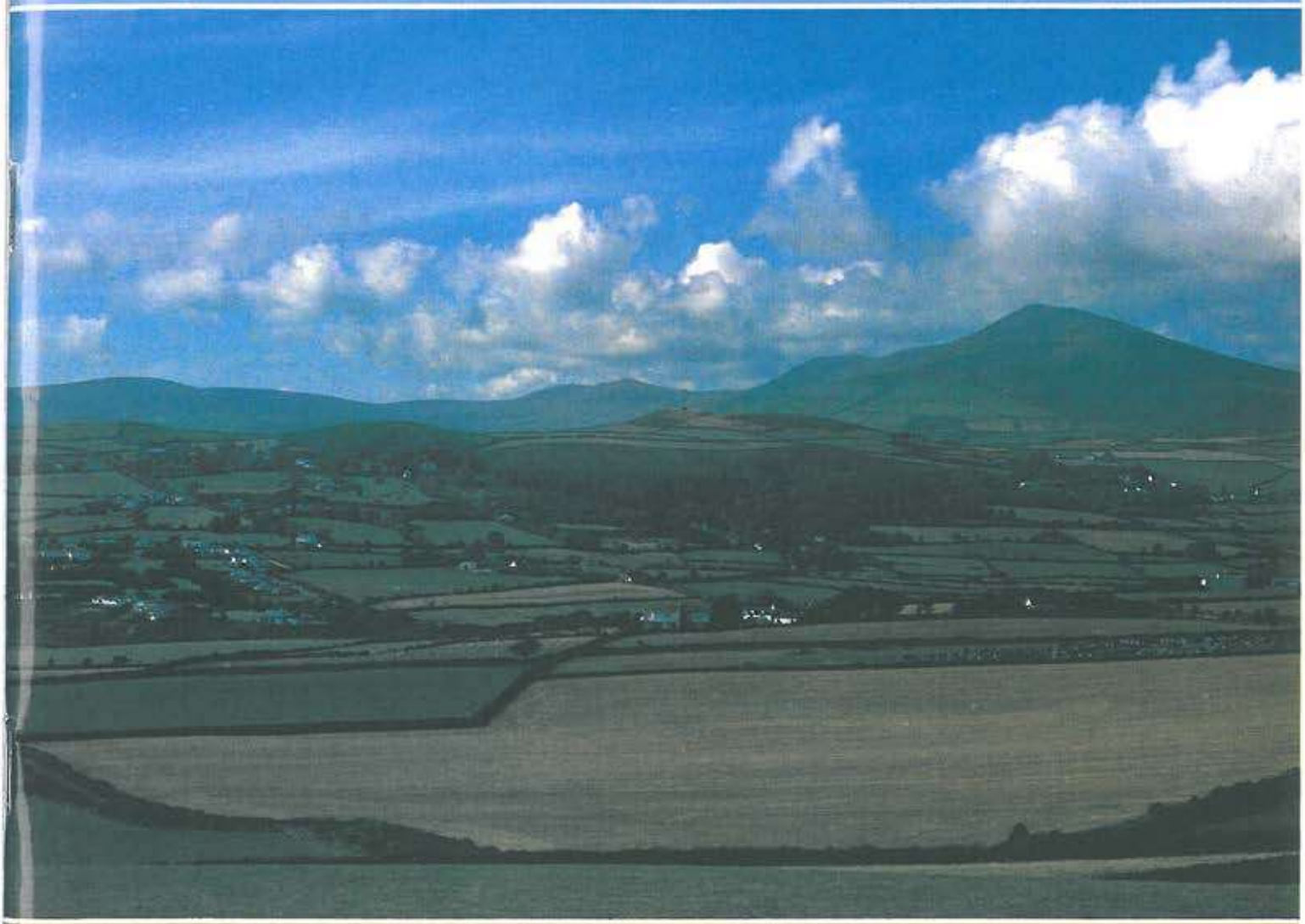
AGRICULTURAL SOILS OF THE ISLE OF MAN



J Harris, M A Fullen and M D Hallett

CENTRE FOR MANX STUDIES
University of Liverpool

Research Report 9 2001

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Corrigendum

Table 4: Land Use Capability Classes of the Soil Survey of England and Wales and their extent on the Isle of Man. (June 28 / 01)

Class	Characteristics	Extent	
		Hectares	(%)[1]
1	Land with very minor or no physical limitations to use	222	0.60
2	Land with minor limitations that reduce the choice of crops and interfere with cultivations	2,516	6.78
3	Land with moderate limitations that restrict the choice of crops and/or demand careful management (g>c>w)[2]	24,613	66.32
4	Land with moderately severe limitations that restrict the choice of crops and/or require very careful management (g>w>c)[2]	9,152	24.66
5	Land with severe limitations that restrict its use to pasture, forestry and recreation (w>g>c)[2]	609	1.64

Notes:

1. Calculated as percentage of the total agricultural land area of the Isle of Man, estimated in the survey as 37,112 hectares.

2. Limitations may be due to the land use capability subclasses: Wetness (w), Soil limitations (s), Gradient and soil pattern limitations (g), Susceptibility to erosion (e) or Climatic limitations (c).

Codes denote the land use capability classes and subclasses (for example 2g, 4e, 5c). For classes 3, 4 and 5, subclasses are shown in descending order of importance in terms of their effect on agricultural capability.

Source: Bibby and Mackney (1972), Bibby (1991).

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ILLUSTRATIONS

FOREWORD

Soil type plays a critical role in agricultural production. The farmer will look for a deep soil with good texture, drainage, soil fertility and a stable structure.

A simple chemical analysis can tell us the gross composition of soils, pH and nutrient levels, minerals and organic matter, but takes little account of the soil texture or structure. To know the proportion of such elements is to understand the nature and variety of the soil and how it will perform.

A soil survey accompanied by explanatory background text is therefore an essential tool for the industry in the assistance it can provide in maximising and determining management options.

In broader terms overall soil classification can contribute to farm enterprise planning and urban planning discussions and decisions.

The Department is pleased to have supported this important work and to be associated with the Report.

Hon. A.F. Downie
Minister

AGRICULTURAL SOILS OF THE ISLE OF MAN

J. Harris, M.A. Fullen and M.D. Hallett

INTRODUCTION AND HISTORY OF RESEARCH

The soils of the Isle of Man have attracted considerable interest, as they exemplify many of the important contrasting soil types within the British Isles. These are of interest to archaeologists, ecologists, geographers, environmental scientists and planners (Fullen *et al.* 1996) and illustrate broader patterns and processes of soil formation (Fullen *et al.* 1999). Manx soils also have an applied agricultural interest, as their properties strongly influence agricultural (cropping and grazing) and forestry activities and their intensity, sustainability and likely success (Davies 1990). Soils are also important for planning activities, including urban development and nature conservation (Kear 1971).

Most of the initial soil surveys and soil maps of the Isle of Man were produced by Brian Kear of the University of Manchester (Kear 1971, 1976, 1979, 1980; Davies and Kear 1974). These activities led to publication of the one inch to one mile (1:63,360) Soil Association Map of the Isle of Man (Kear 1982). Soil series identified on the Island were tentatively correlated with those in England and Wales (Kear 1976). Detailed soil mapping of the Island at the soil series scale has recently been performed by the Soil Survey and Land Research Centre (SSLRC) (Palmer *et al.* 2000), which also investigated relationships between soil properties and groundwater resources (Palmer and Holman 2000). Some 77 series were identified by the SSLRC, using the established nomenclature in England and Wales. The most extensive are typical brown earths of the Denbigh series and typical brown podzolic soils of the Manod series. However, the consistency of soil series between England and Wales and the Isle of Man remains to be verified (Palmer *et al.* 2000).

In a separate study, the nature and properties of agricultural soils were surveyed by John Harris (Manx Department of Agriculture, Fisheries and Forestry), who worked as an agricultural advisory officer to Manx farmers for 24 years (1969-1993). Over this period, he visited and classified the soils of most fields on the Island. In this context, agricultural soils are defined as soils of enclosed fields used for pastoral or rotational farming, but not including unimproved hill or coastal land used solely for extensive sheep farming and upland forestry.

