performance will vary with climate and in particular with rainfall.

Soil Fertility: Naturally low fertility difficult to correct by management may be taken into account under this subclass heading but specific fertility problems are better considered at the management unit level (see p.7).

Gradient and Soil Pattern Limitations

Gradient has a marked effect on mechanized farming. Sites with gradients of 0-7° do not usually present obstacles to farm operations, though between 3-7° difficulties may be experienced with gapping machines or mechanized weeders, precision seeders and some root crop harvesters. Between 7° and 15° the use of a combine harvester becomes very restricted; 10-12° (Finkenzeller, 1957) is considered to be its limit without loss by spillage from trays. Two way ploughing also reaches a limit about 11°, though much depends on the configuration of the ground e.g. a short slope of 15° within a field with turning space at head and foot might well be tackled whereas a field with uniform 15° slope would call for one way ploughing only. Towards the 15° limit loading difficulties with trailers may be met (loading on one side only) and loads can only be removed from the field directly downslope. Over about 11° additional weights may be necessary on the front of the tractor to compensate for drag and consequent steering difficulties.

Slopes greater than 15° are not suitable for normal rotations and remain in grass for long periods; cultivation costs can be large. Slopes greater than 20° are difficult to plough, lime and fertilize and even if these dangers are accepted costs are large and normal rotations impossible. Between 20° and 25° occasional tillage for pasture improvement is sometimes practiced. Above 25° some soil movement and the formation of paths across slope by animals starts (Ruhmann, 1957), and no mechanised operations are possible without specialized machinery.

The following table of slope classes has been derived from the above analysis:

0 - 3	Gently sloping
3 - 7	Moderately sloping
7 - 11	Strongly sloping
11 - 15	Moderately steep
15 - 25	Steep
25 +	Very steep

Both gradient and the pattern or frequency of slopes are important factors influencing farming costs and crop performance. Where slopes or soil types of widely differing capability occur in intricate small scale patterns the exploitation of the good land may be limited by that of the bad land. In many areas depth and stoniness variations may justify the recognition of a mosaic of soils ranging by at least one capability class.

Liability to erosion

Two major forms of erosion, by wind and by water are recognised. The former includes coastal sand dune movements and blowing of sandy or peaty light soils in exposed situations when the vegetative cover is breached either by natural causes or by cultivations. Young spring crops e.g. sugar beet may be seriously affected, necessitating reseeding.

The erosive effects of water include marine erosion e.g. boulder clay cliffs of the east coast, the formation of gullies or screes on steep slopes where overburning or overgrazing is practiced, the formation of hags in peat. Sheet erosion can occur on quite gentle slopes after violent storms, and thick topsoils at lower field boundaries are further evidence of gradual transfer of material downslope under cultivations.

Loss of peat soils through wastage particularly in lowland fens, is effectively erosion.

Climatic limitations

More knowledge of the relationships between weather and crop growth is needed but it is already clear that differences in macroclimate (Hogg, 1964), influence land capability, and this is clearly reflected in the land use pattern.

R.W. Gloyne (Meteorological Office, Scotland) has devised a formula using water balance and temperature to provide the macro-climatic index $C = R - \frac{PT}{T(X)}$ where, in the period April - September, R = rainfall, PT = potential transpiration and T(X) = mean maximum temperature* (°C) (Appendix and Fig. 1). The utility of this index in land capability assessments needs further study but results so far available suggest it is useful for defining climatic limits in the higher capability classes (1-4) and when more data are plotted it may be shown to have wider application at all class levels.

Three climatic groups, which accord with commonsense and experience, are recognised from the data:

* average monthly value of the mean monthly maximum.

- Group 1. $\bar{T}(X) > 15^{\circ}\text{C}$, $C < 5$.
no climatic limitations
- Group 2. $\bar{T}(X) 14-15^{\circ}\text{C}$, $C = 5 - 20$
minor to moderately severe climatic limitations
- Group 3. $\bar{T}(X) < 14^{\circ}\text{C}$ $C > 20$.
moderately severe or severe climatic limitations

In utilising the index mesoclimatic factors such as exposure and aspect which modify the effects of macroclimatic factors need to be considered.

