ADAS

Llywodraeth Cymru
Welsh Government

Rhaglen Galluoedd, Addasrwydd a Hinsawdd

Ail-redeg SP1104 gyda data UKCP18

6 Tachwedd 2020
Cod Rhaglen: CSCP06

 WG41030

Rhaglen Galluoedd, Addasrwydd a Hinsawdd

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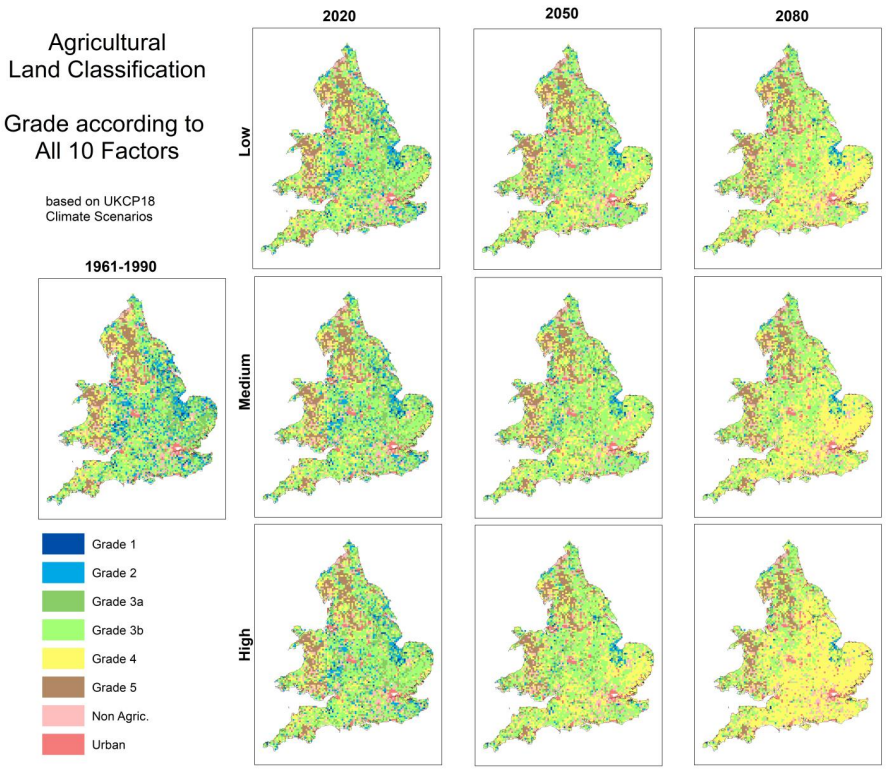
Paratowyd gan: Caroline Keay

Dyddiad: *06 November 2020*



Cynnwys

1 CYFLWYNIAD

Yn 2012, cynhaliodd NSRI astudiaeth ar gyfer Defra a Llywodraeth Cymru (SP1104), mewn cydweithrediad ag ADAS (gan gynnwys mewnbwn gan y Swyddfa Dywydd), i asesu sut y gallai newidiadau yn yr hinsawdd yn y dyfodol effeithio ar amaethyddiaeth yng Nghymru a Lloegr gan ddefnyddio'r system Dosbarthiad Tir Amaethyddol (ALC) fel mesur dirprwyol. Canolbwyntiodd yr astudiaeth ar y cyfnod 1961-1990 i gynhyrchu gwaelodlin y mae cysylltiadau'n deillio ohoni i'w defnyddio mewn senarios newid hinsawdd yn y dyfodol. Ymchwilir i ddeuddeg o senarios newid hinsawdd UKCP09, sef y senarios allyriadau canolig, uchel ac isel ar gyfer y cyfnodau 2020 (2010-2039), 2030 (2020-2049), 2050 (2040-2069) a 2080 (2070-2099). Nod yr astudiaeth hon oedd ailedrych ar allbynnau SP1104 gan ddefnyddio'r data UKCP18 newydd a gynhyrchwyd gan ADAS ar gyfer cyfnodau o ddeng mlynedd ar hugain yn canolbwyntio ar y 2020au, y 2050au ac, fel y disgrifiwyd yn Wilson a Hockridge, 2019.

2 DULL

Disgrifir methodoleg a chefndir gwreiddiol SP1104 yn Keay et al. (2013). Llwythwyd setiau data 5 cilometr newydd UKCP18 i mewn i'r un gronfa ddata Oracle SQL, a rhedeg y sgriptiau SQL gwreiddiol gan ddefnyddio'r data UKCP18. Mae'r "nsidata_ne" yn dal y paramedrau pridd a safle NSI gwreiddiol a ddefnyddiwyd yn y prosiect SP1104. Cynhyrchwyd y tablau UKCP18_xxxxy gan ADAS, gan ddal y paramedrau hinsawdd ar grid 5 cilometr (gyda phwyntiau ychwanegol wedi'u hychwanegu o amgylch yr arfordir fel y disgrifiwyd yn CSCP - Cyfrol 4 - ALC Rhagfynegol v2 - Newid Hinsawdd). Mae'r sgriptiau ar gyfer yr hinsawdd, gwlybaniaeth, llethr, dyfnder a'r terfyn cyffredinol (ln$alcgrade, ln$alcwetness, ln$alcslope, ln$alcdepth ac ln$alclimit) wedi'u rhestru yn CSCP - Cyfrol 3 - ALC Rhagfynegol v2. Rhestrir sgriptiau ychwanegol yn Adran 5. At ddibenion creu'r rhastr 50 metr o newidynnau hinsawdd yng Nghymru, roedd angen ymestyn y data hinsawdd 5 cilometr i gwmpasu mwy o'r ardaloedd arfordirol na'r data UKCP09 gwreiddiol a'r data UKCP18 newydd. Ar gyfer yr ail-rediad hwn o'r SP1104, defnyddiwyd y data hinsawdd 5 cilometr estynedig, a'r ail-rediad o'r data UKCP09 ar gyfer yr ardal fwy o faint. Felly, gall y Tablau sy'n dangos y ganran ym mhob gradd fod ychydig yn wahanol i'r niferoedd gwreiddiol.

3 CANLYNIADAU

3.1 Gradd ALC yn ôl Hinsawdd

Mae'r gwelliant yn y Tymheredd Cronedig uwchlaw 0° yn arwain at welliant mewn gradd ALC yn ôl hinsawdd. Yn y data UKCP18, nid yw'r tymheredd yn codi mor uchel ag yn nata UKCP09, felly mae llai o welliant. Mae Ffigur 3 a Ffigur 4 yn dangos dosbarthiad graddau ALC o dan senarios UKCP18 a UKCP09 yn y drefn honno.

Tabl 1 Canran y safleoedd NSI ym mhob Gradd ALC yn ôl hinsawdd -UKCP09 vs UKCP18

			2020		2050		2080	
ALC	61-90	Scenario	UKCP09	UKCP18	UKCP09	UKCP18	UKCP09	UKCP18
1	58.3%	low	80.3%	73.4%	85.6%	79.2%	87.2%	82.4%
		medium	81.0%	73.3%	87.3%	78.9%	89.1%	83.6%
		high	81.4%	74.3%	88.4%	81.2%	90.6%	86.6%
2	17.9%	low	7.5%	8.8%	6.0%	6.6%	5.5%	6.1%
		medium	7.3%	8.7%	5.4%	6.6%	5.0%	5.8%
		high	7.1%	8.4%	5.2%	6.4%	4.4%	4.8%
3a	4.9%	low	3.2%	3.2%	2.6%	2.9%	2.4%	2.5%
		medium	3.2%	3.3%	2.5%	2.9%	1.9%	2.3%
		high	3.1%	3.1%	2.1%	2.7%	1.6%	1.9%
3b	5.6%	low	3.8%	4.4%	2.4%	3.4%	1.7%	2.7%
		medium	3.7%	4.3%	1.7%	3.6%	1.5%	2.6%
		high	3.6%	4.2%	1.6%	2.9%	1.4%	2.3%
4	11.0%	low	4.9%	7.7%	3.3%	6.4%	3.0%	5.4%
		medium	4.7%	7.9%	2.9%	6.5%	2.4%	4.9%
		high	4.5%	7.8%	2.6%	5.8%	1.9%	4.0%
5	2.3%	low	0.2%	2.5%	0.2%	1.5%	0.1%	0.9%
		medium	0.2%	2.5%	0.1%	1.5%	0.1%	0.8%
		high	0.2%	2.2%	0.1%	1.0%	0.1%	0.5%

3.2 Gradd ALC yn ôl Gwlybaniaeth Pridd

Mae'r newidiadau a ragwelir mewn FCD yn dal i arwain ar newidiadau eithaf cynnil yn y radd ALC dros y cyfnod 2020-2080. Waeth a ddefnyddir data UKCP09 neu UKCP18. Mae tuedd gyffredinol tuag at briddoedd sychach. Mae Ffigur 5 a Ffigur 6 yn dangos dosbarthiad graddau ALC o dan senarios UKCP18 a UKCP09 yn y drefn honno.