DEVELOPMENT OF A SOIL CATEGORY MAP OF THE ISLE OF MAN

Fullen *et al.* (1996) attempted to synthesise the pedological and agricultural soil information and published the first reconnaissance agricultural soil map of the Isle of Man. However, the map had some uncertainties, including the extent of calcareous soils in the south of the Island, the extent of sandy soils around Peel and the boundaries in the soil complex around Cooil, south-west of Douglas. Consequently, John Harris surveyed these areas between 1996 and 1999.

John Harris developed a classification system for potential of land in agricultural use, essentially based on the nature and properties of parent materials. The soils were divided into five categories, each of which was divided into a number of sub-categories, based mainly on soil textural characteristics. Some sub-categories were further subdivided into **phases**, which were differentiated on the basis of slope, stoniness, depth or other criteria significant for land use. In the first version of the map, 25 map units were recognised (Fullen *et al.* 1996), but further soil survey has suggested an additional seven. These 32 map units (consisting of 27 sub-categories and 10 phases) are described below. The five categories are:

Category A. Soils associated with slates, flagstones and shales (11 mapping units, 11 sub-categories).

Category B. Soils associated with limestone (4 mapping units, 3 sub-categories and 2 phases).

Category C. Soils associated with Peel Sandstone and Neb gravels (3 mapping units, 3 sub-categories).

Category D. Soils associated with glacial deposits (8 mapping units, 6 sub-categories and 4 phases).

Category E. Soils associated with peat deposits (6 mapping units, 4 sub-categories and 4 phases).

The areas occupied by these and non-agricultural land use categories are summarised in Table 1. Each soil category (A-E) was matched with the soil subgroup on the 1:250,000 Soil Association Map of England and Wales (Soil Survey of England and Wales, 1983) with which it was considered to have the closest affinity and the soil subgroup map was used to develop a soil category map (Figure 1). The categories, comparable soil subgroups and subgroup codes are:

Category A soils:
Typical brown podzolic soils (6.11)

Category B soils:
Typical brown calcareous soils (5.11)

Category C soils:
Typical brown sands (5.51)

Category D soils:
Typical brown earths (5.41)

Category E soils:
Earthy oligo-fibrous peat soils (10.21).

Soil sub-categories were numbered on a scale, based on a qualitative evaluation of the relative extent and agricultural importance of each sub-category (i.e. A1 is the most extensive Category A sub-category). The sub-categories were then classified according to soil texture, using a scale from 1 (heaviest or most clay-rich or **argillaceous**) to 11 (light sandy or **arenaceous** soils) (Table 2). Soil textures were assessed by field survey, supported by laboratory determinations of the particle size distributions of selected soil samples by Dr T. Batey (University of Aberdeen). Soil categories A-E were allocated different colours and the textural classes within each distinguished by different colour intensities, the lighter colours for the lighter textural classes and darker for the heavier textural classes.

On completion of the field survey in March 1999, a digital map and associated database were constructed at the University of Wolverhampton by Michael Hallett. A fortunate recent development was the creation of the Manx Geographical Information System (G.I.S.), known as the MANNGIS Project. Co-operation with the Manx Government enabled use of MANNGIS to extract a georeferenced digital base map on which coastal and urban areas were accurately presented. The soil map boundaries were then digitised onto the base map and an interactive database constructed.

Table 3 shows the areas and perimeters of each agricultural and non-agricultural **polygon** (individual recognised map units) and the spatial distribution of these polygons is presented in Figure 2. All of the agricultural units have been labelled according to the soil sub-category codes as in Table 2, and the non-agricultural units have location name labels. The 143 recognised individual map polygons consist of 108 agricultural and 35 non-agricultural polygons (16 urban and 19 coastal or upland). The digital map was then annotated with the soil classification codes, before cartographic output (Figure 3). The completed soil G.I.S. was also exported in a format (ArcView Shapefiles) which will allow it to be incorporated into and accessed via MANNGIS.

LAND USE CAPABILITY MAP

Land quality can be evaluated by the 'Land Use Capability Classification' system (Table 4). Little Manx agricultural land is Grade 1 or 2 and most is Grade 3 and 4. This is partly a result of the relatively short history of intensive farming (Davies 1990) and low soil nutrient levels, though there are also climatic, relief and soil limitations to land use in these categories (Fullen *et al.* 1996).

Each of the 32 map units was assessed in terms of Land Use Capability Classes and only nine units were classified as belonging to one class. Due to the variability of Manx soils, some units include two Classes. Therefore, these have been divided into those having a dominant class (13 units) or an approximately equal mixture of two classes (10 units) on the Land Use Capability map (Figure 4).

The main attributes of the agricultural classification of Manx soils are presented in Table 5. The identified attributes include a suggested name, salient characteristics, extent (computer calculated), variability and drainage needs. The prevalent soil characteristics (texture, pH, NPK status and depth) are specified, along with agricultural characteristics, such as suitability for grass and crop production, normal land use, dominant land use capability class and susceptibility to drought.

Table 1: Extent of Manx soil and land use categories

Category	Number of mapping units	Area (ha)	% of total land area[1]
A	73	25,225	44.07
B	9	1,584	2.77
C	3	524	0.92
D	11	7,191	12.56
E	12	2,588	4.52
Urban land	16	3,242	5.67
Open moorland and upland forestry (hill and coastal)	19	16,878	29.49
Total	143	57,232	

Notes:
[1] The % of total land area is calculated as percentage of total land area of the Island estimated in the survey (572.32 km^2).

Table 2: Scale of the relative texture of soil sub-categories

Relative Texture Scale	Category A	Category B	Category C	Category D	Category E
(Heaviest)	A9	B3	C1	D4A	E4A
↓	A5	B2B	C3	D4B	E4B
	A11	B2A	C2	D5	E2
↓	A6	B1		D3A	E3
	A8			D3B	E1B
↓	A4			D2	E1A
	A10			D6	
↓	A3			D1	
	A2				
↓	A1				
(Lightest)	A7				

Note:
The heaviness/lightness of textures are denoted on a relative scale and can be compared within the same category (A-E), but not between categories.

