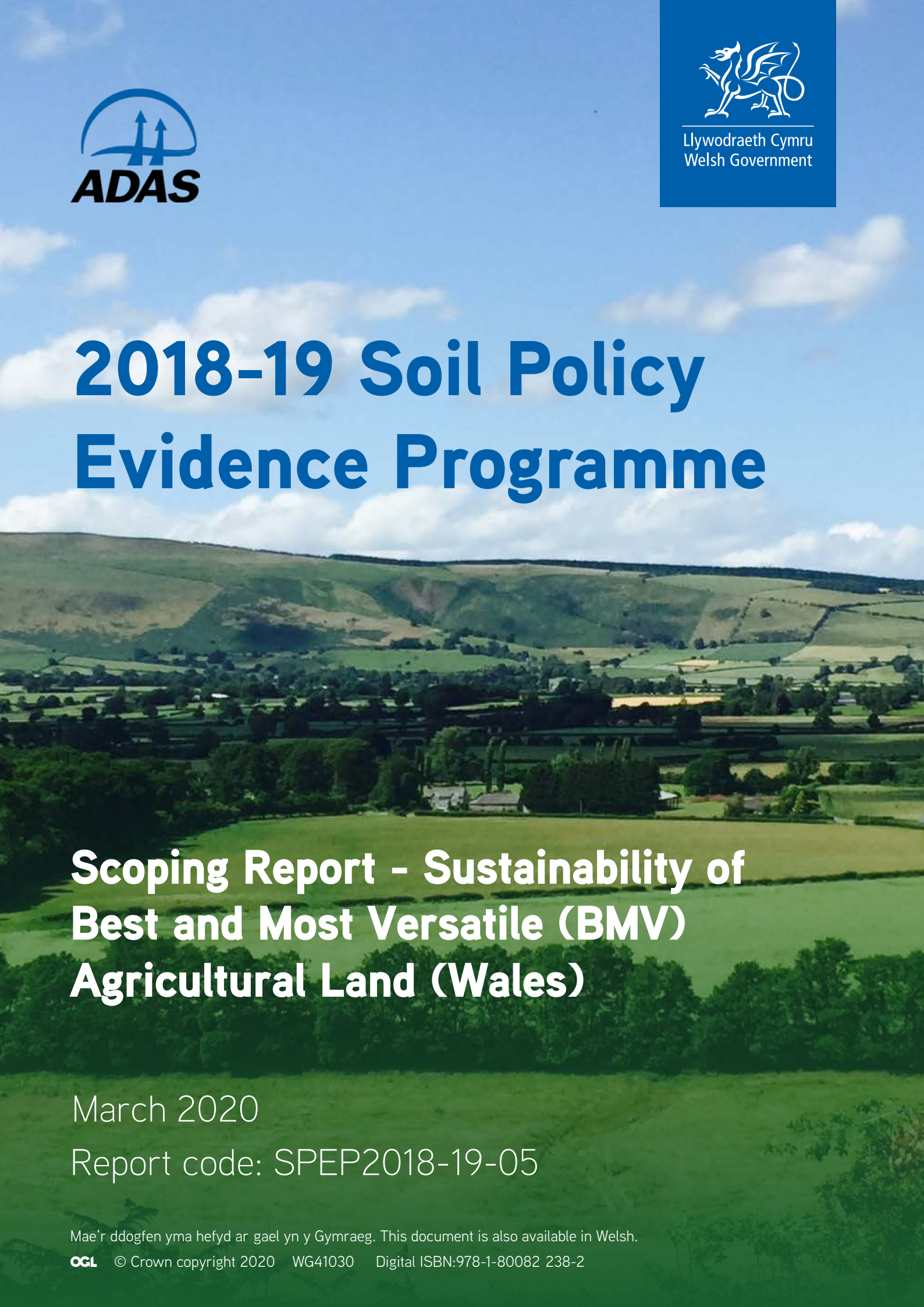

ADAS

Llywodraeth Cymru
Welsh Government

2018-19 Soil Policy Evidence Programme

Scoping Report - Sustainability of Best and Most Versatile (BMV) Agricultural Land (Wales)

March 2020

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ADAS GENERAL NOTES

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EXECUTIVE SUMMARY

The Welsh Government (WG) commissioned ADAS to provide an expert insight on their current high quality agricultural land protection measure, the Conservation of Best and Most Versatile (BMV) delivered through Planning Policy Wales. The aim of this work was to utilise the expertise within ADAS to determine whether the current weight of evidence generated by the other reports commissioned as part of the Soil Policy Evidence Programme Report (SPEP) 2018/19 either supported the view that BMV land should be protected/maintained or that this resource is so insignificant, WG should be prioritising limited resources elsewhere. Framed as a 'think piece' document and based on a mixture of expert opinion and published evidence, this report provides insight into how BMV policy, and potentially wider soil policy, could be shaped to best meet the needs of future generations.

Presently, Planning Policy Wales (PPW) sets out the Welsh Governments land use planning policies, including those related to Best and Most Versatile (BMV) land. Future land use planning and support, including the development of Area Statements, clear minimum standards and an effective reward system for the delivery of Sustainable Land Management (SLM) outcomes by Welsh Farmers, will need to be designed around the objectives of current and future legislation (e.g. Well-being of Future Generations Act (Wales) 2015, Environment (Wales) Act 2016, the Agriculture Bill, UN Sustainable Development Goals (SDG), etc). Consequently, it is important that decision makers in WG fully understand the implications of this in relation to the future role of BMV land.

Best and Most Versatile Land (BMV) Extent

Historically the area of BMV land in Wales has decreased from 318,235 hectares in 1939 to 296,960 hectares in 2011. The total loss of BMV land over the period 1939 to 2011, was 21,275 hectares (~0.10% loss per year). This area is equivalent in size to approximately 21,100 rugby fields or 440 Welsh farms[1].

The conversion of land for urban development purposes has been a key driver of BMV land loss in Wales. The area of land classified as Urban grew from 22,372 hectares in 1939 to 84,986 hectares in 2011, with significant growth occurring in 1965 (2.5% across all Wales) and 1980 (2.8% across all Wales). The total growth in Urban area from 1939 to 2011 is equivalent in size to approximately all of Monmouthshire county.

The predicted annual loss of BMV land to urbanisation over the next five decades is expected to be minimal when compared to historical loses. An estimated 125 hectares, on average, of BMV land will be lost to urbanisation per annum over the period 2018 to 2065. By 2065, under a high urban growth scenario, the total area of BMV land in Wales is predicted to decline to around 290,214 hectares.

Economic Assessment of BMV Land Loss to Urbanisation

The economic analysis of BMV land loss indicates that the cumulative loss of agricultural Gross Margin Value in 2065, for the each of the low, medium and high urban growth scenarios will be around £4.46, £7.44 and £11.18 million respectively.

The loss of ALC grade 2 land has the largest impact on agricultural Gross Margin Value loss (~48%), closely followed by ALC grade 3a land lost (~44%). The loss of ALC grade 1 land makes

[1] Average farm size of 48ha

a minimal contribution (<10%) to the total agricultural Gross Margin Value loss from the transformation of BMV land under all urban growth scenarios.

The Net Present Value (NPV) of cumulative BMV land loss due to urbanisation under each of the predicted growth scenarios is estimated to be around £138.37 million. The NPV as an annuity is expected to be around £5.74 million per annum.

Sustainable BMV Land Use

It is important for farmers, advisors and regulators to be able to broadly classify land capability so that land use can be matched to land capability and a sustainable level of production achieved. The key to sustainable use is matching the type and intensity of land use with its natural capability (site characteristics, soil properties and their interaction with the local climatic regime).

Only 95,500 hectares of the total 296,897 hectares of BMV land in Wales are currently used to grow crops and high value horticultural products. The remaining ~200,000 hectares of BMV land is likely to be predominantly grassland.