Tabl 2 Canran y safleoedd NSI ym mhob Gradd ALC yn ôl gwlybaniaeth pridd - UKCP09 vs UKCP18

			2020		2050		2080	
ALC	61-90	Scenario	UKCP09	UKCP18	UKCP09	UKCP18	UKCP09	UKCP18
1	26.2%	low	26.6%	26.4%	30.5%	30.0%	31.3%	31.0%
		medium	26.6%	26.4%	30.8%	30.0%	32.0%	31.4%
		high	26.6%	26.5%	31.1%	30.6%	32.7%	32.6%
2	15.4%	low	15.0%	15.2%	15.3%	15.2%	15.5%	15.8%
		medium	15.1%	15.2%	15.4%	15.2%	15.8%	15.9%
		high	15.1%	15.2%	15.5%	15.4%	16.2%	16.1%
3a	20.3%	low	20.2%	20.1%	21.5%	21.3%	21.6%	21.3%
		medium	20.3%	20.1%	21.6%	21.4%	21.8%	21.4%
		high	20.3%	20.2%	21.5%	21.4%	21.6%	21.5%
3b	24.4%	low	24.2%	24.3%	20.7%	21.3%	19.9%	20.2%
		medium	24.1%	24.4%	20.3%	21.3%	19.0%	19.7%
		high	24.1%	24.3%	20.1%	20.7%	18.4%	18.8%
4	5.7%	low	5.8%	5.7%	4.4%	4.4%	4.2%	4.2%
		medium	5.7%	5.7%	4.3%	4.4%	4.0%	4.1%
		high	5.7%	5.6%	4.2%	4.3%	3.8%	3.8%
5	8.1%	low	8.0%	8.0%	7.4%	7.5%	7.3%	7.4%
		medium	8.0%	8.0%	7.4%	7.5%	7.2%	7.4%
		high	8.0%	8.0%	7.4%	7.4%	7.1%	7.0%

3.3 Gradd ALC yn ôl Sychder

Mae'r tymheredd is rhwng data UKCP09 a UKCP18 yn golygu nad yw'r gostyngiad mewn ALC a achosir gan sychder mor eithafol ag yr oedd o dan ragfynegiadau UKCP09. Mae'r data UKCP18 newydd yn llawer agosach at y sychder wedi'i addasu a gyfrifwyd yn SP1104 gan ddefnyddio data MORECS i ddyfeisio hafaliadau atchweliad newydd. Sychder yw'r ffactor mwyaf arwyddocaol o hyd o ran lleihau'r radd ALC ledled Cymru a Lloegr yn y dyfodol. Mae Ffigur 7, Ffigur 8 a Ffigur 9 yn dangos dosbarthiad gradd yn ôl sychder o dan UKCP18, UKCP09 a UKCP09 (gan ddefnyddio atchweliad MORECS) yn y drefn honno.

Tabl 3 Canran y safleoedd NSI ym mhob gradd yn ôl sychder - UKCP09 vs UKCP18

			2020		2050		2080	
ALC	61-90	Scenario	UKCP09	UKCP18	UKCP09	UKCP18	UKCP09	UKCP18
1	35.6%	low	20.0%	24.7%	11.6%	16.7%	9.6%	12.2%
		medium	19.4%	24.9%	9.9%	16.8%	7.7%	11.0%
		high	18.9%	23.8%	8.7%	14.0%	6.1%	8.4%
2	30.1%	low	17.3%	21.9%	9.2%	12.8%	7.7%	8.8%
		medium	16.2%	22.1%	7.9%	13.1%	5.6%	7.8%
		high	16.1%	21.1%	6.9%	10.4%	3.7%	5.6%
3a	20.5%	low	28.3%	28.5%	15.2%	22.7%	12.1%	15.2%
		medium	28.0%	28.5%	12.7%	23.3%	9.1%	13.7%
		high	27.6%	28.8%	10.8%	18.5%	7.2%	9.5%
3b	11.0%	low	24.3%	18.8%	31.4%	31.7%	26.1%	31.5%
		medium	25.5%	18.5%	27.3%	31.2%	18.3%	28.7%
		high	26.2%	19.6%	23.6%	32.9%	13.2%	19.3%
4	2.7%	low	10.1%	6.2%	32.6%	16.1%	44.6%	32.3%
		medium	10.9%	6.0%	42.1%	15.5%	59.3%	38.7%
		high	11.2%	6.6%	50.0%	24.2%	69.8%	57.3%
5	0.0%	low	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		medium	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		high	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

3.4 Gradd ALC gyffredinol

Ar ôl i'r tri maen prawf sy'n cael eu heffeithio gan yr hinsawdd gael eu hasesu (hinsawdd, gwlybaniaeth pridd a sychder), fe'u cyfunwyd â'r saith maen prawf pridd a safle (graddiant, llifogydd, ansawdd, dyfnder, natur garegog, cemegol ac erydiad) a phenderfynwyd mai'r radd ALC gyffredinol oedd y radd isaf o'r 10 maen prawf i gyd. Mae Ffigur 1 a Ffigur 2 yn dangos dosbarthiad graddau ALC ar gyfer data UKCP18 a UKCP09 yn y drefn honno.