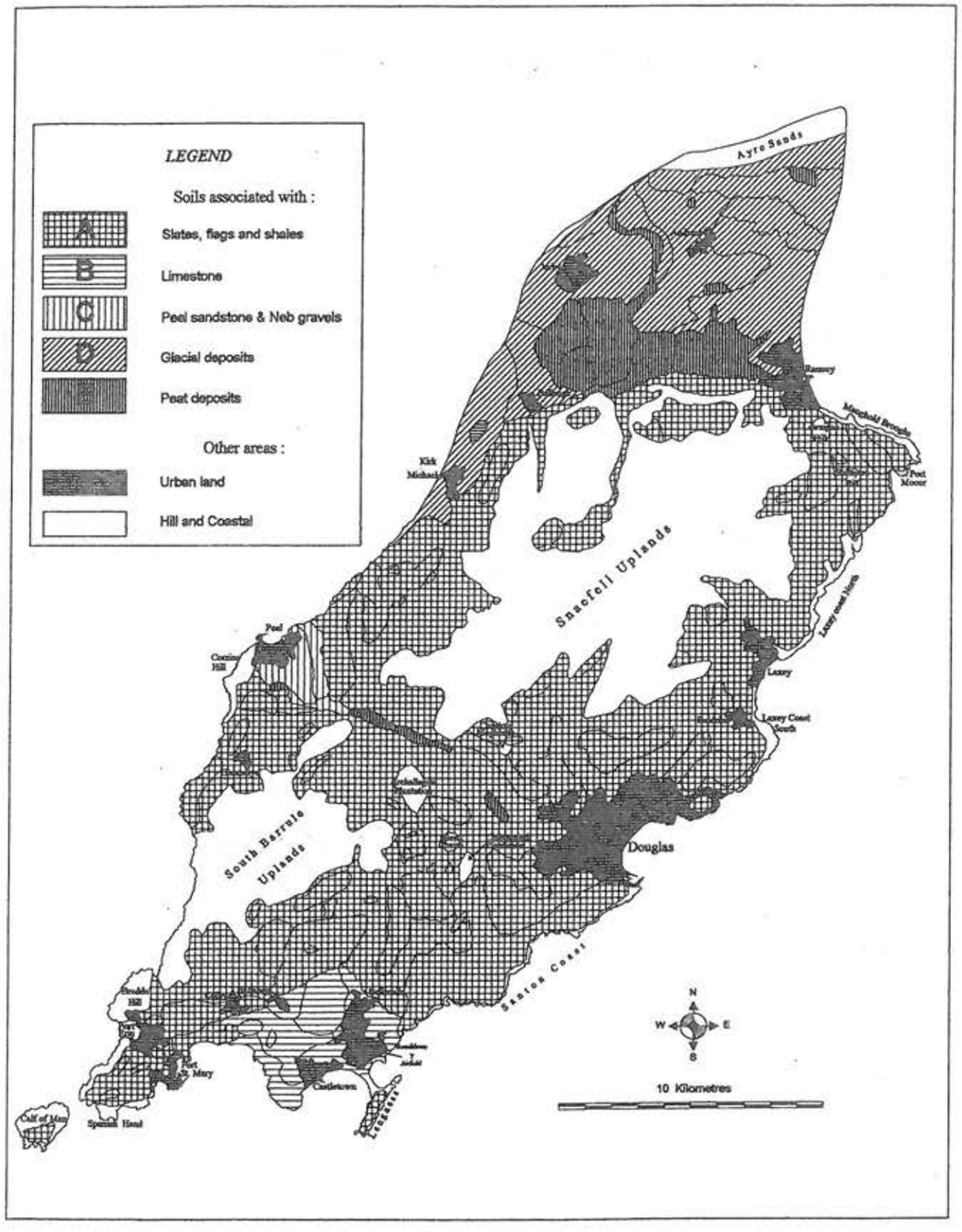

Figure 1: Simplified agricultural soil classification map of the Isle of Man (a colour version is in the end pocket)

Figure 2. The numbered individual map units recognised in the survey.
(Polygon ID numbers)

Figure 2: The numbered individual map units recognised in the survey (polygon ID numbers)

Table 3: Areas and perimeters of the 143 individual map polygons recognised in the survey

Polygon ID	Area (m^2)	Perimeter (m)	Labels
1	1,776,876	9,245	B2B
2	229,405	1,837	A10
3	513,624	3,137	A10
4	442,855	3,683	A10
5	3,556,252	9,458	A9
6	340,595	2,345	A10
7	628,420	3,182	A9
8	120,119	1,365	A11
9	2,531,973	7,929	A2
10	1,328,112	6,645	A3
11	420,943	2,434	A3
12	3,798,032	13,872	A8
13	1,379,369	9,295	E1B
14	788,603	6,015	C3
15	952,709	3,946	A8
16	192,793	1,860	E1B
17	773,376	5,311	A2
18	2,866,513	10,770	C1
19	16,384,456	32,390	A3
20	4,031,572	10,993	A8
21	1,583,583	7,588	C2
22	6,246,348	12,847	A6
23	98,893,788	251,225	A1
24	112,542,657	114,876	Snaefell Uplands
25	32,825,260	45,391	South Barrule Uplands
26	61,033,248	171,899	A1
27	276,314	2,426	Glenmaye
28	510,807	3,877	Baldrine
29	461,316	4,034	Colby
30	260,614	2,609	Ballabeg
31	3,044,619	11,682	Ballasalla and Ronaldsway.
32	1,894,115	11,723	Calf of Man
33	1,743,809	8,155	Laxey
34	14,768,524	35,193	Douglas
35	1,582,537	8,625	Peel
36	1,073,628	6,475	Castletown
37	882,531	7,616	Port St. Mary
38	1,287,990	7,891	Port Erin
39	1,388,267	5,625	Jurby (including Airfield)
40	505,678	3,908	Andreas
41	430,348	2,853	Ballaugh
42	711,824	4,172	Kirk Michael
43	3,494,614	12,485	Ramsey
44	6,719,128	27,646	Ayre Sands
45	5,151,635	18,015	D6
46	611,998	3,276	E1A

Table 3 cont.

Polygon ID	Area (m^2)	Perimeter (m)	Labels
47	6,591,923	17,136	D4B
48	105,768	1,194	E1A
49	4,369,884	13,160	D1
50	2,436,793	11,420	D3A
51	160,446	1,852	E2
52	10,949,663	21,496	D3A
53	7,320,769	21,901	E2
54	1,902,925	5,325	E1A
55	3,631,690	8,940	E3
56	5,895,369	12,463	E4B
57	4,754,934	15,770	D3B
58	723,526	3,335	A1
59	377,048	2,423	D4A
60	8,564,316	26,100	D2
61	842,545	3,623	A10
62	406,858	2,613	A10
63	3,577,743	8,887	A1
64	372,655	2,801	E2
65	530,373	2,724	Lewaigue Hill
66	227,270	1,995	A7
67	237,744	1,819	Ballajora Hill
68	977,424	10,799	Maughold Brooghs
69	1,156,553	5,343	A7
70	1,598,962	5,874	A4
71	406,795	3,121	A7
72	292,376	2,419	A10
73	3,794,132	10,756	E4A
74	582,679	2,859	A10
75	1,078,648	4,686	A4
76	92,968	1,233	A11
77	524,025	3,169	A1
78	97,331	1,265	A11
79	49,467	920	A11
80	13,537,146	28,498	D4A
81	13,898,312	33,147	D5
82	385,546	3,951	A7
83	202,163	1,918	A11
84	157,637	1,878	A11
85	214,740	2,131	A11
86	183,354	1,681	A11
87	3,935,624	21,072	A1
88	189,114	1,685	A9
89	456,630	2,562	B2B
90	159,100	1,613	B1
91	3,291,569	12933	A2
92	4,149,342	15,715	B3
93	989,113	6,064	B2B
94	2,137,898	6,015	A2

Table 3 cont.

Polygon ID	Area (m^2)	Perimeter (m)	Labels
95	187,753	1,845	A10
96	1,512,329	5,796	A5
97	255,172	2,179	A11
98	149,164	1,645	A11
99	109,051	1,372	A11
100	1,489,537	9,915	B1
101	3,701,118	7,580	B2A
102	748,168	6,485	B2B
103	591,172	4,411	A1
104	663,534	15,055	Langness
105	1,609,856	7,628	A7
106	2,373,397	12,531	B1
107	2,450,508	8,206	A2
108	202,185	2,282	A11
109	78,478	1,166	A11
110	2,865,346	7,178	A6
111	382,631	2,256	Sileau Chairn
112	505,855	2,923	Chibbanagh Plantation
113	76,425	1,117	A11
114	1,186,590	5,144	A2
115	1,217,120	5,216	A9
116	1,223,341	4,503	A9
117	514,848	3,191	E1B
118	113,362	1,285	A11
119	59,751	1,220	A11
120	1,112,476	7,045	A6
121	1,602,679	4,931	Archallagan Plantation
122	119,146	1,553	A11
123	600,460	3,560	A7
124	1,708,103	8,474	A7
125	151,490	1,667	A10
126	309,251	3,467	A11
127	165,296	1,778	A10
128	184,934	1,775	A11
129	186,049	1,729	Cronkny Moghlane
130	3,709,686	12,690	A2
131	2,349,793	9,603	A9
132	2,091,261	7,298	Bradda Hill
133	1,736,804	16,615	Spanish Head
134	1,298,576	31,857	Santon Coast
135	1,074,090	12,052	Laxey Coast South
136	1,938,073	17,422	Laxey Coast North
137	195,935	5,243	Port Mooar
138	1,372,807	8,517	Corrins Hill
139	217,248	1,933	A1
140	26,671	843	A1
141	1,074,553	5,440	A7
142	2,048,726	5,972	A9
143	1,280,588	6,757	D6

Table 4: Land use capability classes of the Soil Survey of England and Wales and their extent on the Isle of Man

Class	Characteristics	Extent	
		Hectares	(%)[1]
1	Land with very minor or no physical limitations to use	370	1.00
2	Land with minor limitations that reduce the choice of crops and interfere with cultivations	1,436	3.87
3	Land with moderate limitations that restrict the choice of crops and/or demand careful management (g>c>w)[2]	29,785	80.26
4	Land with moderately severe limitations that restrict the choice of crops and/or require very careful management (g>w>c)[2]	5,051	13.61
5	Land with severe limitations that restrict its use to pasture, forestry and recreation (w>g>c)[2]	471	1.27

Notes:

[1]Calculated as percentage of the total agricultural land area of the Isle of Man, estimated in the survey as 37,111 hectares.