To aid the recognition of climatic limits in capability classes 4 - 7 altitude and rainfall limits have been introduced. With elevation land suffers increasingly from shorter growing seasons, heavier rainfall, lower insolation, and exposure, all factors which reduce productivity. The limits chosen, which include some introduced by the Study Group on Agricultural Land Classification (A.L.S. 1966), try to take account of (i) rainfall increase with altitude (though the rate of increase decreases from west to east), and (ii) temperature decrease both with altitude and latitude.

The limits are as follows:-

- (i) Land over 2,000 ft. is generally above the tree-line, and provides only poor rough grazing.
- (ii) Land over 1,000 ft. with more than 60 in. annual rainfall provides rough grazing but pasture improvement is usually not feasible.
- (iii) Land over 600 ft. with more than 50 in. annual rainfall, allows pasture improvement but is not suitable for arable crops.
- (iv) Land over 400 ft. with more than 40 in. annual rainfall (45 in. in Western Britain) is mainly suitable for grass and limited arable cropping.

MANAGEMENT UNITS

Soils placed in these units respond in a similar way to management and improvements although they may be in different soil series or phases. The concept differs from that of the capability unit (Klingebiel and Montgomery, 1961) in that yield limits are not specified.

Management units should be identified during the soil survey, in consultation with advisory officers, farmers and other users of soils. They will be usually recorded on maps of 1:25,000 or 1:10,000 scale, while on maps at scales of 1:63,360 and smaller only class and subclass groupings would be used.

Descriptions of management units could include information on the physical and chemical characters of land, its suitability for cropping and the problems in management. It is hoped that in time it will be possible to give general recommendations with respect to fertilizer usage and liming and to indicate the kind of, and degree of liability to, plant and insect pests associated with adapted crops and to suggest the most suitable crop varieties. As much of this information is obtainable only through the various agricultural advisory organisations and research institutes, it is assumed that these bodies will participate in the recognition and description of the management units; the establishment of small consultative groups interested in specific areas is to be encouraged (Kellogg 1961; Vink 1963).

The management unit thus brings together different soil series and/or phases with similar agronomic characteristics. The use of such units should help to systematize and collate knowledge in agricultural science and assist in its extension from area to area.

GUIDELINES FOR THE RECOGNITION OF CAPABILITY CLASSES

As the classification is interpretative, guidelines (not rules) for the recognition of soil classes are offered to maintain uniformity. These will need to be reviewed periodically as new information arises on the relationships between soil, site and climate on the one hand and land capability on the other.

Class I

Gradient: Not above 7°, but usually below 3.
(average monthly
Climate: Group 1 on Fig. 1; (value of mean > 15°C (April to
(monthly maximum < 5 September)
C index < 5

Usually below 500 ft. O.D.

Wetness: Not a limitation; soils are usually well or moderately well drained, with some imperfectly drained in areas of low rainfall (< 30 in.)

Soils: Usually loams, sandy or silty loams, or humose variants, deeper than 30 in., or peat; stoneless or only slightly stony; clays in wet areas, or coarse sands or loamy coarse sands in areas with low summer rainfall should be excluded.

Erosion: Risk should be very slight.

Class 2

Gradient: Not above 7°.
(average monthly
Climate: Group 1 on Fig. 1; (value of mean > 15°C
(monthly maximum < 5
C index < 5

Normally not above 1,000 ft. O.D.

Wetness: Soils subject to this limitation are usually moderately well or imperfectly drained;

Soil: Soils usually have a rooting depth > 20 in.; stoneless or slightly stony; clays in wet areas and coarse sands or loamy coarse sands in areas with low summer rainfall should be excluded.

Erosion: Wind erosion is possible in some eastern areas, effecting root crops, such as sugar beet, red beet, and carrots, growing in light peat. Otherwise risks should be slight.

Class 3

Gradient: Not above 11°
(average monthly
Climate: Groups I and II in Fig. 1; (value of mean > 14°C
(monthly maximum < 20
C index < 20

Usually not above 1,000 ft.

Land over 400 ft. with more than 40 in. annual rainfall (45 in. in western Britain) not better than Class 3.

Wetness: Usually imperfect or poorly drained soils where an effective drainage scheme has been, or could be, installed. There will be a continuing wetness limitation even after drainage.

Soil: Rooting depth is usually > 10 in.; textures range from stoneless to stony and sandy to clayey. Well drained sandy soils in areas with soil moisture deficits 7 yrs. in 10 should not be graded above Class 3.

Erosion: Risk should be slight.