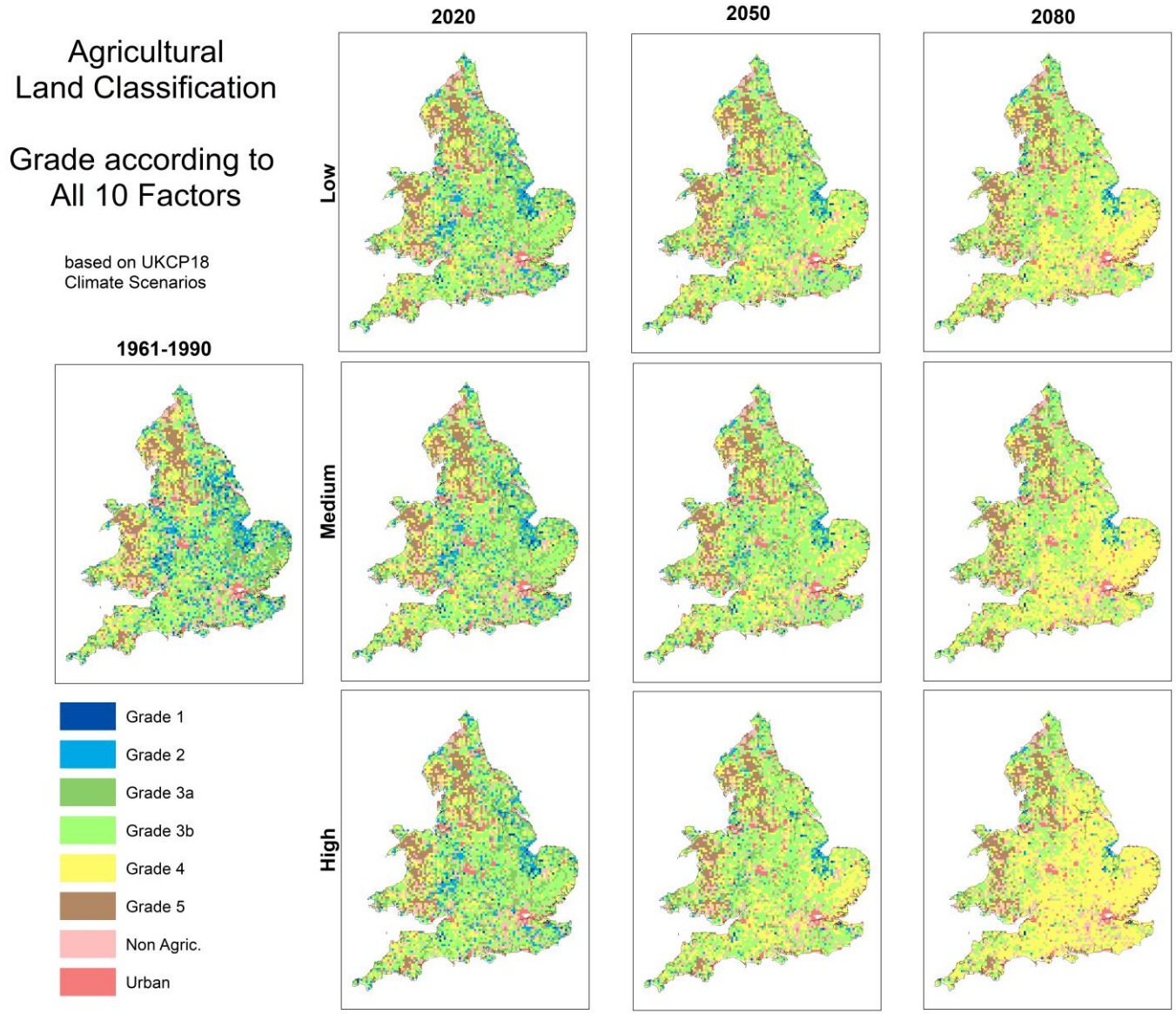
Tabl 4 Canran y safleoedd NSI ym mhob gradd ALC gyffredinol (gan gymhwyso pob un o'r 10 maen prawf) ac eithrio tir trefol a thir anamaethyddol - UKCP09 vs UKCP18

			2020		2050		2080	
ALC	61-90	Scenario	UKCP09	UKCP18	UKCP09	UKCP18	UKCP09	UKCP18
1	2.0%	low	0.8%	1.0%	0.4%	0.7%	0.4%	0.5%
		medium	0.7%	1.1%	0.4%	0.7%	0.3%	0.4%
		high	0.7%	1.0%	0.3%	0.5%	0.2%	0.3%
2	14.3%	low	6.8%	9.3%	2.6%	4.8%	1.9%	2.7%
		medium	6.3%	9.4%	2.0%	5.0%	1.3%	2.2%
		high	6.1%	8.9%	1.5%	3.6%	0.7%	1.3%
3a	21.6%	low	18.5%	20.9%	9.0%	15.1%	6.6%	8.8%
		medium	18.1%	21.0%	7.0%	15.6%	3.9%	7.6%
		high	17.9%	20.6%	5.4%	11.6%	2.7%	4.4%
3b	36.8%	low	44.4%	41.5%	39.6%	45.8%	32.0%	39.7%
		medium	44.8%	41.3%	33.6%	45.6%	21.3%	35.7%
		high	45.1%	41.9%	28.3%	43.5%	14.2%	22.6%
4	14.6%	low	19.1%	16.3%	38.6%	23.3%	49.4%	38.3%
		medium	19.8%	16.3%	47.2%	22.9%	63.6%	44.2%
		high	20.0%	16.7%	54.7%	30.8%	72.7%	61.9%
5	10.9%	low	10.4%	11.0%	9.8%	10.2%	9.7%	10.0%
		medium	10.3%	11.0%	9.7%	10.2%	9.6%	9.9%
		high	10.3%	10.9%	9.7%	10.1%	9.5%	9.5%

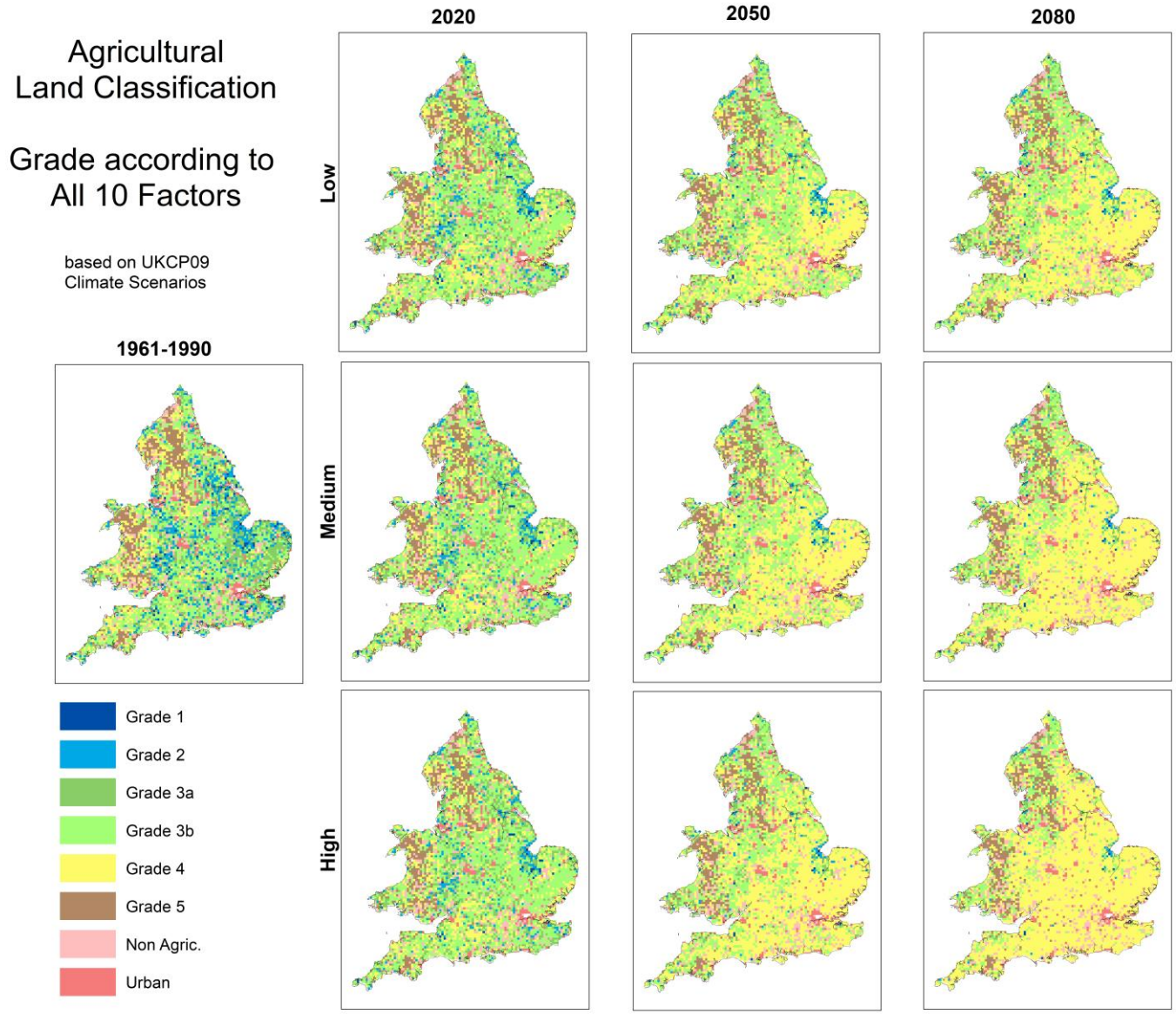
4 CYFEIRIADAU

KEAY, C.A.; JONES, R.J.A.; PROCTER, C.; CHAPMAN, V.; BARRIE, I.; NIAS, I.; SMITH, S.; ASTBURY, S. (2013). SP1104 the Impact of climate change on the capability of land for agriculture as defined by the Agricultural Land Classification, DEFRA 138tt.
http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=0&ProjectID=16929