[2]Limitations may be due to the land use capability subclasses: Wetness (w), Soil limitations (s), Gradient and soil pattern limitations (g), Susceptibility to erosion (e) or Climatic limitations (c). Codes denote the land use capability classes and subclasses (for example 2g, 4e, 5c). For classes 3, 4 and 5, subclasses are shown in descending order of importance in terms of their effect on agricultural capability.

Source: Bibby and Mackney (1972), Bibby (1991).

Table 5: Agricultural classification of Manx soils (first version published in Fullen et al., 1996)

Table 5 follows on pages 11 to 14. A key for the symbols and abbreviations used in this table is given below.

Key to symbols used in Table 5:

1. Textural classes (based on U.S. Department of Agriculture System)

LS	=	Loamy sand
SL	=	Sandy loam
SCL	=	Sandy clay loam
FSL	=	Fine sandy loam
L	=	Loam
ZyL	=	Silty loam
ZL	=	Silt loam
ZyCL	=	Silty clay loam
CL	=	Clay loam
PyL	=	Peaty loam
Prefix: Org	=	Organic

2. PK reserves

0 = Deficiency level
1 = Low
2 = Moderate
3 = Satisfactory

Source: Ministry of Agriculture, Fisheries and Food (1981).

3. Drought Susceptibility is an estimate of the number of years in which drought occurs in the growing season out of every 2, 3, 4 or 5 years.

4. L.U.C. = Land Use Capability classification categories.
L.U.C. in **bold** denotes dominant L.U.C. within each mapping unit.

Code	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
Suggested Name	Stony Upland	Strang	Port Soderick	Linague	Glen Cam	Ballatrollag	Dalby	Lhergydhoo	Ballaharry	Dreem	Clycur
Characteristics	Free draining soils	Deeper soils than A1	Pale-coloured soils	Stoneless lowland soils	Deep upland soils	Shallow soils over blue clay	Coastal sandy loams	Heavy drift soils N.E & S of Peel, much exposed to West	Heavier upland soils	Reclaimed hill land	Garey soils
Hectares	16952	1608	1813	268	151	1022	717	878	1121	416	278
Altitude (m)	Often Steep 60-240	Fairly Flat 30-150	Variable 30-150	Flat 30-90	Gently Sloping 180-210	Flat 60-120	0-60	50-100	100-150	200-300	80-150
Variability	Not Severe	Moderate	Very Variable	Slight	Slight	Moderate	Slight	Considerable, especially stone content	Fair	Not serious	Very variable
Drainage Needs	Not Severe	Not Severe	Important	Most Important	Not Severe	Important	Slight	Important	Important	Localised	Often not feasible
Texture	Stony ZyL	Loam	Stony ZL	ZL	ZyL	ZL over ZyCL	SL	Stony CL over red & blue clay	Stony ZL	Highly organic ZyL	Peat
PH	5.0-6.0	5.5-6.5	5.0-6.0	5.5-6.0	5.0-6.5	5.5-6.0	5.0-6.5	5.5-6.0	5.5-6.0	5.2-6.0	4.0-5.0
PK reserves	P0-1 K0-1	P1-2 K0-2	P0-1 K0-1	P0 K0-1	P0-1 K0-1	P0-1 K0-1	P0-2 K0-2	P0-1 K1	P0-1 K1	P0-1 K1-2	P0 K0
Nitrogen (Natural fertility)	Low	Medium	Low	Very Low	Medium	Medium	Medium	Fair	Fairly Good	Good	Low
Depth (cm)	13-20	20-25	13-20	10-18	25-38	10-20	15-23	15-20	15-20	12-20	6-10
Grass Production	Good	Very Good	Fair	Poor	Good	Fairly Good	Good	Good	Good	Good	Rough summer grazing
Crop Production	Good	Good	Fair	Poor	Poor	Moderate	Good	Difficult due to variability	Good but short season	Not Feasible	N/A
Drought Susceptibility	1/3 (Patches)	0	0	0	0	0	1/5	0	0	0	0
Normal Land Use	Mixed	Dairy	Mixed	Sheep	Cattle	Beef & Dairy	Mixed Crops & livestock	Mixed cattle & sheep	Dairy & mixed farming	Sheep & cattle grazing	Rough summer grazing
L.U.C.	3	2/3	3/4	4/3	3	3/4	2/3	3/4	3	3/4	4/5
No. of mapping polygons	9	7	3	2	1	3	8	3	7	11	19

Table 5 cont.

Code	B1	B2A	B2B	B3	C1	C2	C3
Suggested Name	Scarlett	Billown	Glashen	Dumb	Peel	Sandhouse	Ballaleece
Characteristic	Coastal Sandy Loams over Limestone	Deep brown loams over limestone	Reddish loams over limestone	Low lying medium & heavy soils over limestone	Free draining soils over sandstone	Light undulating Sandy soil	River Neb Gravels
Hectares	402	370	397	415	287	158	79
Altitude (m)	10-20	Fairly Flat 15-45	Undulating 30-60	10-30	Fairly Flat 30-60	30-60	15-30
Variability	Slight	Slight	Moderate	Moderate	Moderate	Slight	Slight
Drainage Needs	Nil	Quite Important	Quite Important	Important	Not Severe	No	No
Texture	SL	Loam	Loam	ZyL to ZL	Brown SL	LS	Gravelly SL
PH	6.0-7.0	6.5-7.5	5.5-7.0	5.5-6.5	5.0-6.0	5.0-6.0	5.0-6.0
PK reserves	P1-2 K1-2	P1-2 K0-2	P0-2 K0-2	P0-1 K0-1	P0-2 K0-1	P1-3 K0-2	P1-2 K0-1
Nitrogen (Natural fertility)	Good	High	Medium	Fairly good	Fairly good	Medium	Medium
Depth (cm)	20	20-30	18-25	15-20	18-23	15-20	15-20
Grass Production	Good	Very Good	Good	Fairly good	Fairly Good	Restricted	Restricted
Crop Production	Good	Very Good	Good	Possible, but harvest limitations	Fairly Good	Good in places	Restricted
Drought Susceptibility	Occasional 1/3	0	0	0	1/5	1/3	1/3
Normal Land Use	Crops (with horticulture & grass)	Dairy & Cereals	Dairy & Cereals	Mixed Livestock	Very mixed (mostly urban)	Mixed crops and grass	Grass Conservation
L.U.C.	2/3	1/2	2/3	3/4	2/3	3/4	3/4
No. of mapping polygons	3	1	4	1	1	1	1

Table 5 cont.

Code	D1	D2	D3A	D3B	D4A	D4B	D5	D6
Suggested Name	Bride Hills	Broughjairg	Bretney	Dollagh	Ballavastyn	Glentruan	Regaby	Ballacree
Characteristic	Terminal moraine soils	"Platform" soils	Sandy loam over sand	Sandy loam over gravel	Saucer shaped Depression in N. Undulating in S.	Good soils N. of Bride Hills	Mixed soils of N.E. coast	Ayres border soils
Hectares	437	856	1339	475	1391	659	1390	643
Altitude (m)	Hilly 60-90	Undulating 15-45	Flat 15-45	Flat 15-30	Flat/Slightly undulating 15-30	Flat 15-30	Mainly flat 15-30	Flat 10-15
Variability	Moderate	Moderate	Slight	Slight	Considerable	Moderate	Considerable	Slight
Drainage Needs	Nil	Patches only	Slight	Nil	Considerable	Patches	Considerable	High Winter Water table
Texture	LS/SL	LS/SL	SL	SL	SL/SCL	SL/SCL	SL	LS
PH	4.5-6.0	4.5-6.0	5.5-6.5	5.0-6.0	5.5-6.5	6.0-6.5	5.5-6.5	5.5-7.0
PK reserves	P0-1 K0-1	P0-2 K0-1	P1-2 K0-1	P0-2 K0-1	P0-3 K0-2	P1-3 K1-2	P0-2 K0-2	P1-2 K1-2
Nitrogen (Natural fertility)	Low	Rather Low	Moderate	Moderate	Moderate	Good	Fairly Good	Low
Depth (cm)	8-18	13-20	18-25	15-23	18-25	18-25	18-25	8-15
Grass Production	Poor	Moderate	Fairly Good	Variable	Good	Very Good	Good	Poor
Crop Production	Moderate	Fairly Good	Good	Good	Very Good	Good	Good	Poor
Drought Susceptibility	2/3	1/2	1/4	½	1/5	1/5	1/4	3/3
Normal Land Use	Winter Grazing	Crops & Grazing	Crops & Grazing	Crops & Grazing	Dairy & Cereals	Sheep & Cereals	Dairy & Mixed	Extensive Grazing
L.U.C.	4/5	3/4	3	3	2/3	2/3	2/3	4
No. of mapping polygons	1	1	2	1	2	1	1	2

Table 5 cont.