Class 4

Gradient: Not above 15°

Climate: All groups in Fig. 1. Land with > 50 in. annual rainfall usually not better than Class 4.

Wetness: Poorly drained soils, with or without peat, requiring a comprehensive drainage scheme, but where piecemeal drainage has, or could, effect improvements. Land may be subject to occasional damaging floods (1 in 5 years).

Soil: Soils sufficiently deep to allow ploughing; they may be very stony and with a wide range of texture.

Erosion: Risk should be low; some difficulties may be encountered with sandy soils in exposed areas.

Class 5

Gradient: Not over 25° but usually below 20°.

Climate: Usually below 1,750 ft. O.D. Land over 600 ft. with more than 50 in. annual rainfall not better than Class 5.

Wetness: Very poor or poorly drained land where drainage can be improved to maintain grassland. Land may be subject to floods (1 year in 3).

Soil: Only rocky, boulder strewn soils which prevent mechanised improvement are excluded from this class.

Erosion: Mountain soils may be subject to severe gully erosion without expert management, and some soils are liable to be severely eroded by wind if the natural vegetation cover is destroyed.

Class 6

Gradient: Level to over 25°.

Climate: Usually below 2,000 ft. Land over 1,000 ft. with more than 60 in. annual rainfall not better than Class 6.

Wetness: Poorly drained peat or humose soils of the uplands, and estuarine marshes or undrained peats of the lowlands.

Soils: Extremely stony, rocky or boulder strewn land, with enough vegetation to maintain grazing.

Erosion: Severe hazard on steep slopes.

REVIEW

The Land Capability Classification reflects current knowledge of the influence of soil, site and climate on crop performance and management. As more knowledge is required appropriate revisions will be needed.

COSTS

In England and Wales the cost of the new development is expected to be £2,500 for the year 1967 - 8, with an anticipated production of five maps. The cost would be made up as follows:

Staff cost	£1,500
Travelling expenses	£ 250
Map production	750
	<hr/>
	£2,500
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The recurring cost is expected to be of the same order annually.

CONCLUSIONS

See Summary

RECOMMENDATIONS

The Board is invited to consider the development described above, suggestions for the improvement of which will be welcome, and to give it their support.

APPENDIX 1

A TENTATIVE SCHEME FOR AN INVENTORY OF BRITISH CLIMATE

by

Dr. R. W. GLOYNE (Meteorological Office, Scotland)

1. Introduction

In order to supplement the data on soils - which form the bases of a current Land Use Capability Survey - a broad specification of climate is required.

It is anticipated that any acceptable system would contain:

- (i) Not more than about four (possibly six) classes, defined by unambiguous macro-climatic parameters.
- (ii) Provision for subclasses according to deviations assessed during on-site surveys. Such deviations would arise from local geomorphic and topographic features and would be based upon judgements of exposure (mainly arising from wind), of the liability to local frost, of the penetration of sea influences inland along valleys, of natural (e.g. sea-salt) and industrial pollution.

Any useful resulting categorisation must correspond to the realities of existing land use and must, for example, differentiate between the cereal and sugar beet areas of eastern Britain and the dominantly pasture farming of the west; between coastal Ayrshire and the inner Islands such as Tiree; between N.E. Aberdeenshire and eastern Caithness. Clearly therefore the final decision on boundaries between categories would be a matter of informed judgement on agricultural and botanical grounds.

2. The Basis of a Climatic Survey

Arising from a preliminary inspection of possibilities, the following gross climatic parameters were selected:

- (i) Rainfall (R) - which has a general tendency to increase from east to west.
- (ii) Evaporation (expressed as Potential Transpiration (P.T.)) - which broadly decreases from south to north but which has a very strong tendency to decrease from the coast inland. (Recently revised values of P.T. have been adopted in this study.) Negative corrections for heights above 1,200 ft. have not been attempted - such places therefore have a lower P.T. than have been adopted in this preliminary study.
- (iii) Temperature (T) - which decreases from roughly south west to north east but which, like (ii), is strongly modified by distance from the sea.

All three elements are further decisively influenced by altitude.