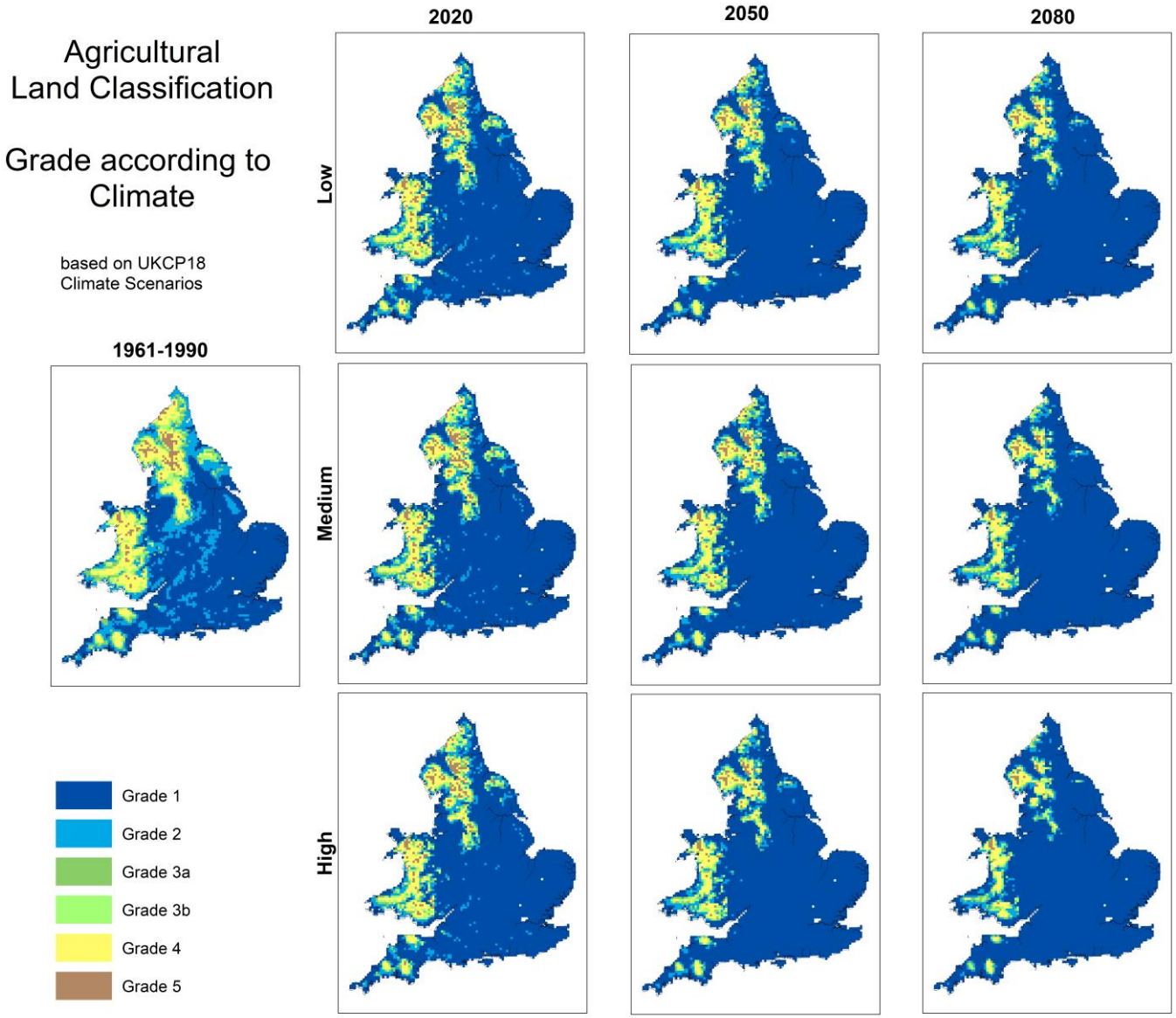
Wilson a Hockridge (2019) ALC Climate Data Processing Methodology. Adroddiad a luniwyd ar gyfer Llywodraeth Cymru.



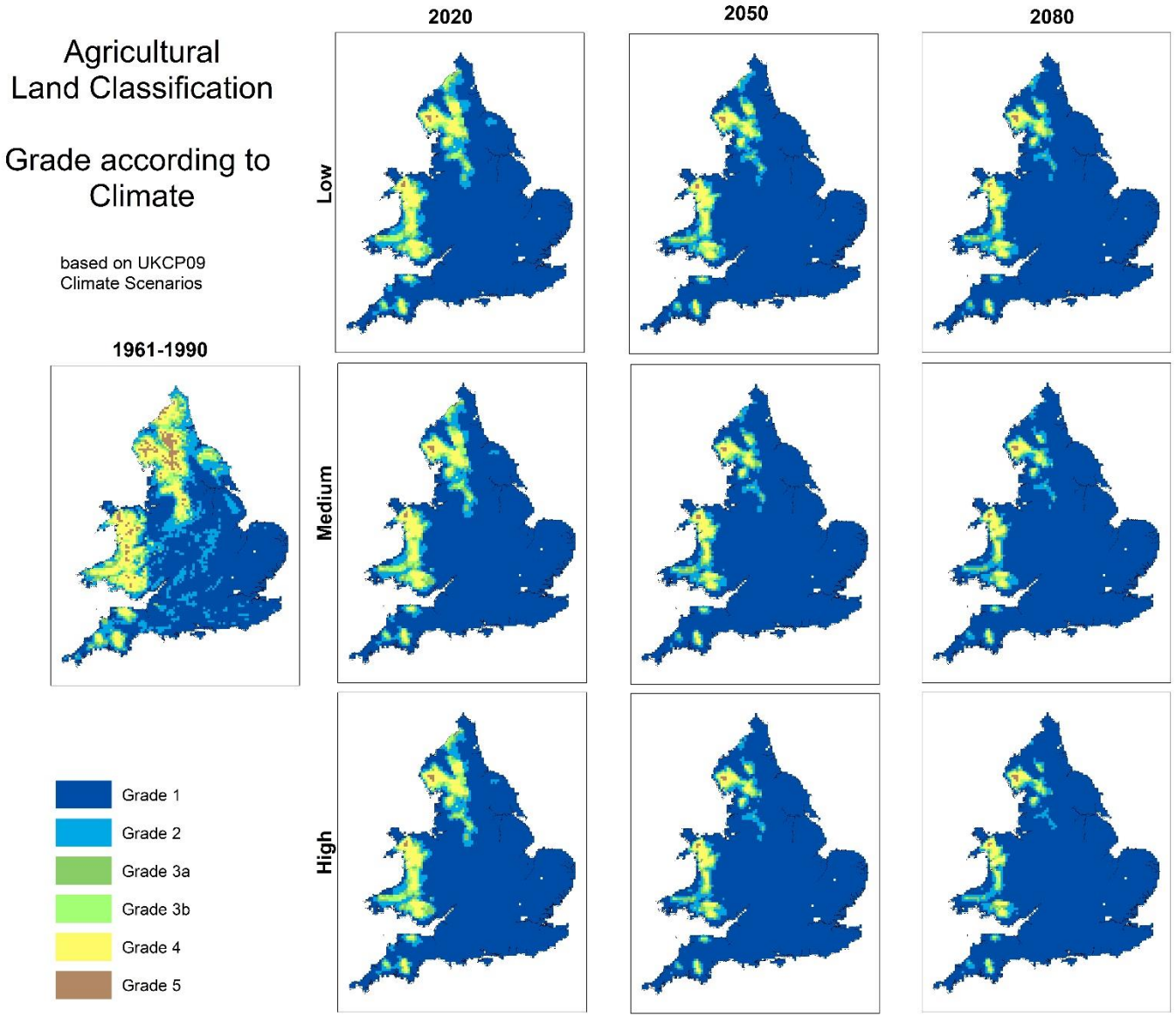
Ffigur 1 Gradd ALC Rhagfynegol (y mwyaf cyfyngedig o'r 10 maen prawf) o'r safleoedd NSI gan ddefnyddio data hinsawdd UKCP18 o dan senarios hinsoddol gwahanol.