Code	E1A	E1B	E2	E3	E4A	E4b
Suggested Name	Ballaugh/ Cranstal Curragh	Greeba Curragh	Clanagh	Loughdhoo	Kella	Lough Mullagh
Characteristic	Uncultivated or long neglected peats	Uncultivated or long neglected peats	Variable organic Loams	Cultivated Curragh land	Over blue silt, with gravel beds east of Curraghs	Over blue silt NW of Ramsey
Hectares	262	209	785	363	379	590
Altitude (m)	Flat 10	Flat 45	Flat 10-12	Flat 10-12	Flat 10-15	Flat 5-10
Variability	Fairly uniform	Less uniform	Very	Very	Moderate	Moderate
Drainage Needs	Severe	Severe	Ditching Mainly	Most Important	Very Important	Essential
Texture	Peat, with silt and clay admixture	Peat	PyL to Org SL/SCL	Org SL, Org FSL Org SCL	ZL	ZL
PH	5.5	5.0	4.5-6.0	5.0-6.0	5.0-6.5	5.0-6.0
PK reserves	?	?	P0 K0-1	P0-1 K0-1	P0-2 K0	P0-1 K0-1
Nitrogen (Natural fertility)	?	?	Fair	Good	Good	Fair
Depth (cm)	30-90	30-60	20-30	25-30	20-30	18-25
Grass Production	--	--	Potentially Very good	Good	Very good	Good
Crop Production	--	--	Fair	Very good	Very good	Summer fodder crops only
Normal Land Use	Nature	Nature	Grazing & silage	Potatoes & Silage	Silage, Cereals & Sheep	Silage & Sheep
L.U.C.	5	5	3/4	3	2/3	3/4
No. of mapping polygons	3	3	3	1	1	1

Table 6: Main soil types for different crops and livestock systems

Wheat	B2A B2B D4A D4B D5 E3 E4A
Barley	A1 A2 A6 A7 A9 B1 B2B D3A D3B D4A D4B D5 E3 E4A
Oats	A1 A3 A6 A8 A9 D3A D4A D4B D5 E3
Potatoes	A2 A7 B2A B2B C1 D2 D3A D4A D5 E3 E4A
Carrots	A1 C1 D2 A8
Brassica crops	A2 B2A C1 D3A D5 E3
Kale	A1 A7
Swedes	A1 A7 A8 D3A D4B
Peas	C2 D3A D3B D5 E4A
Forage Maize	A9 B2A D3B D5 E3 E4A
Fodder Beet	A2 B2A D3A D3B D5
Dairy Cow Grazing[1]	A2 A6 A9 B2A B2B D4B D5 E3
Sheep Grazing	A1 A3 A4 A7 A8 A10 C2 D2 D3A D3B D4B D5 E4B
Cattle Grazing	A1 A2 A3 A5 A6 A9 A10 B3 D3A D4A D4B D5 E2 E3 E4A

Notes:
[1]Dairy cow grazing also generally on A1, where altitude and precipitation allow.

CLIMATE

The agricultural area of the Isle of Man is covered by three main climatic zones, which influence agricultural activities. The **large central area**, including much of the west and east coasts, has an annual precipitation of over 1000 mm (225-510 mm in spring and summer, 635-760 mm in autumn and winter). Mean temperatures are 5-6°C in winter and 13-15°C in summer. Sunshine amounts are higher than for many comparable upland areas in the British Isles, but drought is rarely a problem, except on shallow, stony soils. However, much of the south-eastern part of the Island experiences hill and coastal fogs. Wind speeds are often sufficiently high to limit crop and grass production. Much rain falls in heavy showers, but soil erosion is rarely a problem. A notable exception is on sloping fields with cultivation perpendicular to the contour and planted with autumn sown crops.

The **southern coastal area** has lower precipitation (710-890 mm) and higher sunshine amounts than the large central area and fairly frequent coastal fogs. Drought is rarely a problem, due to the more argillaceous nature of the soils. Mean temperatures are 5-7°C in winter and 14-16°C in summer.

Climate is notably variable on the **northern plain** compared with the other two zones, but fogs are relatively rare. Precipitation is generally lower than in the central area, but very variable (e.g. annual precipitation varied from 711 to 1220 mm at one site during the 1990s). Precipitation totals are fairly consistent in autumn and winter, totalling 510-635 mm, but summer and spring rainfall is often 300 mm or less, resulting in quite frequent drought conditions on light or shallow soils. Sunshine amounts are quite high for northern Britain. High wind speeds often impede crop and grass production. Temperatures are quite variable, with winter means of 4-8°C and 14-17°C in summer months.

LAND DRAINAGE

Land drainage has fundamentally influenced the nature and properties of Manx agricultural soils. Drainage has taken several forms. **Strategic drainage** has been applied to heavier soils and lower lying areas, in otherwise free draining fields. Much of this work was carried out in the nineteenth century using slates or flagstones to construct channels at 0.4-0.7 m depth. Maintenance of these systems and construction of new ones are normal parts of good farm practice. Many of the newer (post-1970) systems use plastic pipes and porous fill at 0.6-0.8 m depth to promote drainage in otherwise well drained fields, where old systems have broken down or were non-existent. Although strategic drainage costs £3 to £5 per metre run (1996 prices), it can still be economically feasible, provided the system is expertly designed to give the uniform soil conditions essential for intensive crop and stock production.

Many fields are wet because of water seepage, often where springs emerge between more and less permeable materials. A strategically placed **interceptor drainage** system dug immediately upslope of the problem area can improve quite large areas at reasonable cost. These systems need to be deep (up to 1 m) and with at least 0.5 m of porous fill, such as shells or gravel.

Much of the Island was comprehensively drained using stone drains prior to 1900 and these remain marvellous examples of engineering. However, from 1970 to 1990, virtually all drainage work attracted a government grant, and this attracted many farmers to new **comprehensive drainage** systems. A comprehensive system (using 100 mm pipes, 0.3-0.5 m of gravel fill and pipes spaced 10 m apart) costs over £2500 per hectare, even allowing for grant aid, which currently is only 20% and only available for replacement and repair. Few Manx farmers therefore find this an economic proposition. There are no specialist land drainage contractors and virtually no new comprehensive systems, except on small areas and hence no specialist land drainage contractors on the Island. Fortunately, the most extensive agricultural soil type (Stony Upland; A1) rarely needs new comprehensive systems. Experience has shown that on Garey soils (such as A11), drainage is rarely economically viable and not always fully effective. The following soils would justify comprehensive drainage systems for intensive grassland and crop production in a good economic climate:

A2	Strang
A9	Ballaharry
B2A	Billown
D4A	Ballavastyn
D5	Regaby
E3	Loughdhoo
E4A	Kella

Generally, soil pans are not a particular problem on most profiles. However, several of the more progressive and intensive farmers have found that arable subsoiling to 0.4-0.6 m every five years, or once during the arable part of the rotation, contributes to successful crop production and probably also helps subsequent grass production. Subsoiling is common on Grades 2 and 3 land in soils types A2, B2, D4, E3 and E4. Table 6 shows the most suitable crop and livestock systems for the different soil types.

SUMMARY OF MANX AGRICULTURAL SOIL TYPES

A. Soils associated with slates, flagstones and shales

A1. *Upland stony silty loams*
(suggested name: Stony Upland)
These are the most widespread soils and are found extensively in the central uplands, especially in the east (Maughold, Laxey and Baldrine) and Cronk y Voddy, The Braaid and the Lezayre uplands. Soil depth is variable, stone content often high and natural drainage usually good. With good husbandry and manuring they can be very productive.

A2. *Deeper stony loams*
(suggested name: Strang)
These soils contain more drift admixture than A1. Where natural drainage is satisfactory and fertility improved by careful management, they are potentially fertile soils, capable of high crop yields and of supporting high stocking rates. They are found in a belt from Baldrine to Glen Vine, centred on Strang. Other areas are around Ballafesson and Ronague in the south-west and St. Marks in the south.