Given the prominence of grassland, any shift in land use potential could have significant implications for carbon, soil protection (in a high rainfall area), water quality and soil organisms. These in turn, would have implications for both strategic resource planning and for developing climate change adaptation actions if some of the potential land use options are not, at present, being actively considered and deliberated.

Any change in the current ALC grade 4[2] or ALC grade 5[3] land area could significantly influence environmental priorities because some of these areas have experienced less disruption from either frequent cultivation or intensification; therefore, tending to have a higher biodiversity value. These areas also tend to store large amounts of carbon in organic soils.

Impact on Sustainability

Fundamental to this long term capability of soils, and consequently the ability to produce food, are the aforementioned level of soil organic matter (SOM) and soil biodiversity. Cranfield University have suggested that the primary risk to these two indices is type of land use, with urban, horticulture and intensive arable systems representing the largest threat. Although development will continue to be a feature in some areas of Wales, the primary risk to the resilience (ability to withstand shocks) of the Welsh BMV resource, and as a consequence their food producing potential, is the manner in which it is managed.

Horticulture, woodland expansion, bioenergy crops, demands for rural amenities (second homes and associated infrastructure) all represent alternative land uses for BMV soils. The potential challenge and opportunity that they represent to the BMV resource, underline the necessity to view a soil system from a multifunctional perspective rather than a single narrow focus (whether that be food production, development potential or carbon storage).

It is not yet clear how BMV land and its soil resources are responding to a changing climate, with much debate over whether measured declines in UK soil carbon concentrations over the last few decades are a result of climate change or other factors such as changes in land management or recovery from acidification. However, given the predicted increases in temperature and changes in the seasonality and magnitude of rainfall events, changes to BMV soils and the services they provide are highly likely, particularly if land-use patterns also

[2] Poor quality agricultural land with severe limitations to agricultural use.
[3] Very poor agricultural land with very severe limitations to agricultural use.

change. A change in climatic and soil constraints implies that new opportunities for, or risks to, BMV land use could become more evident over time, based solely on inherent conditions.

BMV Land Issues and Policy Responses

Fully functioning soils provide rich biodiversity, safeguards and sequesters carbon, cleans and slows the flow of water, helps to regulate the climate and air quality and produces a sustainable supply of food. Making soil management decisions which support all of the services however is not always straightforward. This is reflected in the suite of strategies adopted by the EU over the past 15 years. These have all focussed on efforts to reduce soil erosion, to enhance soil organic matter, and on the integration of land use aspects into coordinated policies across all relevant levels of government; culminating in the adoption of the 17 Sustainable Development Goals (SDGs) by all United Nations Member States in 2016.

Despite these agreed high-level initiatives and widespread political leadership, the absence of clear objectives or easily measurable and monitored targets, has resulted in the continued fragmentation of targeted policies for the prevention of land and soil degradation. With respect to the protection of the BMV resource, the integrated nature of the Well-being of Future Generations Act (Wales) 2015, the Environment (Wales) Act 2016 and the current PPW, already represents an example of an interdisciplinary land policy framework. By expanding the drivers of this framework to encompass the wider objectives of productivity (social, economic and environmental), land cover and carbon stocks, this could enable Wales to become one of the European frontrunners alongside Italy in the delivery of the Land Degradation Neutrality(LDN) SDG target.

The WG is already committing additional resources in order to gain a better understanding of what has impacted upon historical and future loss of soils, how soils function and how best to use this existing and emerging data to inform policy development and implementation. Given this resource allocation and the emerging knowledge base, establishing themselves as a European frontrunner by operationalising an SDG such as the LDN, is well within the grasp of WG.

Key Considerations

- Detailed modelling incorporating climate variability that expands on the work undertaken by ADAS and that done under the Welsh Governments Capability, Suitability & Climate Programme should be considered as a next step to further understanding and evidence on the sustainability of BMV land and its resources.
- The total economic value of the BMV land resource in Wales was not possible to determine in the scope of this report. Consideration should be given to further research and analysis in this area. Understanding the total economic value will help identify whether preserving BMV land is the best option for WG policy or whether efforts should be focused towards the potential for ALC grade 3b or other grades to provide goods and services that meet future societal demands.
- Changes in climatic and soil constraints on agricultural land-use and broader environmental issues strongly imply the need for the ALC system to take account of the capability of Welsh soils to support sustainable intensification of agriculture in order for it to continue to meet a broad range of stakeholder needs.
- Consider further exploration of the impact of changes in climatic and soil constraints on BMV land. This could involve integrated analysis across different spatial (local vs regional vs national) and temporal scales (historical and predicted timeframes) that would allow efficient land allocations, trade-offs and co-benefits to be modelled in greater detail.

- Matching land use to land capability on BMV land with the highest flexibility and greatest options, should continue to be a key requirement for any future land use planning to ensure optimal utilisation of agricultural land and the achievement of sustainable development goals.
- There are various metrics available which enable the assessment of natural systems from a multifunctional perspective. A natural capital accounting programme which mapped, assessed and valued the natural capital delivered by Welsh soils may be a next step to further understand and evidence the value of Welsh soils and their associated services
- Consider the relevance of the Land Degradation Neutrality targets (land cover, land productivity and carbon stocks) as a mechanism for delivery and monitoring wider UN Sustainable Development Goals and associated Welsh legislation

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CONTEXT AND STRUCTURE

Context

The preservation of agricultural land is a global issue. Productive land is becoming scarcer as degradation, urban encroachment, changing societal preferences with respect to wider ecosystem services, dietary requirements, and other competing land uses put pressure on limited agricultural land resources. The reduced availability of lands with the versatility to support high yielding agricultural production reduces the sustainability of existing agricultural systems and encourages the use of more marginal lands for agriculture. Understanding the natural capability of the land and its relative suitability for agricultural production will help with the development of strategic plans and policy that value and protect those more productive and versatile soils.

Protecting the productive capacity of agricultural land in Wales falls under land use planning policies implemented through the planning system which manages the development and use of land in the public interest. Planning Policy Wales (PPW)[4] sets out the Welsh Governments land use planning policies, including those related to Best and Most Versatile (BMV) land.[5] BMV land is defined as ALC[6] Grades 1, 2 and 3a agricultural land and current policy aims to minimise or deter development on this land, instead redirecting it elsewhere.

BMV land is recognised as the most productive and versatile land and is considered to be a nationally significant resource in Wales. PPW treats BMV land as a resource of special importance because of its finite nature and long term strategic value. [7] A range of crops can be grown on BMV land and it is the most flexible, productive and efficient in response to inputs, making it the best land to deliver a variety of food and non-food goods and services including crops, fibres, biomass, ecosystem services and pharmaceuticals.

Environmental considerations, driven by sustainable development goals, continue to drive societal views towards land use in Wales. Sustainable agricultural systems and land management practices that serve to maintain ecological resilience and recognise the non-market value of ecosystem services will be key to resolving issues related to the ongoing protection of BMV land as a valuable finite resource. A primary delivery vehicle for this objective is the proposed Sustainable Farming Scheme in Wales which is aimed at rewarding farmers for the delivery of non-market land management outcomes.[8]

Future land use planning and support, including the development of Area Statements, clear minimum standards and an effective reward system for the delivery of Sustainable Land Management (SLM) outcomes by Welsh Farmers, will be designed around this concept so it is important that decision makers fully understand the implications of this in relation to the future role of BMV land.