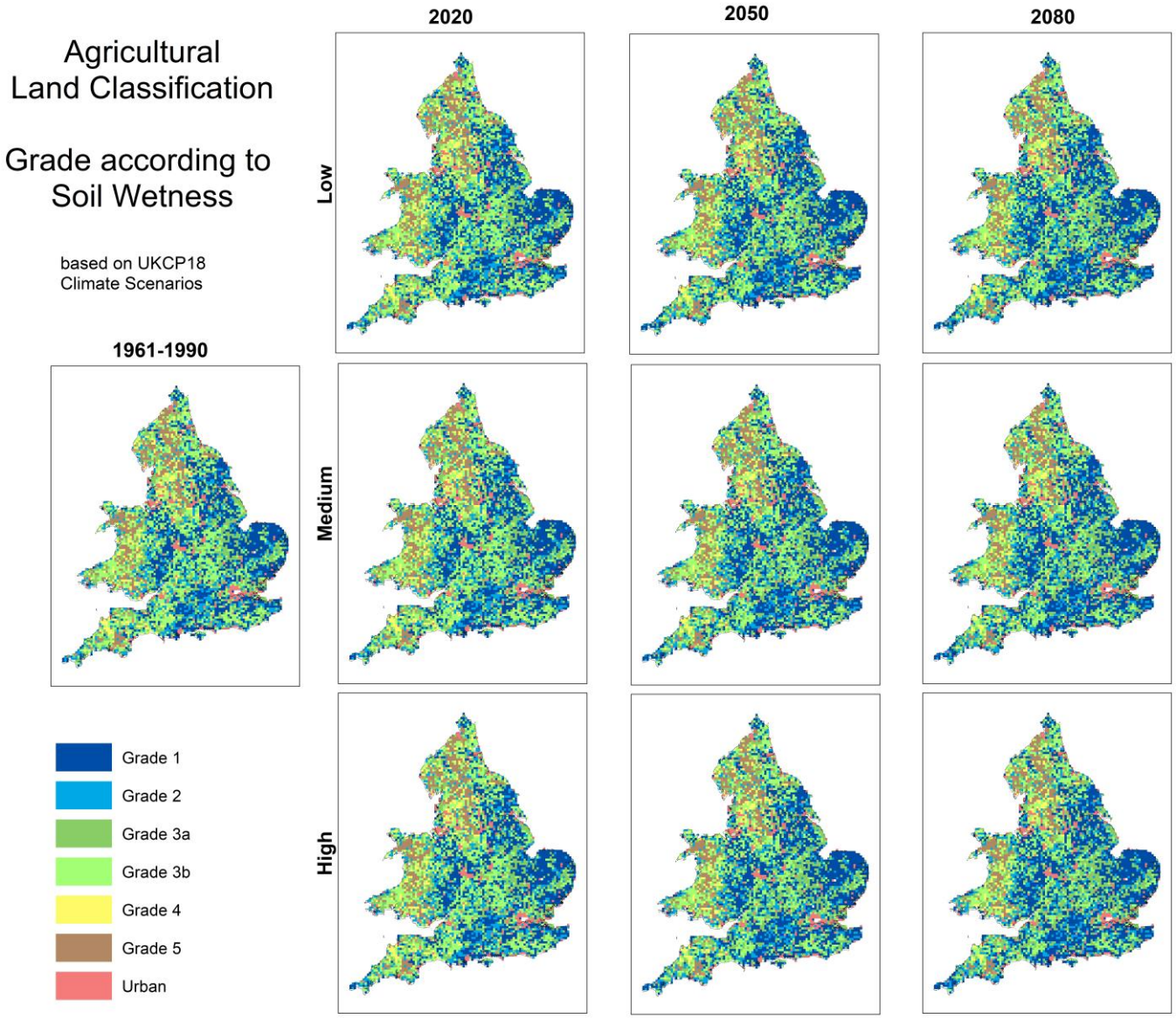
Ffigur 2 Gradd ALC Rhagfynegol (y mwyaf cyfyngedig o'r 10 maen prawf) o'r safleoedd NSI gan ddefnyddio data hinsawdd UKCP09 o dan senarios hinsoddol gwahanol.



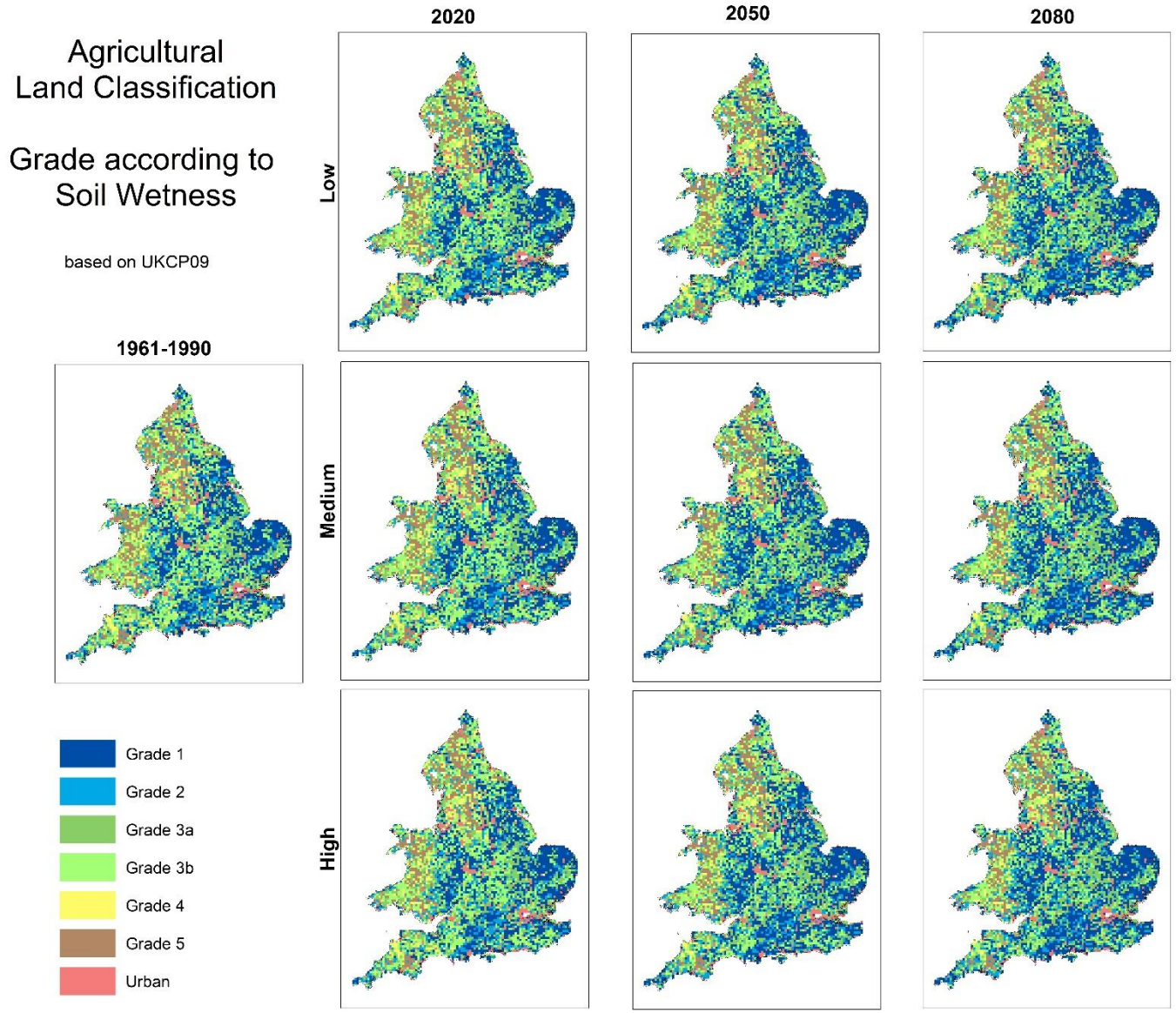
Ffigur 3 Gradd ALC (yn seiliedig ar feini prawf hinsawdd yn unig) wedi'i chyfrifo o'r glawiad blynyddol cyfartalog a'r tymheredd cronedig uwchlaw 0 °C mewn safleoedd NSI ar gyfer y rhagamcaniadau UKCP18.