A3. *Shallower stony loams*
(Port Soderick)
These loams typically overlie flagstones and are usually pale-coloured and nutrient deficient. They are most extensive around Port Soderick and Santon. Natural drainage is variable, but often poor over grey, silty clay. The soil has the reputation of being the poorest Manx agricultural soil but, when properly managed, it can support good dairy herds and even arable crops. For instance, one large farm has grown barley continuously on A3 soil for over 30 years.

A4. *Stoneless silt loams*
(Linague)
There are two small areas of these soils in German and Maughold. They illustrate the importance of stone content in promoting natural drainage, as they are very difficult to manage in wet seasons and need very closely spaced artificial drainage for improvement. This drainage usually utilises 10 cm diameter tile drains, emplaced at no more than 60 cm depth and 5-10 m apart, with a porous fill of gravel or scallop shells. This practice is expensive and much remains to be done.

A5. *Deep upland silt loams*
(Glen Cam)
A strip of these dark soils, which are 45 cm or more deep, is found south of South Barrule. Climate imposes severe limits to their potential fertility, as they are at an altitude of about 200 m, with consequent low temperatures, frequent fogs and over 1250 mm of precipitation per year.

A6. *Silt loams over blue stony silty clay*
(Ballatrollag)
These heavy soils are typical of areas extending from near the coast at Arbory and running north-east to Ballamodha. They are often quite shallow, with white quartz stones and large granite **erratics** (rocks transported by glacial ice from other areas). Wetter areas often grow a profusion of yellow flag iris (*Iris pseudacorus*). These soils can support good quality grass, but require artificial drainage and careful management.

A7. *Sandy loams in coastal areas*
(Dalby)
These are most extensive in Dalby, where their considerable agricultural potential is limited by exposure. Other areas include Kentraugh/Croit-e-Caley, which has good horticultural soils, and smaller areas in Maughold and above Glen Maye.

A8. *Heavy till soils*
(Lhergydhoo)
These occur in a rather cold and exposed area north-east and south of Peel. They are capable of good grass production when drained, but their textural variability (from clay loam through sandy clay loam, with occasional patches of sandy loam) limits sowing and harvesting of arable crops and very careful soil management is necessary.

A9. *Heavier upland soils*
(Ballaharry)
These soils are associated with upland stony silty loams (A1), but occur on gentler slopes and have more restricted drainage. They are found particularly near the Clypse and to the north and south of Marown parish, and include some of the best Manx grassland.

A10. *Reclaimed hill land*
(Dreem)
These soils were brought into cultivation from hill land (either virgin hill or more often historically cultivated) in the 1970s and have remained in grass since then. They were cultivated for pioneer crops, but for only one or two years. They often have a high topsoil organic content, with a mixed minero-organic subsoil produced by initial ploughing. Because of altitude, both early and late production of grass is limited, but they include much high quality grazing land.

A11. *Peaty valley soils*
(Clycur)
These peaty valley or "Garey" soils overlie stony silts and clays. They tend to be poorly to badly drained and support willow scrub, with gorse and heather in drier areas. Soil depth is very variable. These soils are particularly common in blocks of 2-10 hectares in the south-central part of the Island. Some have been successfully drained and reclaimed, particularly where the peat is shallow. However, the economic feasibility and long term benefits of drainage and reclamation are questionable in most cases.

B. Soils associated with limestone
All the limestone soils are located in the south. They can be divided into three sub-categories and one of these is subdivided into two phases.

B1. *Light sandy loams*
(Scarlett)
These have developed over sand and gravel, with limestone at depth. They are mainly coastal and urban (Castletown) and so of limited agricultural importance, except in the Strandhall/Poyllvaaish/Scarlett areas, where they form productive arable soils.

B2. *Good quality loams*
(Billown and Glashen)
These soils are developed over limestone and are in a favourable climatic area. They have considerable potential for crops and grass production and can be divided into two phases:

B2A (Billown) are the most fertile Manx soils, some up to Grade 1 standard. They are found around Billown and Ballahott and are fairly deep brown loams, with neutral to alkaline pH values.

B2B (Glashen) are reddish loams occurring to the east and west of the Billown soils. They are productive, but can be quite acid with low nutrient levels, despite the hard limestone beneath. These soils were more extensive before the construction of Ronaldsway Airport in the 1930s. However, they were much modified during airport construction, particularly by levelling with the use of gravels from the Point of Ayre (P.J. Davey, pers. comm.). Therefore, these soils have been classified as 'urban', along with those of the other smaller airport at Jurby.

B3. *Medium to heavy lowland soils*
(Dumb)
These are derived from till and alluvium, with limestone at depth. They are in fairly flat and low lying situations between Castletown and Colby and include the Dumb River flats. They are moderately drained, with fairly good potential for arable crops and grass production. Textures are typically silty loam to silt loam.

C. Soils associated with Peel Sandstone and Neb gravels

These soils are formed on a complex and varied admixture of material weathered from Peel Sandstone and transported mainly as gravels within the valley of the River Neb. However, their arenaceous nature means they have common properties, in particular their tendency to allow rapid drainage.

C1. *Brown sandy loams*
(Peel)
These are good soils, with a distinctive reddish brown colour, giving potentially good arable land. However, much of this land has been urbanised.

C2. *Light loamy sands*
(Sandhouse)
These soils comprise an undulating strip of pale loamy sands east of Peel. They are worked mainly for building sands, but include some useful early cropping land, which is however subject to drought.

C3. *Neb Valley gravels over Peel Sandstone*
(Ballaleece)
These are typical river gravels, with a high stone content. Being above the water table, they suffer from water shortage in dry periods. They form the largest area of river gravels in agricultural use on the Island, although there is a larger area within the Douglas urban area at Port e Chee, which is used for recreation.

D. Soils associated with glacial deposits

D1. *Loamy sands*
(Bride Hills)
These very sandy soils with some gravel admixture are associated with the undulating topography of the Bride Hills. Typically, they are very dry and excellent for outwintered stock, but unreliable for summer crops because of water shortage. They are useful as an adjunct to other heavier soils.

D2. *Light loamy sands/sandy loams over sand*
(Broughjairg)
These are associated with the Orrisdale Platform, a uniform area of undulating land. Because of their naturally well drained and droughty nature, these soils have been under developed, due to poor summer production of grass and arable crops in lighter-textured areas in 3-4 years out of 10. However, they are excellent for winter use and virtually all are in grass managed for winter grazing and are most suitable for outwintered stock. In wet years, these soils can grow excellent crops of potatoes and carrots.

D3. *Sandy loams*
(Bretney and Dollagh)
The sandy loams represent some of the main cropping areas and form two phases, overlying either sand (D3A, Bretney) or gravel (D3B, Dollagh). They are concentrated around Jurby and Ballaugh and grow winter cereals, potatoes and spring and autumn grass. Most Manx vegetables are grown in the Jurby area, usually assisted by summer irrigation. The soils are sometimes unreliable for summer grass production, particularly in the Ballaugh area over gravel. Jurby tends to specialise in early lambing sheep. There are a few autumn calving dairy herds, using small patches of heavier phases for summer grazing, or nearby reclaimed curragh land for grass conservation (production of winter fodder).

D4. *Sandy clay loams/clay loams to sandy loams*
(Ballavastyn and Glentruan)
These texturally variable soils usually overlie red clay, with sand and 'black rock' (iron/manganese pan) patches. Two phases are recognised:

D4A. (Ballavastyn). Soils in Andreas Parish tend to be heavier clay loams. They occur in saucer-shaped depressions within small, rather wet fields, particularly in the northern area. In the southern part, fields tend to be larger and better drained and include some of the best wheat and arable croplands and grasslands.

D4B. (Glentruan). In Bride Parish, between the Bride Hills and the Ayres, there is excellent arable and grazing land on sandy loams with some first class flocks of sheep. The northerly aspect does pose some limits to agriculture, but earlier drainage problems have largely been rectified.

D5. *Mixed sandy loams and sandy clay loams*
(Regaby)
These soils are concentrated in the Regaby area of the north-east. Generally, this is high quality land, but with much variability and some limitations resulting from drainage problems. However, the soils do not usually suffer from drought and can grow excellent winter cereals or support high quality dairy herds.