Sustainable land management is defined as:

Reflecting the use of land for production, while ensuring long-term productive potential and maintenance of key environmental services.[9]

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[4] https://gov.wales/sites/default/files/publications/2018-12/planning-policy-wales-edition-10.pdf

[5] PPW BMV policy wording contained in Section 4

[6] ALC system for grading agricultural land quality in England & Wales (MAFF 1988) – see Appendix 1

[7] The Planning Policy for Wales (PPW), Edition 10, December 2018

[8] IEEP, 2019. *The emerging agricultural policy frameworks in the four UK administrations. A briefing for the UK Land Use Policy Group*.

[9] Ibid.

Structure

The key objective of this report was to assess likely land use changes, in particular, growth in urban areas, and climate changes over the coming years to provide a judgement based evaluation of potential impacts on the sustainability of BMV land in Wales. This has led to a set of considerations aimed at identifying future research and evaluation paths to help guide planning strategies on how best to utilise BMV land to minimise the potential identified future threats. The following 5 sections (summarised below) make up this report:

Section 1 Best and Most Versatile Land (BMV) Extent

This section provides insight into the historical and predicted extent of BMV land in Wales and assesses the impact of predicted urban growth on future BMV land resources.

Section 2 Economic Assessment of BMV Land Loss to Urbanisation

Drawing on data from the predictive modelling outlined in Section 1, this section provides an economic assessment of the loss of BMV land due to urbanisation over the period 2011-2065.

Section 3 Sustainable BMV Land Use

This section discusses key agricultural land uses in Wales and their influence on BMV land. By understanding how shifts in land use might impact on BMV land we will, in turn, be able to better understand how BMV land can be best utilised for agricultural and sustainable development goals.

Section 4 Impact on Sustainability

This section focuses on the risks and opportunities to the sustainability of BMV soils in Wales, and further afield with respect to sustainable food production, diversification, land competition and climate change.

Section 5 BMV Land Issues and Policy Responses

This section discusses the policy frameworks in place within Wales and across the EU with a focus on how current Welsh resource commitment and policy development could set the stage for a fully integrated Welsh soils policy.

1 BEST AND MOST VERSATILE (BMV) LAND EXTENT

1.1 Introduction

Environmental, economic and social factors influence decisions on the way land is utilised in Wales. Soil quality, climate, topography and other environmental features are key influencers of land suitability decisions that need to be incorporated into a broader sustainable development framework to ensure BMV land, other high value environmental areas and lower grade agricultural land are all given due consideration.

Current and predicted land cover and land use modelling can help understand the dynamics of different systems (including agricultural and ecosystems), evaluate scenarios for use in sustainability assessments and identify important features that can aid decision making. The impact of urbanisation on BMV land, for example, can be assessed with the aid of predictive modelling that incorporates urban data on household growth with data on land cover and land use.

Land cover and land use are not synonymous. Land cover represents the biophysical attributes of the earth's surface while land use is the utilisation of land assets for human intent and purpose (Lambin et al., 2001). Land cover and land use are often combined under the common term Land Use and Land Cover Change (LUCC). Land cover and land use change are key measures of anthropogenic disturbance on ecosystems and impact significantly on many natural processes (Tomlinson, et al., 2018).

The Environment (Wales) Act 2016 introduced tools to aid decision making and help plan and manage natural resources for a more sustainable Wales. The Welsh Government's principal advisor on the environment and natural resources, Natural Resources Wales, is required to periodically produce a State of Natural Resources Report (SoNaRR) that assesses the state of natural resources in Wales and the extent to which they are sustainably managed. The first of these reports[10] highlighted the need for increased woodland cover to deliver multiple benefits for Wales. The SoNaRR 2020 will include analysis of eight ecosystems with seven cross-cutting themes, of which land use and soils (including BMV land) will be a reporting feature. In this context, maintaining a balance between conservation and sustainable development is seen as a key challenge for policy making and land management in Wales, especially in relation to the use and management of Best and Most Versatile (BMV) land.

The purpose of this section is to provide an insight into the historical and predicted extent of BMV land in Wales and assess the impact of predicted urban growth on future BMV land resources. It is reasonable to assume that society would prefer land of lower agricultural capability to be developed for urban purposes ahead of higher capability BMV land, because loss of BMV land is perceived as a reduction in the ability of Wales to feed the population. Given changing government and societal views in relation to climate change, natural capital, ecosystem services and the future role of agriculture, preserving BMV land for food production alone, however, may not be the most economic or sustainable decision.

[10] NRW. 2016 *A Summary of the State of Natural Resources Report*. Natural Resources Wales.

1.2 Welsh agricultural land cover

Land cover in Wales comprises a mix of managed and semi-natural habitats, built up urban areas, and natural cover such as mountains, coastal margins and moors. Figure 1-1 shows the breakdown of land cover in Wales in 2018. Around 31% of land is naturally occurring or semi-natural habitat including forest and wetlands.[11] Less than 6% is classified as artificial surface which includes built-up urban and development areas. Nationally important landscapes are designated as National Parks or Areas of Outstanding Natural Beauty. These areas cover approximately 25% of Wales and include over 1000 Sites of Special Scientific Interest (SSSIs).

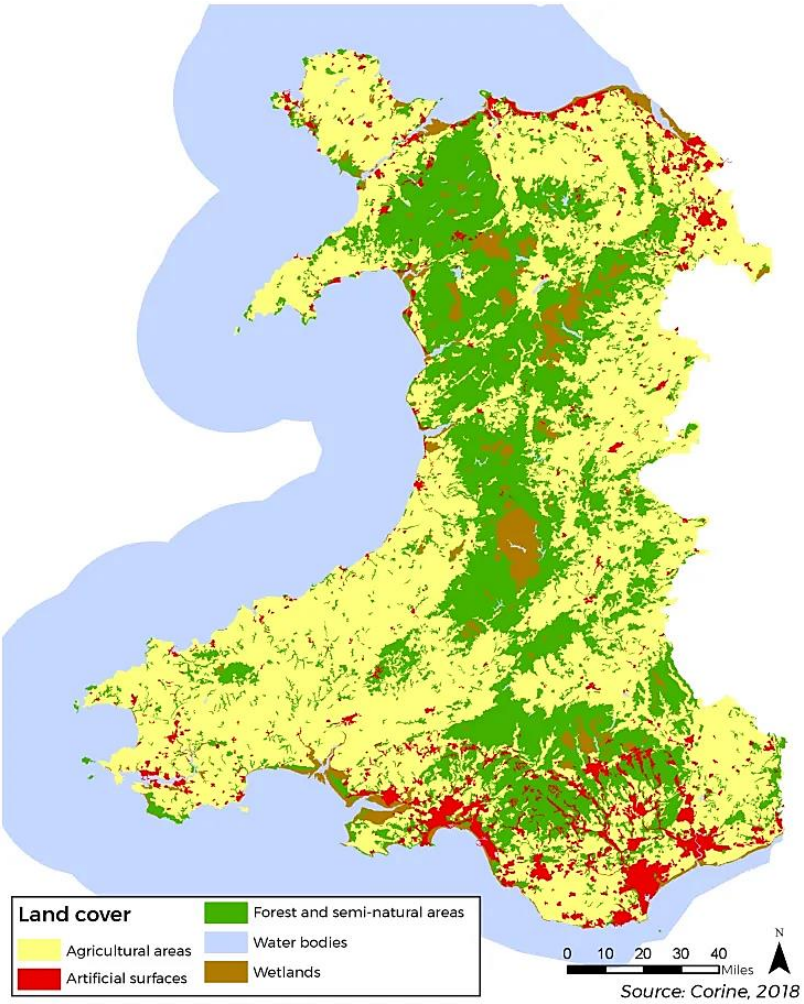

Figure 1-1: Land cover in Wales, 2018.