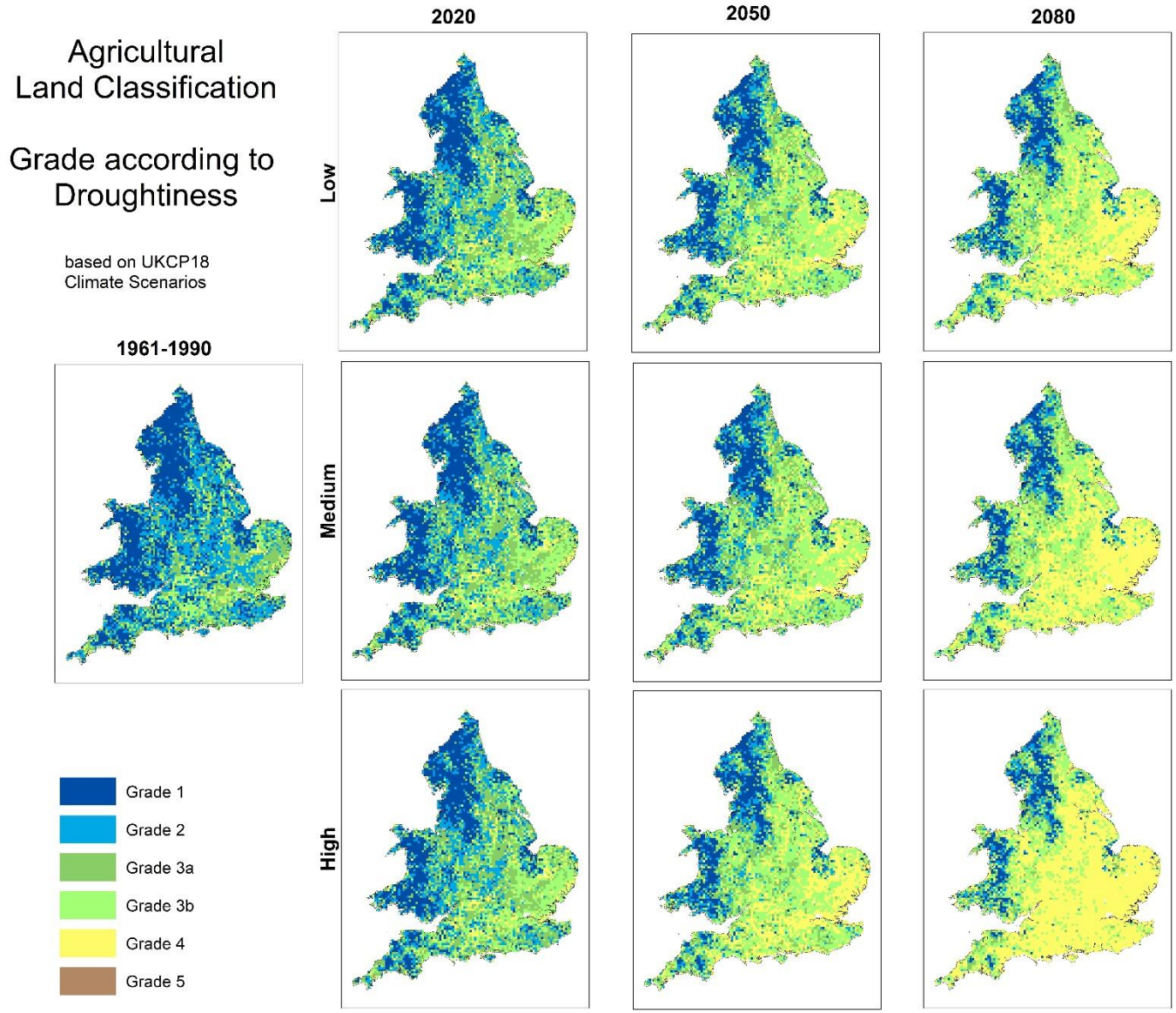
Ffigur 4 ALC gradd (yn seiliedig ar feini prawf hinsawdd yn unig) wedi'i gyfrifo o'r glawiad blynyddol cyfartalog a'r tymheredd cronedig uwchlaw 0 ° c yn safleoedd NSI ar gyfer amcanestyniadau UKCP09.



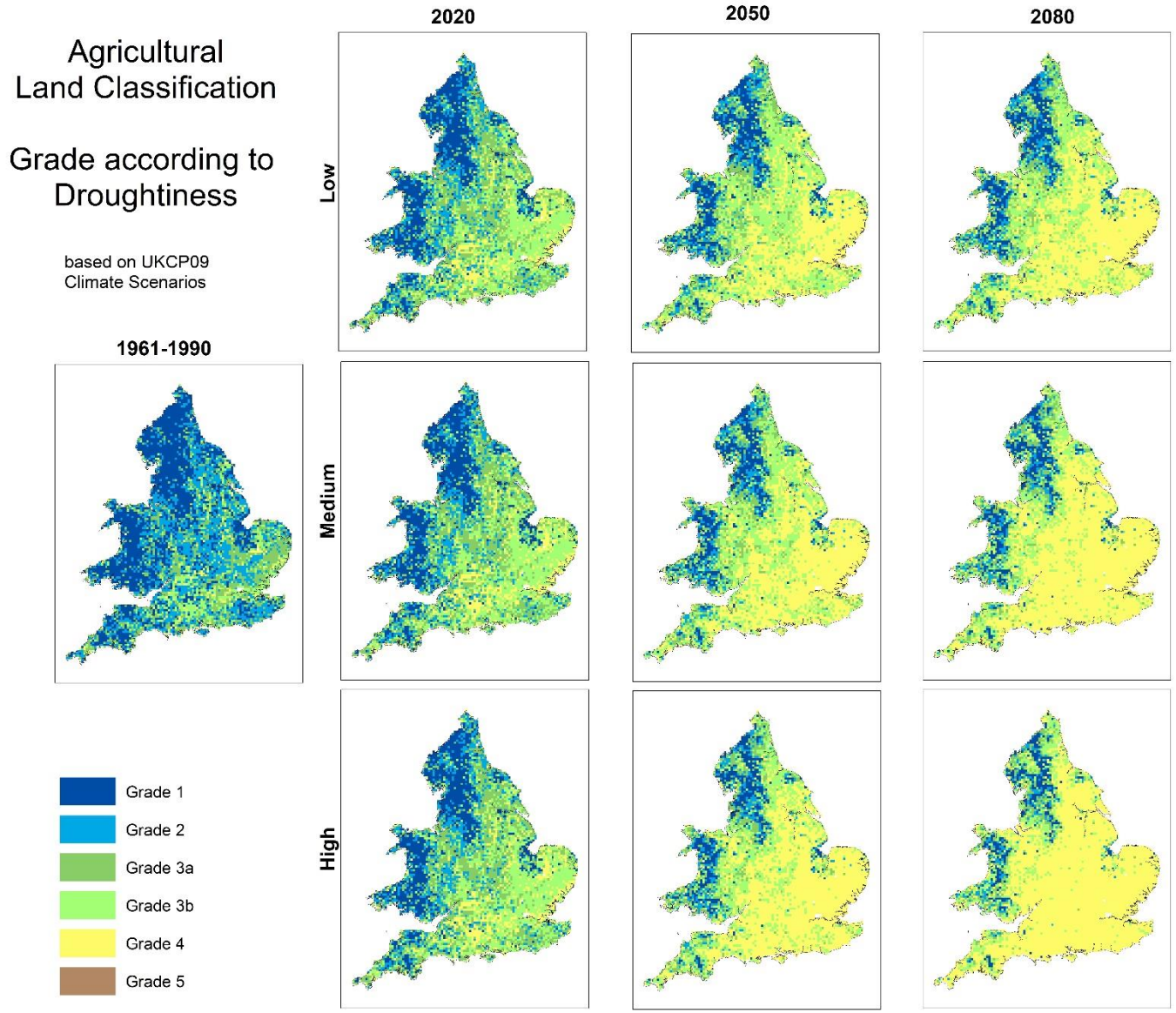
Ffigur 5 Gradd ALC (yn seiliedig ar wlybaniaeth pridd yn unig) ar safleoedd NSI ar gyfer amcanestyniadau UKCP18