In view of these influences of latitude, longitude, distance from the sea and altitude (relative as well as absolute in terms of height above m.s.l.) it is not surprising to find great difficulty in arriving at that type of spatially determined classification which

CLIMATIC INVENTORY DATA

No.	Height a.m.s.l. (ft)	Rainfall (mms)	PT (mms)	R-PT	\bar{x}	Highest Monthly \bar{x}	
Achnashellach	1	225	860.0	379.2	480.8	15.5	17.5
Arbroath	2	95	327.4	417.8	-90.4	15.5	18.2
Benbecula	3	18	505.2	429.3	75.9	14.2	16.0
Blairgowrie	4	70	350.3	403.9	-53.6	15.8	18.7
Braemar	5	1113	400.8	320.0	30.8	14.7	17.6
Cape Wrath	6	367	528.1	397.5	120.6	12.2	14.1
Carnwath	7	706	401.1	385.3	15.8	15.2	17.9
Colmonell	8	170	462.3	444.5	17.8	15.9	18.0
Colonsay	9	87	572.5	439.4	133.1	15.1	16.9
Cupar	10	210	359.9	412.2	-52.3	16.2	19.2
Dumfries	11	140	492.3	407.7	84.6	16.4	18.8
Dyce (Aberdeen)	12	190	440.9	379.5	61.4	15.1	17.9
Eskdalemuir	13	794	695.5	370.0	325.5	15.2	17.0
Falkirk	14	100	426.2	415.5	10.7	17.1	19.8
Fettercairn	15	560	478.3	378.5	99.8	14.8	17.7
Forfar	16	633	476.7	375.2	101.5	15.8	18.7
Forres	17	155	376.4	405.1	-28.7	16.1	18.8
Fortrose	18	69	327.4	416.6	-89.2	15.5	18.0
Fort William	19	27	795.3	402.1	393.2	15.9	17.8
Glenbranter	20	120	955.3	401.8	553.5	16.3	17.7
Glenlee	21	181	619.5	410.0	209.5	16.8	19.2
Glenmore Lodge	22	1120	474.5	318.5	156.0	14.4	17.0
Huntly	23	405	446.0	366.0	80.0	15.2	17.9
Kelso	24	195	343.1	402.0	-58.9	16.5	19.4
Kilmarnock	25	115	482.3	426.0	56.3	16.8	19.1
Kinlochewe	26	76	833.1	386.8	446.3	16.1	18.0
Kinloss	27	15	336.5	426.7	-90.2	15.6	18.1
Leadhills	28	1270	696.9	355.6	341.3	14.4	16.9
Leuchars	29	33	339.9	410.2	-70.3	15.9	18.8
Lossiemouth	30	21	339.1	426.7	-87.6	15.3	17.9
Lowther Hill	31	2377	762.0	355.6	406.4	9.9	12.6
Marchmont	32	498	378.5	387.3	-8.8	15.9	18.8
Nairn	33	20	361.2	426.7	-65.5	15.5	18.0
North Berwick	34	118	347.2	420.4	-73.2	16.0	18.8
Onich	35	48	851.4	409.7	441.7	15.5	17.3
Perth	36	77	374.7	398.8	-24.1	17.0	19.9
Pitlochry	37	144	364.7	375.2	-30.5	16.1	18.9
Prestwick	38	30	424.9	444.5	-19.6	15.8	17.9
Ratray Head	39	85	349.3	406.4	-57.1	13.5	16.1
Renfrew	40	26	441.2	420.4	20.8	16.6	19.0
Sourhope	41	900	547.6	366.3	181.3	15.4	18.6
Stornoway	42	11	440.9	398.8	42.1	13.9	15.9
Strathy	43	120	470.4	397.5	72.9	14.7	16.8
Tiree	44	29	484.9	431.8	53.1	14.2	16.1
Turnhouse	45	114	359.7	419.1	-59.4	16.1	18.9
Wick	46	119	355.1	388.6	-33.5	13.3	15.6