Agricultural land, including commons, covers 1.86 million hectares of the Welsh landscape. Representing 88% of the total 2.064 million hectares of terrestrial surface of Wales, this land experiences annual disturbances and change through farming practices such as livestock grazing, crop rotation, ploughing and the planting and logging of forestry. It is important to quantify how much of the Welsh agricultural landscape undergoes such changes, what it is

[11] Natural Resources Wales. *Briefing Note: A new baseline of the area of semi-natural habitat in Wales for Indicator 43.* <https://naturalresources.wales/evidence-and-data/maps/extent-of-semi-natural-habitat-in-wales-indicator-43/?lang=en>

that drives those changes, and what those changes will mean for future land use planning and the sustainability of BMV land.

Across the United Kingdom, Wales has the second highest proportion (~80%) of agricultural land classified as Less Favoured Area (LFA) land.[12] Less than 20% is classified as Best and Most Versatile (BMV) land with the highest agricultural capability.

1.2.1 BMV Land Classification

The Agricultural Land Classification (ALC) system was developed to provide a standardised method for assessing the quality of agricultural land through field surveys. It provides a framework for classifying land according to the extent to which its physical or chemical characteristics impose long- term limitations on agricultural use. The limitations can operate in one or more of four principal ways: they may affect the range of crops which can be grown, the level of yield, the consistency of yield and the cost of obtaining it. The classification system gives considerable weight to flexibility of cropping, whether actual or potential, but the ability of some land to produce consistently high yields of a somewhat narrower range of crops is also taken into account.

The ALC system, classifies agricultural land into one of five grades; Grade 1 representing the best quality land and Grade 5 the poorest.[13] Grade 3 is divided into two sub-grades. Best and most versatile agricultural land (BMV) falls into grades 1, 2 and sub-grade 3a and is the most flexible, productive and efficient in response to inputs. Table 1-1 provides generalised descriptions of the ALC grade forming the BMV land categorisation.

Table 1-1: BMV land grades and generalised descriptions.[14]

BMV Land Grade and Colour Code	Description of Land Quality	Range of Limitations & Activity
1	Excellent quality	No or very minor limitations on agricultural use. Wide range of agricultural and horticultural crops can be grown. High yielding and consistent.
2	Very Good	Minor Limitations on crop yield, cultivations or harvesting. Wide range of crops but limitations on demanding crops (e.g. winter harvested veg). Yield high but lower than Grade 1.
3a	Good	Moderate to high yields of narrow range of arable crops (e.g. cereals), or moderate yields of grass, oilseed rape, potatoes, sugar beet and less demanding horticultural crops.

[12] Welsh Government 2019, *Agriculture in Wales* <https://gov.wales/sites/default/files/publications/2019-06/agriculture-in-wales-evidence.pdf>.
[13] A full description of the grades can be found in Appendix 1
[14] Source: <https://gov.wales/agricultural-land-classification-frequently-asked-questions>

1.2.2 Extent of BMV land in Wales

The majority of BMV Land in Wales is located in the lowland coastal and border areas, with high concentrations in Pembrokeshire, Powys and Monmouthshire (Figure 1-2). Modelling of ALC grade lands undertaken by ADAS in 2019 estimated that in 2011 there were 296,960[15] hectares of BMV land in Wales, comprising 12,133 hectares of Grade 1, 110,274 hectares of Grade 2 land, and 174,553 hectares of Grade 3a land. This equates to 17.63% of the total agricultural land in Wales at the time (2011).

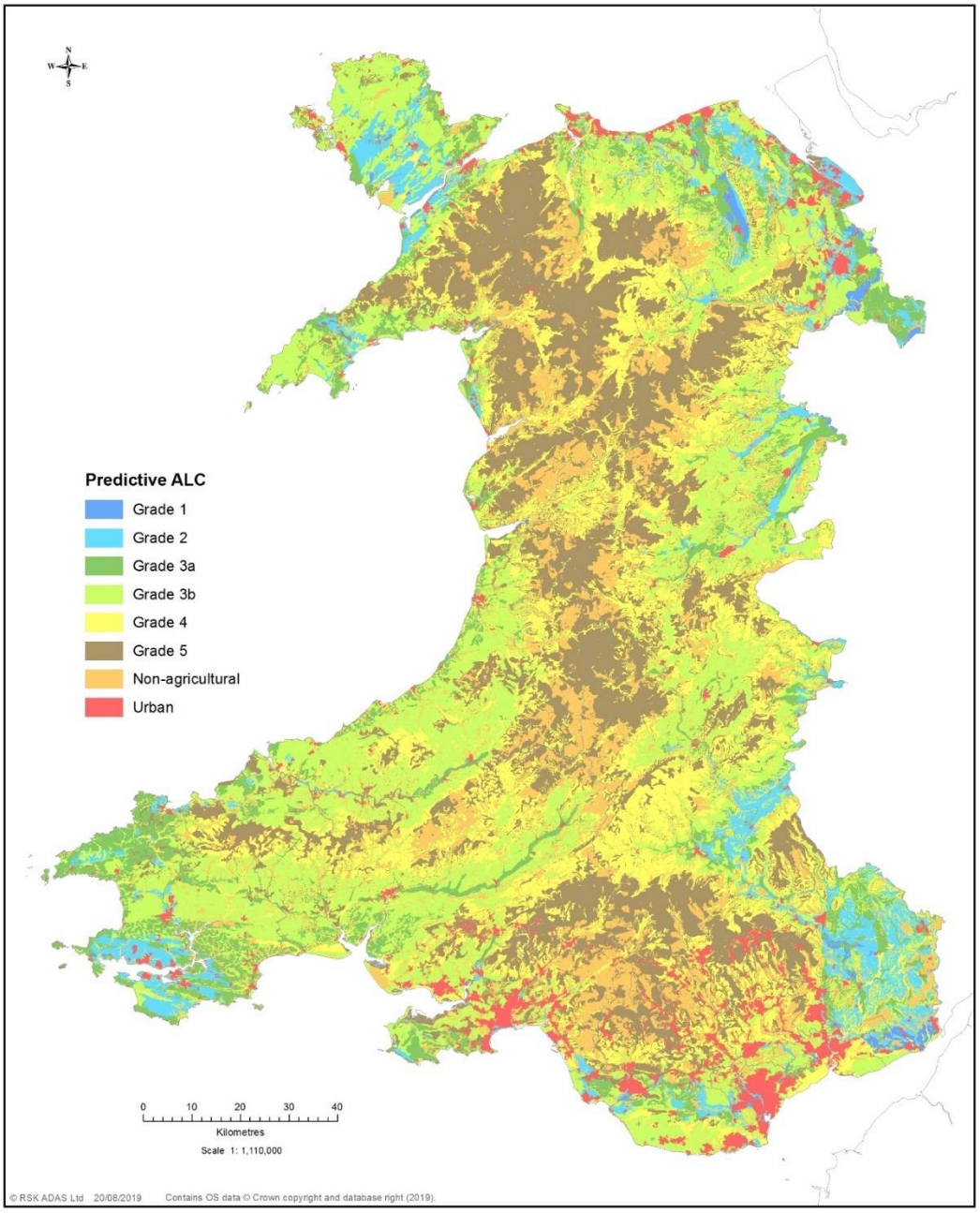

Figure 1-2: Predictive ALC classifications for Wales, 2011.

By 2065, under a high urban growth scenario, the total area of BMV land in Wales is predicted to decline to around 290,214 hectares. Figure 1-3 highlights the predicted changes

[15] At the time of the ADAS 2019 Modelling, ONS Built up Areas (Wales) statistics were only available up to 2011.

in BMV land by ALC grade from 2011 to 2065 under a high urban growth scenario. It should be noted that the modelled scenarios did not attempt to take into account wider policy application or decisions, as such the predicted figures may well differ. The aim of the work was more about understanding the possible area of BMV land at risk.