D6. *Loamy sands*
(Ballacree)
A flat strip of loamy sands, north of the heavier soils (D4B), forms an important part of most Bride farms. This area is liable to localised flooding in winter, due to high water tables. These soils have many limitations for summer use and satisfactory reseeding for winter use is very difficult. An outdoor pig enterprise is proving a potentially profitable land use.

E. Soils associated with peat deposits

E1. *Main peat areas*
(Ballaugh/Cranstal Curragh and Greeba Curragh)
These areas were formerly used for grass production for winter fodder by farmers in dry areas like Jurby, Ballaugh and Andreas, but are now largely left in their natural state for wildlife conservation and future agricultural use is unlikely. Peats occur on the northern plain, in the western Ballaugh Curraghs and Lough Cranstal (Bride) area (E1A, Ballaugh/Cranstal Curragh).

They are also present in the Central Valley, in the Greeba Curraghs and other smaller lowland areas (E1B, Greeba Curragh). These and neighbouring soils (E2, E3 and E4) contain large amounts of "bog oaks", often within plough depth.

E2. *Variable organic and peaty loams*
(Clanagh)
These soils are organic sandy loams and sandy clay loams in the central part of the northern Curraghs and extend along the Lhen Trench. They comprise moderately drained grassland either side of the Clanagh road and are used for summer grazing and cutting for winter fodder. Grazing is limited by 'redwater' (a tick-borne disease) in some areas. Cropping is not normally considered and would only be feasible with comprehensive artificial drainage.

E3. *Cultivated curragh land*
(Loughdhoo)
These areas were reclaimed from willow carr and rough grass in the 1970s and 1980s in northern, southern and western parts of the Ballaugh Curraghs, where drainage falls could be established. Peat has been rapidly lost, both by drying and biochemical oxidation, processes generally referred to as **peat wastage**. The soil after wastage is an organic sandy loam, which has proved to give high yields, both of potatoes and grass silage for drought-stricken dairy farmers in Ballaugh. Both reclamation and wastage have markedly improved agricultural productivity on this map unit. However, in the long term, peat wastage is usually detrimental to crop productivity, unless a ley farming rotation is adopted.

E4. *Organic silt loams*
(Kella and Lough Mullagh)
These soils are either over blue silt with gravel beds east of the Curraghs (E4A, Kella), or over blue silt north-west of Ramsey (E4B, Lough Mullagh). They are typical of much of the low lying areas of Sulby and Lezayre, being flat, generally stoneless and benefiting from artificial drainage. They are mixtures of peat and alluvium. Due to wastage, much peat is degraded and so soil organic content is very variable and sometimes relatively low. Fortunately, these soils tend to be in large fields and can be excellent for grazing, grass conservation or cropping. The most representative area is around Sulby Bridge. The Lough Mullagh area is more variable, liable to flooding and used exclusively for grass conservation and sheep grazing. Between these two areas lies some virtually unreclaimed and unfarmed land, overlying similar parent materials.

CONCLUSIONS

Soil survey and land classification can help to optimise use of land and determine the most sustainable management of the soil. Therefore, it is important to identify both the potential of land and its inherent limitations. Soil and land evaluations should also provide a meaningful basis for planning urban development, so that the limited areas of good quality land are preserved and inappropriate and expensive land management schemes avoided. Agricultural land classification also assists in identifying appropriate crops, thus increasing the likelihood of successful agriculture. Intensive arable cropping is appropriate on some soils, but is likely to fail or prove uneconomic on other soils where pasture is more suitable. Reclamation of some wetland soils may prove expensive and unproductive and retention of the wetland habitat may be the most suitable land use, both from an economic and ecological viewpoint. It must also be recognised that the Isle of Man possesses an extremely rich archaeological heritage, particularly the legacy of Celtic and Norse settlement and this should be recognised in land management plans. It is hoped that this report and the associated GIS project files will facilitate the future conservation and proper management of soils and thus optimise the preservation of the Isle of Man's unique landscape heritage for posterity.

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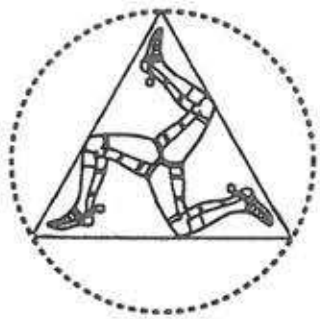
Ooir as yn Eirinagh ayns Ellan Vannin



J Harris, M A Fullen as M D Hallett

LAARE-STUDEYRYS MANNINAGH
Ard-schoill Lerpool

Coontey-ronsee 9 2001

Figure 4. Agricultural land use capability map of the Isle of Man.