CLIMATIC INVENTORY DATA

	No.	Height a.m.s.l.	Rainfall (mms)	PT (mms)	R-PT	\bar{T}	Highest Monthly \bar{x}
Aberystwyth	47	450	449.6	443.2	+6.4	16.3	18.8
Alwen	48	1100	537.5	391.2	+146.3	15.0	17.0
Bath	49	67	363.5	464.1	-100.6	18.6	21.2
Birmingham	50	425	362.9	438.1	-75.2	18.7	21.7
Blackpool	51	65	424.2	464.8	-40.6	16.7	19.2
Bl. Festiniog	52	750	1112.3	419.6	+692.7	15.2	17.2
Bradford	53	439	392.2	421.6	-29.4	16.5	19.4
Brighton	54	32	340.9	483.9	-143.0	17.6	20.4
Burnley	55	458	503.3	446.0	+57.3	17.1	19.0
Buxton	56	1007	616.2	401.1	+215.1	15.2	17.9
Bwlchgwyn	57	1267	486.7	391.2	+95.5	14.0	16.3
Cambridge	58	41	289.6	451.0	-171.4	19.1	22.2
Cardiff	59	202	476.0	461.0	+15.0	17.3	20.3
Ch-en-frith	60	732	491.7	415.3	+76.4	16.0	18.0
Clacton	61	53	257.8	481.3	-223.5	17.9	21.0
Cleethorpes	62	23	289.3	436.9	-147.6	17.1	20.3
Coventry	63	241	337.8	447.8	-110.0	18.2	21.2
Cranwell	64	203	303.0	447.0	-144.0	19.6	21.0
Darwen	65	724	620.5	433.8	+186.7	16.5	19.2
Douglas (I o M)	66	284	494.5	444.5	+50.0	15.2	17.4
Dungeness	67	20	273.3	486.4	-213.1	17.2	19.7
Durham	68	336	340.4	407.7	-67.3	16.7	19.8
Eastbourne	69	35	368.8	483.9	-115.1	17.4	20.3
Exmouth	70	155	330.2	467.4	-137.2	16.9	19.5
Hastings	71	149	308.6	483.9	-175.3	17.6	20.5
Hawkeridge	72	1030	610.4	415.0	+195.4	15.1	17.3
Helmshore	73	854	689.6	401.3	+288.3	15.1	17.1
Huddersfield	74	325	421.9	427.2	-5.3	17.3	20.3
Keswick	75	254	631.4	413.3	+218.1	16.5	21.0
Kew	76	18	304.8	469.1	-154.3	18.7	21.8
Ltte. Rissington	77	740	357.1	426.7	-69.6	16.7	19.0
Llandrindod W.	78	772	439.4	415.3	+24.1	17.1	19.6
Long Ashton	79	162	427.5	459.2	-31.7	18.3	20.9
Lowestoft	80	82	287.0	468.6	-181.6	17.3	20.4
Lyneham	81	455	347.9	444.5	-96.6	17.7	20.6
Lyonshall	82	510	375.9	429.3	-53.4	17.5	20.3
Macclesfield	83	500	436.9	431.8	+5.1	17.7	19.8
Malharm Tarn	84	1297	653.8	383.5	+270.3	13.8	15.8
Margate	85	51	251.5	486.4	-234.9	17.4	20.7
Moor House	86	1825	956.8	383.5	+573.3	12.2	14.3
Newport (Mon)	87	265	500.9	449.3	+51.6	18.3	21.0
Norwich	88	93	312.4	464.6	-152.2	17.3	20.4
Nottingham	89	192	307.6	445.8	-138.2	18.0	21.0
Onecote	90	1350	523.5	391.2	+132.3	13.5	15.4
Oxford	91	208	316.7	456.7	-140.0	18.8	21.7
Penzance	92	55	400.1	463.6	-63.5	17.5	19.7
Portsmouth	93	7	290.0	478.8	-188.8	18.4	21.1
Princetown	94	1359	877.1	411.5	+465.6	14.6	17.1
Reading	95	152	309.9	460.5	-150.6	19.2	22.1
Rochdale	96	762	662.9	430.8	+232.1	16.7	19.5
Shrewsbury	97	184	323.1	446.0	-122.9	18.1	20.9
Southend	98	90	260.1	481.3	-221.2	18.6	21.6
Tunbridge W.	100	351	328.9	464.3	-135.4	18.7	21.6
Tynemouth	101	108	338.6	415.3	-76.7	14.9	17.9
Upavon	102	578	343.4	437.9	-94.5	17.2	19.9
Ushaw	103	594	370.8	394.7	-23.9	16.1	19.1
Valley	104	26	413.3	439.4	-26.1	15.9	18.4
Weymouth	105	16	305.8	476.3	-170.5	17.9	20.7
Worthing	106	25	293.1	483.9	-190.8	17.7	20.5
York	107	57	321.3	428.7	-107.4	18.0	21.0
Belfast (N.I.)	108	57	442.9	400.8	+42.1	16.1	18.4

FIG 1 INVENTORY OF CLIMATE