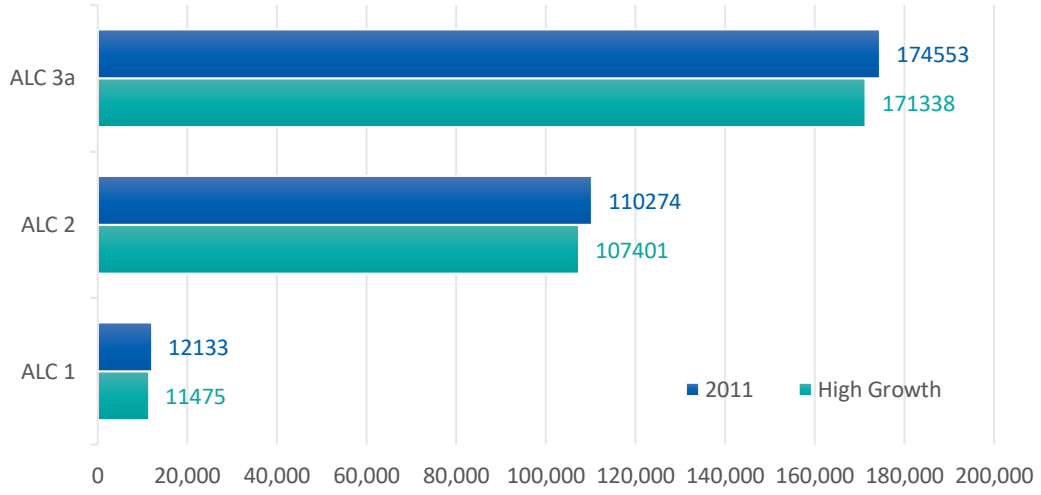

Figure 1-3: 2018 and 2065 area (hectares) of BMV land in Wales.

Over recent decades, agricultural holdings and production in Wales have undergone significant changes. Technological advances, however, have allowed for more precise practices and improved productivity in the more intensively farmed areas of the Welsh agricultural landscape.

Over the next five decades the area suitable for agricultural production in Wales is predicted to decline by 9,309 hectares under a low urban growth scenario, 14,782 hectares under a medium growth scenario and 22,578 hectares under a high growth scenario. By 2065 the total area of agricultural land is estimated to be around 1,661,992 hectares under a high growth scenario (Figure 1-4)[16]. In 2011, the total area suitable for agricultural production in Wales was 1,684,570 hectares.

Figure 1-4 also highlights the change in BMV land by ALC grade over time. ALC grade 1 land declined from 13,870 hectares in 1939 to 12,133 hectares in 2011. A total loss of 1736 hectares over a period of 72 years. This equates to around 0.19% loss per year. ALC grade 2 has declined from 120,339 hectares to 110,274 hectares (~0.12% per year). ALC grade 3a has experienced the smallest decline, around 0.07% loss per year from 1939 to 2011. The percentage change per year in BMV land over the period 1939 to 2011 has been significantly greater than that of lower grade agricultural lands (ALC grade 3b to ALC grade 5). ALC grade 4 and grade 5 land have only experienced a 0.03% and 0.02% change per year, respectively. ALC grade 3b, however, has declined at a similar rate to ALC grade 3a (~0.07% per year). This is discussed further in Section 1.3.1.

The total loss of BMV land (grades ALC 1 to ALC 3a), over the period 1939 to 2011, was 21,275 hectares (~0.10% loss per year)[17]. This area is equivalent in size to approximately 21,100 rugby fields or 440 Welsh farms[18].

[16] Based on calculations from predictive modelling undertaken by ADAS in 2019.
[17] BMV agricultural land loss prior to 1939 accounts for an additional 7,811 hectares (or a cumulative total loss of ~29,000 hectares).
[18] Average farm size of 48ha.

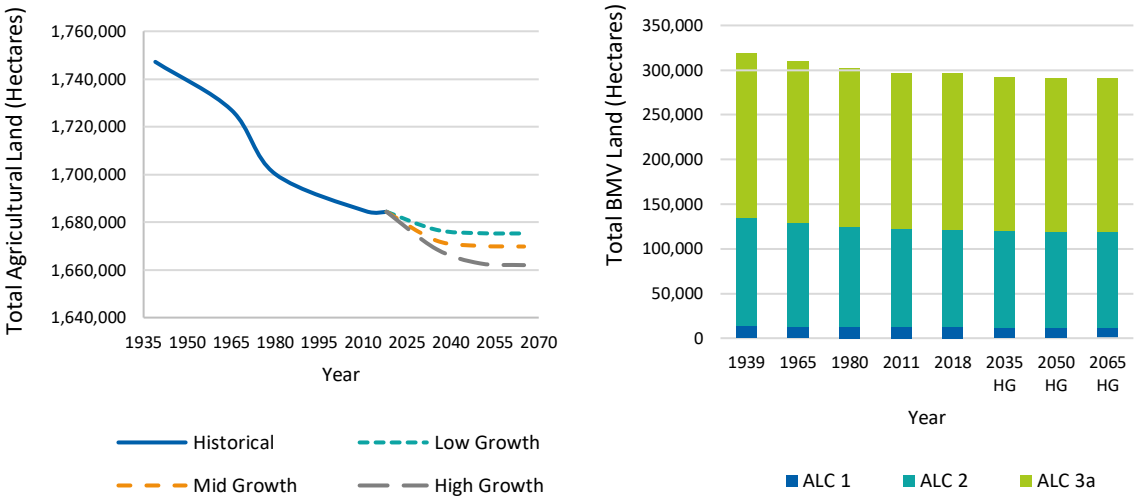

Figure 1-4: Changes in Total Agricultural and BMV land (1939 – predicted 2065).

1.3 Impact of Urbanisation on BMV land assets

The conversion of land for urban development purposes has been a key driver of BMV land loss in Wales. The area of land classified as Urban grew from 22,372 hectares in 1939 to 84,986 hectares in 2011, with significant growth occurring in 1965 (2.5% across all Wales) and 1980 (2.8% across all Wales)[19]. The total growth in Urban area from 1939 to 2011 is equivalent in size to approximately all of Monmouthshire county.

The highest growth in urban development on BMV grade lands in 1965 and 1980 occurred in the lowland coastal areas of Flintshire, the Isle of Anglesey and Wrexham (Figure 1-5) in North Wales. Powys and Bridgend in Central and South Wales also experienced significant conversion of BMV land to urban uses in 1965 and 1980.

In Wales, as with many countries, urban regions tend to be located in areas where the productive capacity of land in agriculture is also highest. If Wales wishes to maintain its most productive agriculture base, development on BMV land will be one of the issues that needs to be addressed, although it is unlikely to be easily resolved. In addition, problems with transportation, population density in urban areas and land use conflicts at the urban fringe will also need to be addressed if sustainable development goals are to be achieved. Flow-on impacts such as fragmentation of farmland that might occur as a result of increased urbanisation of BMV land around the urban fringe, for example, could lead to inefficiencies in production and resource allocation as well as having a negative impact upon environmental outcomes.

The decision to allow urban development on BMV land, however, is not always straight forward. Balancing the needs of a growing population with multiple views on how land should be used involves weighing up trade-offs and co-benefits. Regional housing requirements and lack of brownfield sites, for example, might mean development on BMV land is inevitable. The inclusion of green infrastructure in this development however could help to mitigate some of the negative impacts whilst also providing multiple ecosystem service benefits.

[19] Based on ADAS modelling of historical loss of BMV land in Wales undertaken in 2019. Percentage change in Urban area per year from 1939 base year.