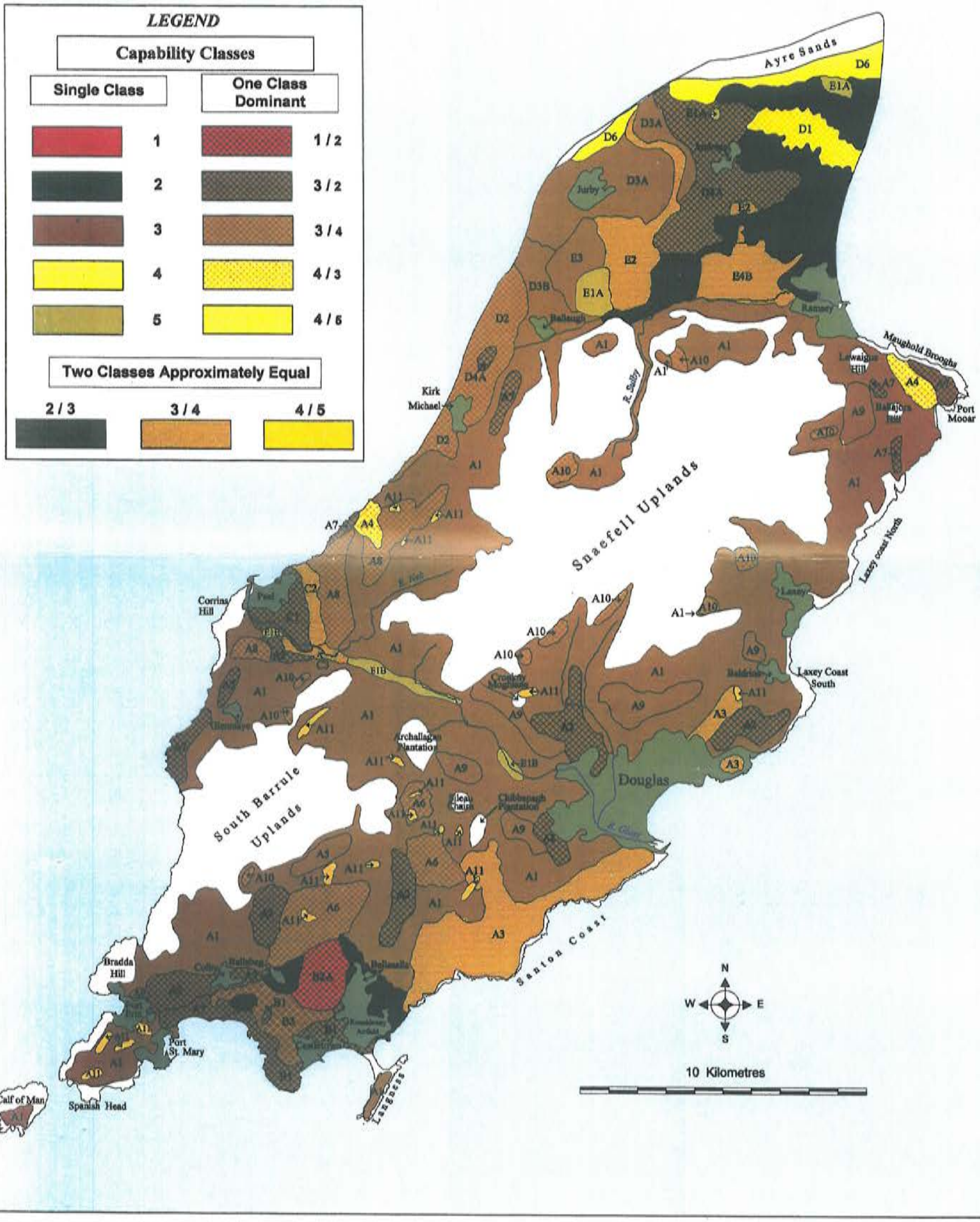


Figure 3. Agricultural soil classification map of the Isle of Man

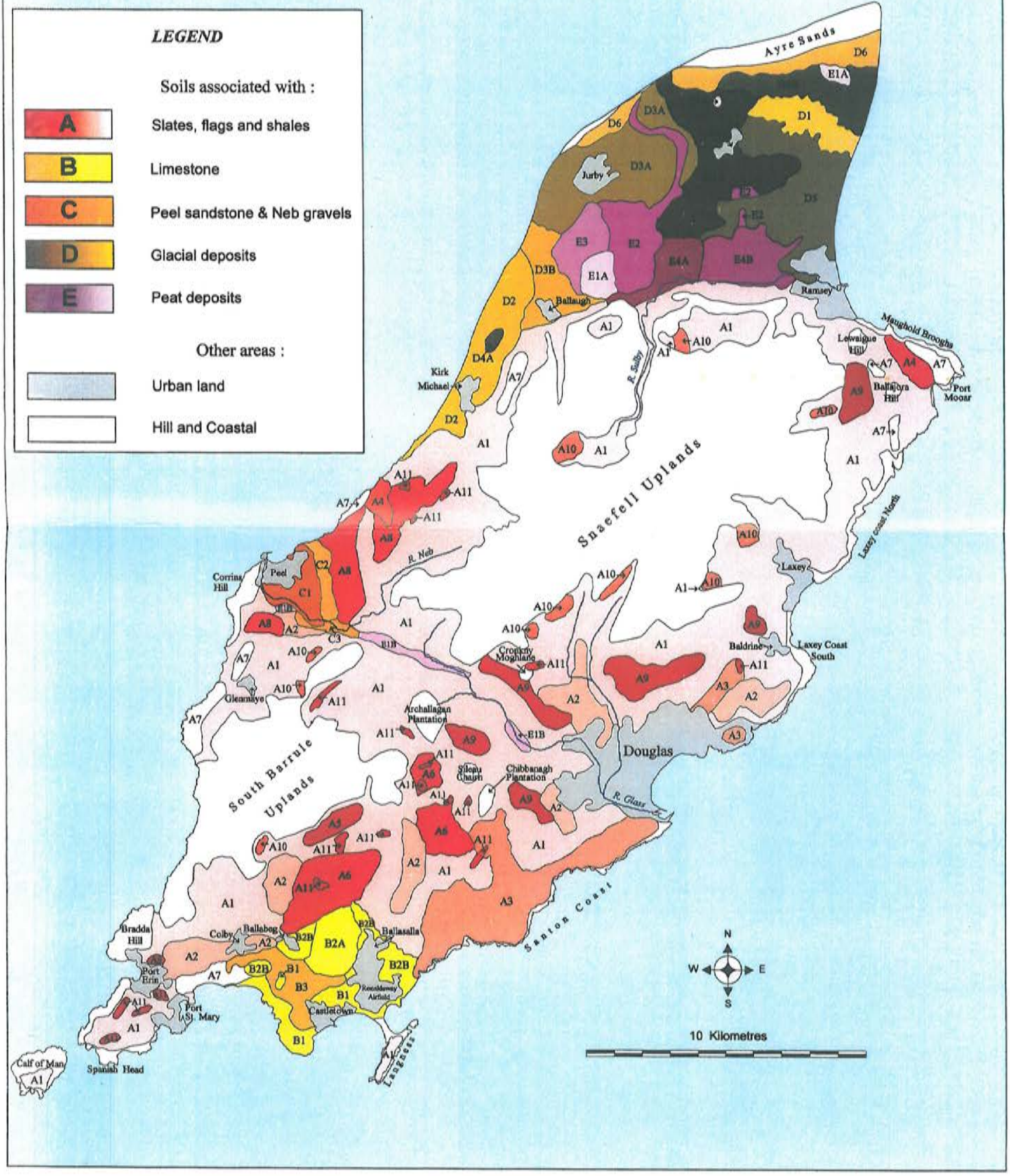


Figure 1. Simplified agricultural soil classification map of the Isle of Man

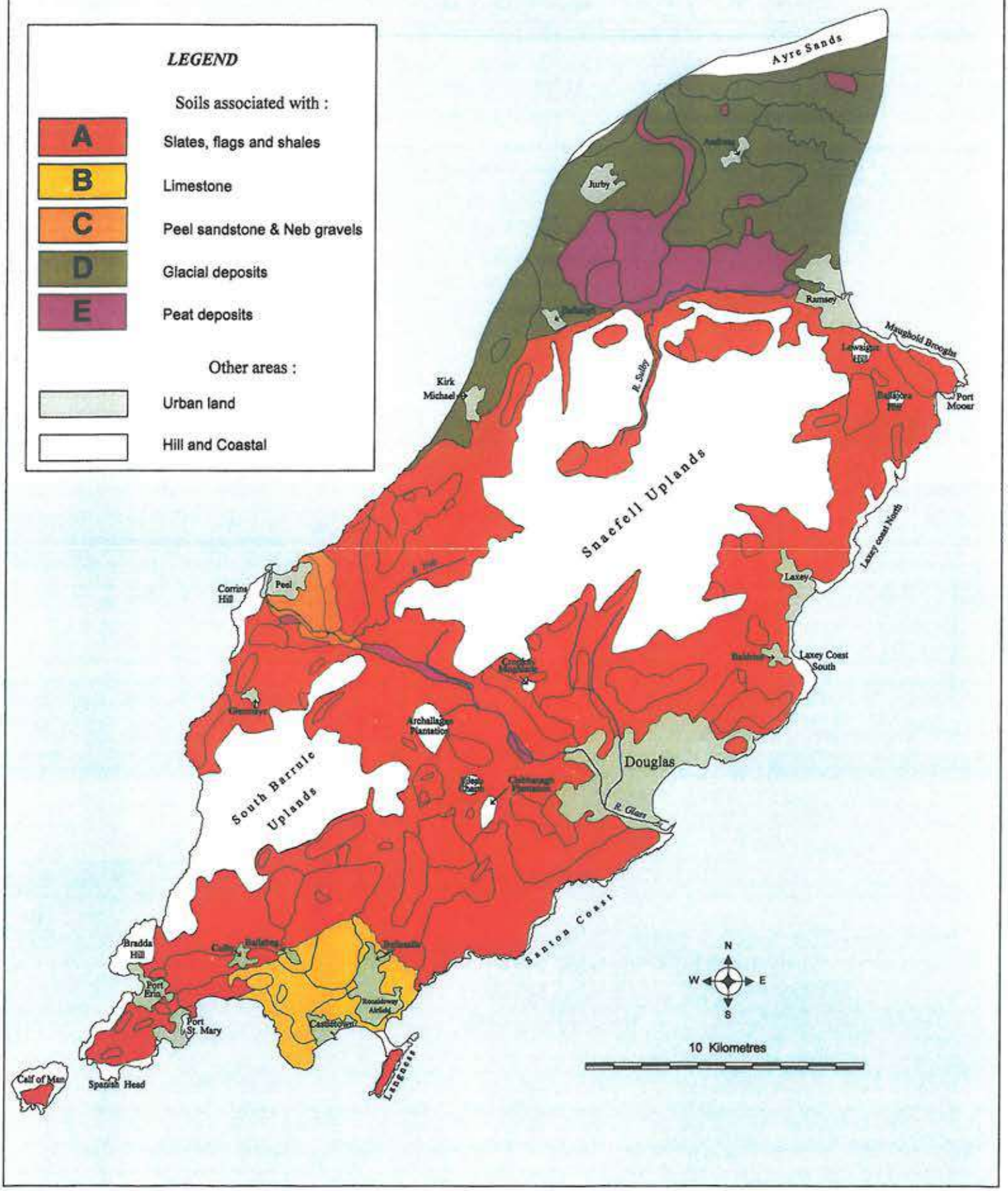


Figure 2. The numbered individual map units recognised in the survey.
(Polygon ID numbers)

OOIR AS YN EIRINAGH AYNS ELLAN VANNIN

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Ard-Schoill Lerpool

Coontey-ronsee 9 2001