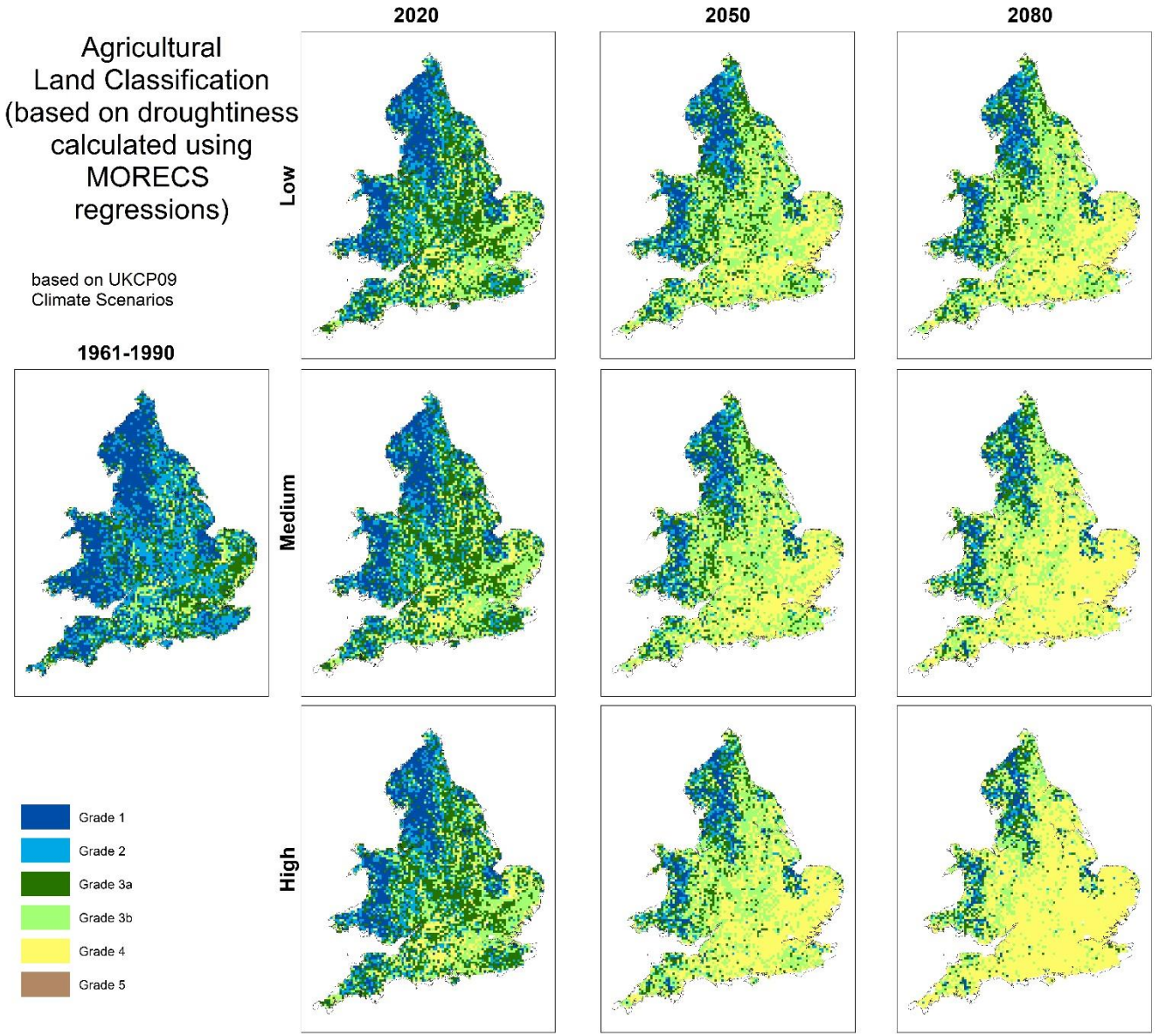
Ffigur 6 Gradd ALC (yn seiliedig ar wlybaniaeth pridd yn unig) ar safleoedd NSI ar gyfer amcanestyniadau UKCP09



Ffigur 7 Gradd ALC (yn seiliedig ar sychder yn unig) ar safleoedd NSI ar gyfer amcanestyniadau UKCP18



Ffigur 8 Gradd ALC (yn seiliedig ar sychder yn unig) ar safleoedd NSI ar gyfer amcanestyniadau UKCP09



Ffigur 9 Gradd ALC (yn seiliedig ar sychder yn unig) ar safleoedd NSI ar gyfer amcanestyniadau UKCP09 gan ddefnyddio hafaliadau atchweliad MORECS ar gyfer Diffyg Lleithder

5 SCRIPTS

5.1 crt_UK_ALC_UKCP18.sql

```
// SQLplus script to generate UKCP18_ALC data on a 5km grid
// &1 is the year (2020,2050 or 2080) and scenario (L,M or H)
// i.e. 2020L or 2080M
// TABLE nsidata_ne holds the original NSI soil and site parameters
// used in the SP1104 project
// The UKCP18_&1 tables were generated by ADAS holding the climate parameters
// on a 5km grid (with additional points added around the coast as
// described in CSCP - Volume 4 - Predictive ALC v2 - Climate Change)
//
// scripts for ln$alcgrade, ln$alcwetness, ln$alcslope, ln$alcdepth
// and ln$alclimit are described in CSCP - Volume 3 - Predictive ALC v2

drop table ukcp18_alc_&1;
create table ukcp18_alc_&1 as
select a.nsi_id, round(a.east_nsi/5000)*5000+1000 east_nsi,
round(a.north_nsi/5000)*5000+1000 north_nsi,
ln$alcgrade(b.aar, b.at0) ALC_CLIMATE,
ln$alcwetness(alcwetness(a.disturbed, b.fcd, a.dspl, a.carbon12, a.psc,
a.omineral, a.drock, a.dgley, a.dsgley, a.red, a.csub, a.alluvium), a.psc,
a.clayloam, b.fcd, a.carbon12, a.omineral) ALC_WETNESS,
ln$alcdrought(a.apw, ln$mdwht(b.asr, b.ats), a.app, ln$mdpot(b.asr, b.ats))
ALC_DROUGHT,
ln$alcslope(a.slope) ALC_SLOPE,
ln$alcdepth(a.drock) ALC_DEPTH,
ln$alcstones(a.stoneab, a.stonesize) ALC_STONES,
ln$alcchemical(a.zn,a.cu,a.ni,a.cd, a.pb) ALC_CHEM,
decode(a.erosion,'Y','2','1') ALC_EROSION,
decode(a.flood, 'Y','2','1') ALC_FLOOD,
'  ' ALC_limit,
round(b.aar,0) aar, round(b.at0,0) at0, b.fcd,ln$mdwht(b.asr, b.ats) mdwht,
ln$mdpot(b.asr, b.ats) mdpot, a.apw, a.app,
a.apw-ln$mdwht(b.asr, b.ats) drwht, a.app-ln$mdpot(b.asr, b.ats) drpot,
alcwetness(a.disturbed, b.fcd, a.dspl, a.carbon12, a.psc, a.omineral,
a.drock, a.dgley, a.dsgley, a.red, a.csub, a.alluvium) wetclass,
a.psc, a.clayloam,  a.slope, a.drock, a.stonesize, a.stoneab,
a.zn,a.cu,a.ni,a.cd, a.pb,a.inaccess, a.landuse
from nsidata_ne a, ukcp18_&1 b
where a.nsi_id = b.grid5k ;
--
update ukcp18_alc_&1
set ALC_LIMIT = ln$alclimit(psc,ALC_CLIMATE, ALC_WETNESS, ALC_DROUGHT,
ALC_SLOPE, ALC_DEPTH, ALC_STONES, ALC_CHEM, ALC_EROSION, ALC_FLOOD, INACCESS,
LANDUSE);

alter table ukcp18_alc_&1 add (ALC_FACTOR VARCHAR(255));
update ukcp18_alc_&1
set ALC_FACTOR = ln$alcfactor(psc,ALC_CLIMATE, ALC_WETNESS, ALC_DROUGHT,
ALC_SLOPE, ALC_DEPTH, ALC_STONES, ALC_CHEM, ALC_EROSION, ALC_FLOOD, INACCESS,
LANDUSE);
COMMIT;

--
alter table ukcp18_alc_&1 add primary key (nsi_id);
--
create index in_ukcp18_alc_&1 on ukcp18_alc_&1 (alc_factor);
```