(a) (b) (c)

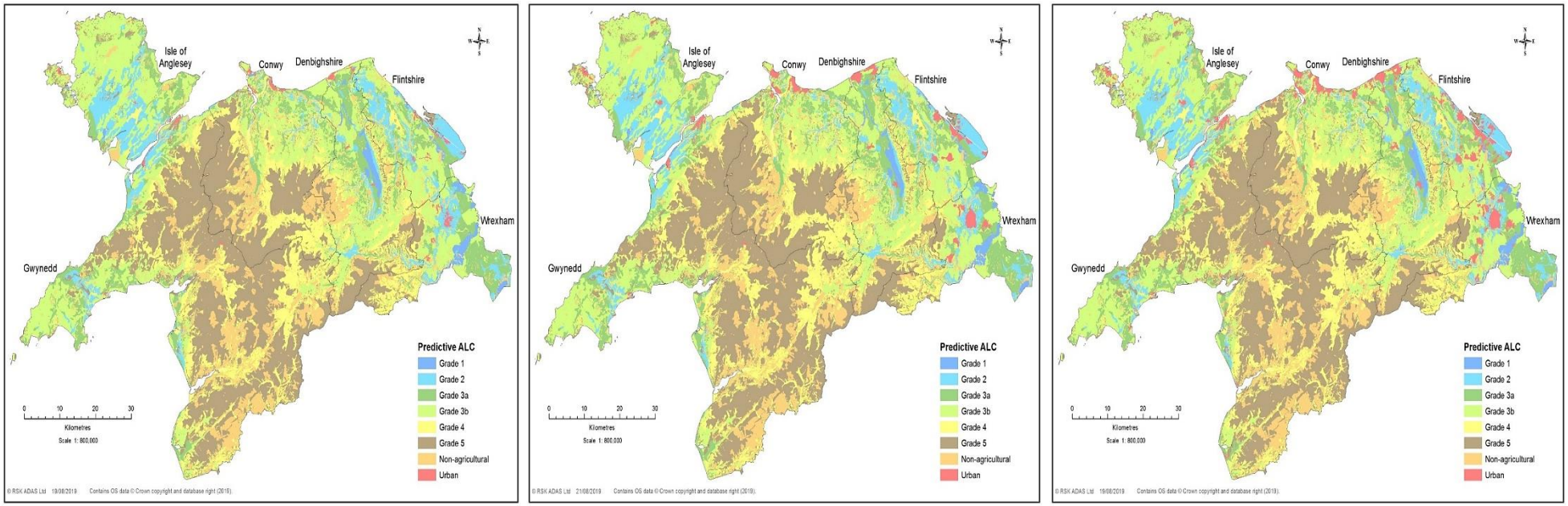

Figure 1-5: Spatial representation of historical ALC grade land loss to urbanisation in North Wales - (a) 1939 (b) 1965 and (c) 1980

1.3.1 Predictive modelling of urbanisation and BMV land loss (2011 – 2065)

Predictive population modelling by the UK Office of National Statistics indicates that the Welsh population will decline by 0.9% from 2018 to 2043. However, changes in the age composition of the population, net in-migration to Wales from other parts of the UK and immigration from overseas will see an increase in household numbers[20]. The associated demand for housing will lead to increased competition for land, especially agricultural land at the urban fringe. Land use planning priorities for BMV land should therefore continue to ensure the land that is currently used to produce food remains available (e.g. un-sealed[21]). Future land use and land allocations must also be optimised in such a way that imminent challenges such as climate change, biodiversity loss and nutritional security are balanced.

The predictive modelling undertaken by ADAS in 2019 examined the future potential loss of ALC grade lands under different population growth scenarios. Results were achieved by combining the Welsh Predictive Agricultural Land Classification for 2011 urban data and expanding these areas based on household growth and future need projection figures for Wales. The 2011 urban data was used as this was the most up to date urban data available from the Office of National Statistics (ONS) at the time of the study.

The results of the predictive modelling showed that the expansion of urban areas will have minimal impact on future agricultural productivity in Wales (Figure 1-6). Overall, the area of BMV land in Wales is only projected to decline by 0.40% by 2065 under a high urban growth scenario[22]. This represents a cumulative estimated loss of 6,746 hectares over the period 2018 to 2065 (approximately 125 hectares, on average, per annum).

Over the same time period, the area of Grade 3b land in Wales is predicted to decline by 0.48% (cumulative loss of 7858 hectares). Combined, Grade 4 and 5 land are also predicted to decline by 0.47% which equates to a cumulative loss of 7971 hectares (Table 1-3).

Table 1-2: Cumulative loss of agricultural land to urbanisation under the different growth scenarios (Hectares) from 2011 base year predictions.

Growth Scenario	LOW			MEDIUM			HIGH		
Year	2035	2050	2065	2035	2050	2065	2035	2050	2065
BMV Land (1, 2 & 3a)	**2273**	**2674**	**2705**	**3731**	**4395**	**4475**	**4791**	**6555**	**6746**
Grade 3b	2660	2948	2988	4278	5043	5144	5539	7615	7858
Grade 4 & 5	2851	3380	3428	4274	5051	5164	5519	7691	7971

[20] https://www.assembly.wales/Research%20Documents/19-072-Demographic%20projections%20and%20planning%20a%20collaborative%20partnership/19-072-Web-Eng.pdf

[21] Soil sealing - the covering of the ground by an impermeable material – is one of the main causes of soil degradation in the EU. Soil sealing often affects fertile agricultural land, puts biodiversity at risk, increases the risk of flooding and water scarcity and contributes to global warming. https://ec.europa.eu/environment/soil/sealing_guidelines.htm

[22] As a proportion of total agricultural land in Wales in 2018.

(a) (b)

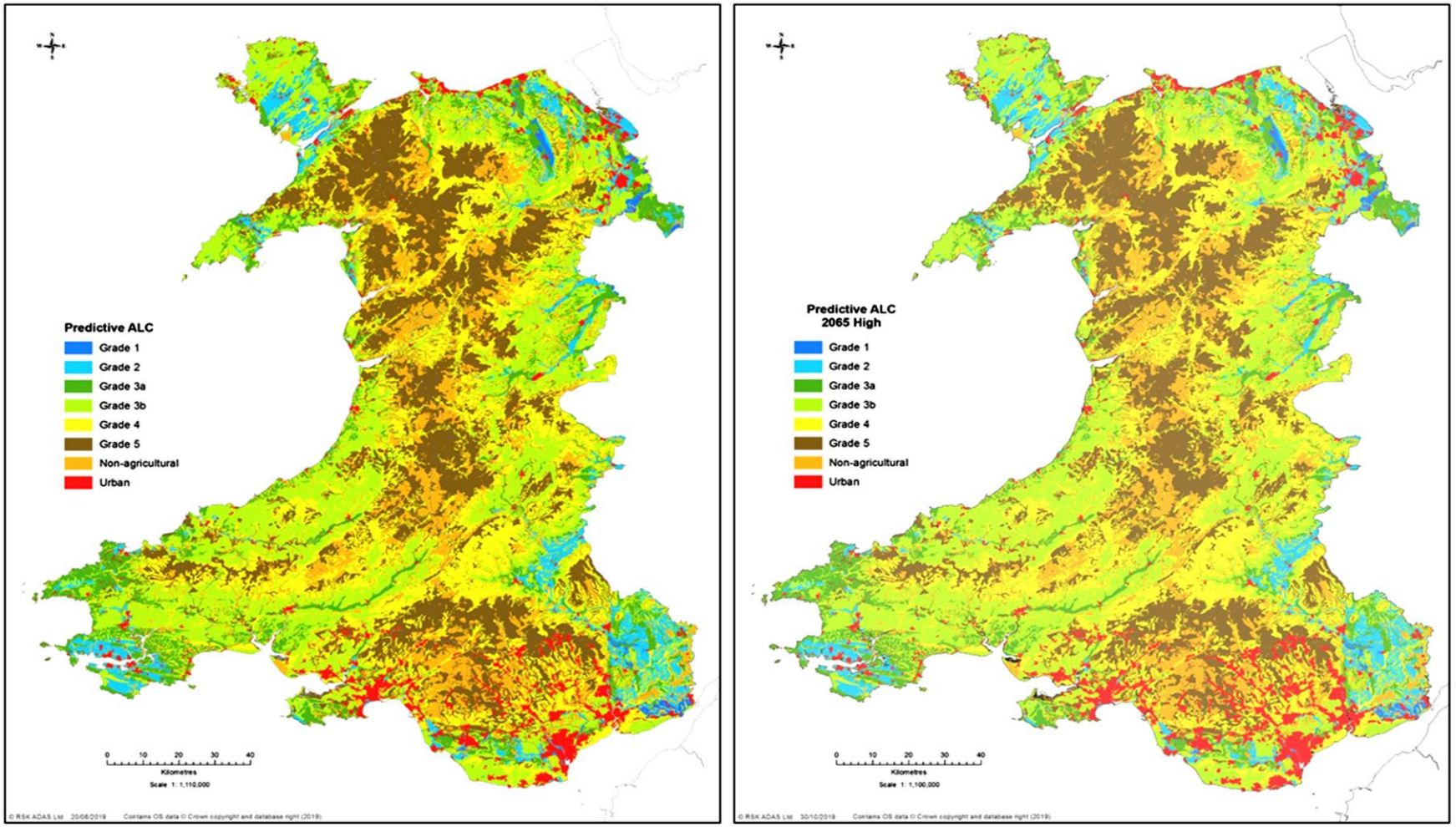

Figure 1-6: Spatial representation of predicted ALC grade land loss to urbanisation for: (a) 2011 base year and (b) 2065 high urban growth scenario.
Source: ADAS, 2019

Figure 1-7 shows the predicted cumulative loss of ALC grade lands to urbanisation compared to historical loses. The predicted annual loss of BMV land to urbanisation over the next five decades is expected to be minimal when compared to historical loses.

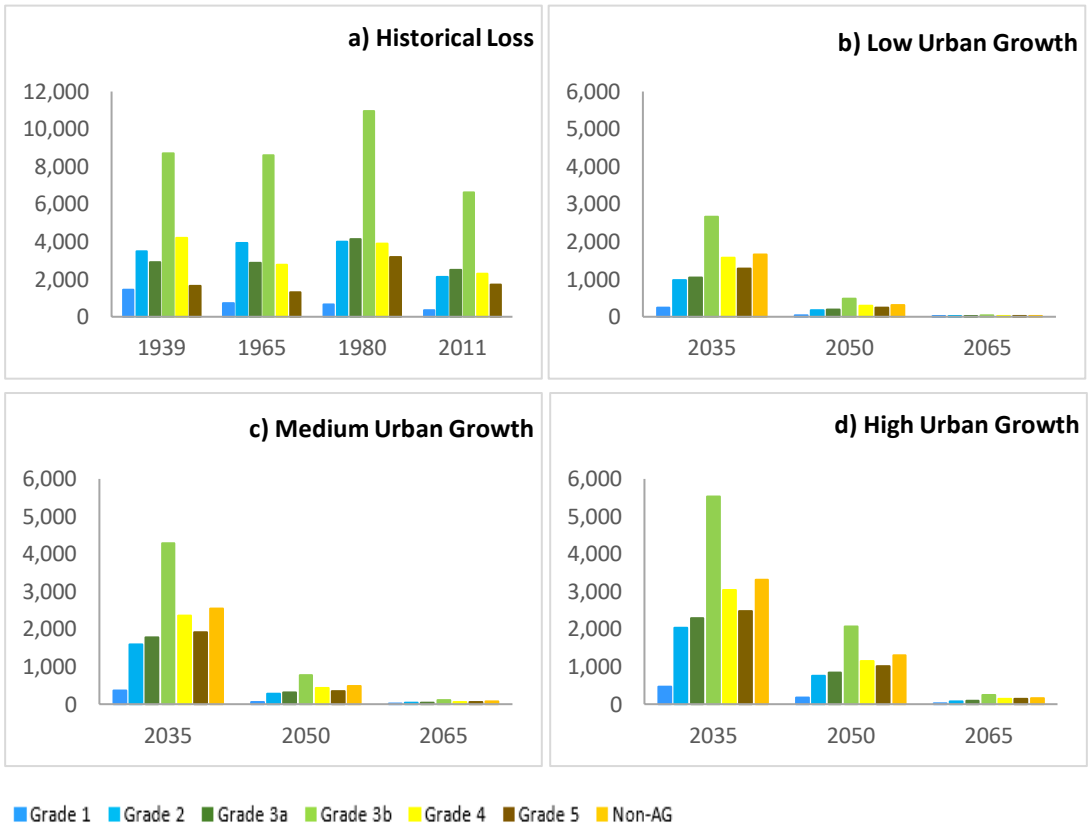

Figure 1-7: Historical and predicted loss of ALC grade land in Wales to urbanisation under different growth scenarios (Total hectares per year).

Planning strategies, however, should not ignore the potential loss of BMV land as areas close to urban fringes could be impacted by unexpected spikes in population, net in-migration to Wales from other parts of the UK and immigration from overseas. The impact of changing climate conditions on soil and water resources are also uncertain. This raises questions around future land use planning to meet sustainable development goals. In particular, which ALC grade lands should be protected to ensure Wales is in a good position to deal with future climate uncertainty and potential changes to soil, water and land resources. UKCP18 maps developed under the Welsh Governments Capability, Suitability & Climate Programme highlight the potential change in ALC grade classifications over time (Figure 1-8). Of significance is the change from BMV grade land to ALC grade 4 in the Border areas of North and South Wales. The modelling work undertaken by ADAS in 2019 focussed on assessing the changes in Urban area across Wales under current climatic conditions. No assumptions around changes in the distribution of BMV land were assessed.

Detailed modelling incorporating climate variability that expands on the work undertaken by ADAS and that done under the Welsh Governments Capability, Suitability & Climate Programme should be considered as a next step to further understanding and evidence on the sustainability of BMV land and its resources.