5.2 crt_all_UK_ALC_CLIMATE.sql

```
// script to call the crt_UK_ALC_UKCP18 script for each of the 9 scenarios

@crt_UK_ALC_UKCP18.sql 2020L

@crt_UK_ALC_UKCP18.sql 2020M

@crt_UK_ALC_UKCP18.sql 2020H

@crt_UK_ALC_UKCP18.sql 2050L

@crt_UK_ALC_UKCP18.sql 2050M

@crt_UK_ALC_UKCP18.sql 2050H

@crt_UK_ALC_UKCP18.sql 2080L

@crt_UK_ALC_UKCP18.sql 2080M

@crt_UK_ALC_UKCP18.sql 2080H

@crt_UK_ALC_UKCP18.sql 2080M
```

5.3 Ln$alcstones

```
// ln$ALCstone defines the ALC classification by stone as defined in
// Table 5, p.14 of the ALC Guidelines
//
create or replace function ln$alcstones(sab char, ssize char)
return char is
BEGIN
if ssize = 'S' or ssize = 'VS' or sab = 'O' or sab = 'F' then
  return('1');
elsif ssize = '?' then
  return('0');
elsif sab = 'M' then
  return('3b');
elsif sab = 'X' then
  return('5');
elsif ssize = 'M' then
  if sab = 'C' then
    return('2');
  else
    return('4');
  end if;
else
  if sab = 'C' then
    return('3a');
  else
    return('5');
  end if;
end if;
END;
```

5.4 Ln$ALCchemical

```
// ln$ALCchemical defines the ALC classification by chemical limitations as defined
// on p.14 of the ALC Guidelines (data from measured NSI laboratory samples in
// 1979-83)
//
create or replace function ln$alcchemical(zn number, cu number, ni number, cd
number, pb number)
return char is
begin
  if zn > 200 or cu > 80 or cd > 50 or cd > 3 or pb > 300 then
    return('3b');
  else
    return('1');
  end if;
end;
```

5.5 Ln$ALCfactor

```
// Script to return the most limiting factor(s) as a text string
// i.e. wetness/slope
//
create or replace function ln$ALCfactor(PSC char,ALCClimate char,ALCwetness
char,ALCdrought char, ALCslope CHAR,
 ALCdepth char, ALCstones CHAR, ALCchem char, ALCerosion CHAR, ALCflood CHAR,
paccess CHAR, planduse CHAR)
RETURN CHAR IS
  ALClimit VARCHAR(2);
  ALCfactor VARCHAR(255);
  factors NUMBER;
BEGIN

  ALClimit := ALCclimate;

  factors := 0;
  ALCfactor := 'None';

  IF ALCnum(ALCclimate) > 1 THEN
    ALCfactor := 'Climate';
    factors := 1;
  END IF;

  IF ALCnum(ALCwetness) > ALCnum(ALClimit) then
    ALClimit := ALCwetness;
    ALCfactor := 'Wetness';
    factors := 1;
  ELSIF ALCnum(ALCwetness) = ALCnum(ALClimit) and ALClimit <> '1' then
    ALCfactor := ALCfactor||'/Wetness';
    factors := factors + 1;
  END IF;

  IF ALCnum(ALCdrought) > ALCnum(ALClimit) then
    ALClimit := ALCdrought;
    ALCfactor := 'Drought';
    factors := 1;
  ELSIF ALCnum(ALCdrought) = ALCnum(ALClimit) and ALClimit <> '1' then
    ALCfactor := ALCfactor||'/Drought';
    factors := factors + 1;
  END IF;
```

```
IF ALCnum(ALCslope) > ALCnum(ALClimit) then
  ALClimit := ALCslope;
  ALCfactor := 'Slope';
  factors := 1;
ELSIF ALCnum(ALCslope) = ALCnum(ALClimit) and ALClimit <> '1' then
  ALCfactor := ALCfactor||'/Slope';
  factors := factors + 1;
END IF;

IF ALCnum(ALCdepth) > ALCnum(ALClimit) then
  ALClimit := ALCdepth;
  ALCfactor := 'Depth';
  factors := 1;
ELSIF ALCnum(ALCdepth) = ALCnum(ALClimit) and ALClimit <> '1' then
  ALCfactor := ALCfactor||'/Depth';
  factors := factors + 1;
END IF;

IF ALCnum(ALCstones) > ALCnum(ALClimit) then
  ALClimit := ALCstones;
  ALCfactor := 'Stones';
  factors := 1;
ELSIF ALCnum(ALCstones) = ALCnum(ALClimit) and ALClimit <> '1' then
  ALCfactor := ALCfactor||'/Stones';
  factors := factors + 1;
END IF;

IF PSC = 'LS' and ALCnum(ALClimit) < 2 THEN
   ALClimit :=  '2';
   ALCfactor := 'Texture';
  factors := 1;
ELSIF PSC = 'LS' and ALCnum(ALClimit) = 2 THEN
   ALCfactor := ALCfactor||'Texture';
  factors := factors + 1;
END IF;

IF PSC = 'S' and ALCnum(ALClimit) < 3.2 THEN
   ALClimit :=  '3b';
  factors := 1;
  ALCfactor := 'Texture';
ELSIF PSC = 'S' and ALCnum(ALClimit) = 3.2 then
  ALCfactor := ALCfactor||'/Texture';
  factors := factors + 1;
END IF;

IF ALCnum(ALCchem) > ALCnum(ALClimit)  THEN
   ALClimit :=  ALCchem;
  factors := 1;
  ALCfactor := 'Chemical';
ELSIF ALCnum(ALCchem) = ALCnum(ALClimit) and ALClimit <> '1' then
  ALCfactor := ALCfactor||'/Chemical';
  factors := factors + 1;
END IF;

IF ALCnum(ALCflood) > ALCnum(ALClimit) THEN
   ALClimit :=  ALCflood;
  ALCfactor := 'Flood';
  factors := 1;
ELSIF ALCnum(ALCflood) = ALCnum(ALClimit) and ALClimit <> '1' then
```

```
    ALCfactor := ALCfactor||'/Flood';
    factors := factors + 1;
  END IF;
  IF ALCnum(ALCerosion) > ALCnum(ALClimit) THEN
     ALClimit :=  ALCerosion;
    ALCfactor := 'Erosion';
    factors := 1;
  ELSIF ALCnum(ALCerosion) = ALCnum(ALClimit) and ALClimit <> '1' then
    ALCfactor := ALCfactor||'/Erosion';
    factors := factors + 1;
  END IF;
  IF paccess in ('URB','TIP') and ALCwetness = '0' THEN
     ALClimit :=  '9';
     ALCfactor := 'urban';
    factors := 1;
  ELSIF (paccess in ('WAT','ROK') and ALCwetness = '0') or planduse IN
('CO','DC','RE') THEN
     ALClimit :=  '7';
     ALCfactor := 'non agricultural';
    factors := 1;
  ELSIF planduse is null or PSC = '???' THEN
     ALClimit :=  '7';
     ALCfactor := 'non agricultural';
    factors := 1;
  END IF;
```