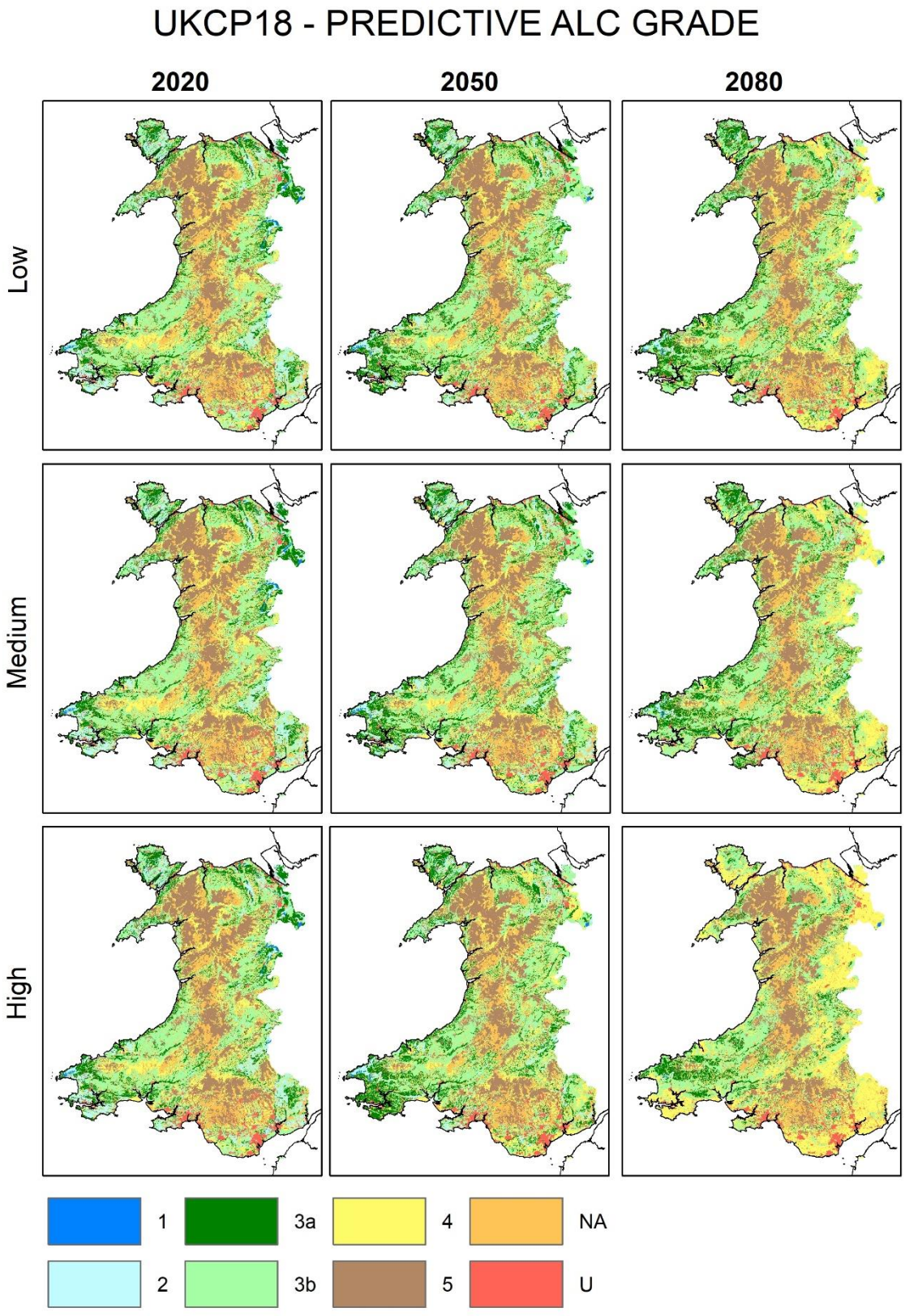

Figure 1-8: UKCP18 predictive ALC grade maps under low, medium and high emissions climate change scenarios.
Source: Welsh Government, Capability, Suitability & Climate Programme (2018-2020). Data supplied by the Met Office; prepared by ADAS and interpolated by Cranfield University.

2 ECONOMIC ASSESSMENT OF BMV LAND LOSS DUE TO URBANISATION (2011 – 2065)

Urban development of BMV land is irreversible from a practical standpoint as it is difficult to remove urban structures such as pavements, roads, buildings etc. and convert the land back to agriculture. Irreversibility has both an economic and biophysical dimension. Some biophysical actions (for example, soil sealing) result in some environments being left in a state that can never be restored. Economic irreversibility occurs when development leaves an environment, in this case BMV land, in a state that can only be restored at a cost greater than that of preventing the loss in the first instance. That is, if restoring BMV land to its original state is excessively costly, in terms of resource allocation or time, then economic irreversibility has occurred.

Total economic valuation of an irreversible decision involves understanding the difference between the value obtained by using expected values (net present value of a decision) and the true value under uncertainty. This is referred to as the quasi-option value[23] (Van Kooten, 1993). As urbanisation of BMV land is an irreversible decision, valuing the loss of BMV land should include a quasi-option value on top of the current agricultural value of the land. The problem that arises though, is that measuring quasi-option value is difficult and, in some cases, impossible. This is because of present and future uncertainty. As time passes though, more information about the costs and benefits of maintaining the land in its current state becomes available, allowing more comprehensive economic valuation to be undertaken.

The purpose of this section is to provide an economic assessment of the loss of BMV land due to urbanisation over the period 2011-2065. It was not possible to determine a total economic value for the predicted loss of BMV land due to incomplete data on parcel specific land use that corresponds to the ALC predictive maps and the time involved in undertaking a comprehensive economic land use change assessment. As such, the economic assessment undertaken involved a partial analysis of the gross value of lost agricultural production resulting from the predicted urbanisation of BMV land.

2.1.1 Value of Agriculture to Welsh Economy

The average annual farm business income for crops and livestock produced in Wales is around £23,600 per farm. In 2018 the Gross Value Added (GVA)[24] contribution of agriculture to the Welsh economy was around £498 million. Agriculture supplies and supports the farm business sector in Wales which has an intermediate consumption value[25] of £1.178 million[26]. Output from agriculture is regionally and nationally important and the focus of future policy and investment. In 2018, the Gross Output[27] from agricultural activities totalled £1.677 million.

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[23] In the context of irreversibility and uncertainty, the decision to delay development would provide an opportunity to gain more information. The value gained from the delay and the additional information gathered is commonly referred to as the quasi-option value.

[24] Gross Value Added (GVA) is a measure of the value of goods and services produced in an area, industry or sector of the economy.

[25] Intermediate consumption value is a national accounts concept which measures the value of the goods and services consumed as inputs in the production process. It excludes fixed assets whose consumption is recorded as consumption of fixed capital.

[26] < https://gov.wales/sites/default/files/statistics-and-research/2019-04/aggregate-agricultural-output-and-income-2018.pdf>

[27] Gross Output is the measure of total economic activity in the production of new goods and services in an accounting period.

It is estimated that cropping activities including cereals, potatoes and horticulture, which typically take place on BMV land and the more arable parts of ALC grade 3b and 4 land, account for approximately 6% of the total gross output from land-based agriculture. This equates to at least £97 million in gross output. Livestock and livestock products (milk, eggs and wool) account for approximately 82% of the total gross output from land based agriculture. This equates to £1.292 million in gross output.

2.1.2 Gross Value of lost agricultural production on BMV land

Given the time required and the limited availability of parcel level data that could be correlated to ALC grade map data, the economic analysis undertaken to quantify the value of lost agricultural production across each of the low, medium and high growth scenarios has been based on the following assumptions:

- Hectares of land classified as BMV land (Grade 1, 2 and 3a), for each growth scenario and each Small Area in Wales, have been taken from the predictive modelling work undertaken by ADAS in 2019.
- Annual transformation of ALC land to non-agricultural use (i.e area of ALC Grade land lost to urbanisation) was linearly interpolated between prediction years (2035, 2050 and 2065).
- A combined activity and area weighted Gross Margin was calculated for each Small Area and for BMV Land (ALC Grades 1 + Grade 2) and BMV land ALC Grade 3a separately.
    - For ALC Grade 1 and 2 land, the combined area weighted Gross Margin was determined using the area of wheat, potatoes and horticulture activity in each of the Small Areas[28]. This calculation assumed that higher valued crops are grown on ALC Grade 1 and 2 land.
    - For ALC Grade 3a, the combined area weighted Gross Margin was determined using the area of arable farming (barley, maize, stockfeed and other cereals) and pasture (new and permanent). The allocation of dairy and beef Gross Margins to pasture area was based on the reported proportion of CTS numbers for dairy cows and beef cows in each Small Area. This calculation assumed ALC Grade 3a land is predominantly used for more intensive grazing livestock activities and livestock feed production.
    - Lowland Sheep production was not included in these calculations as the Small Area statistics did not provide sufficient detail to distinguish lowland from upland sheep production.
    - Calculations assumed that the mix of agricultural activities does not change over time. Detailed forecasting of BMV land use and activity returns was beyond the scope of this analysis.
- All future flows of Gross Margin loss were discounted[29] from a 2011 base year to derive a net present value of BMV land loss to urbanisation for each growth scenario.

[28] Welsh Agricultural Small Area Statistics, June 2018.
[29] Discount rate of 3.5% as per HM Treasury Green Book guidelines

2.1.3 Results of economic quantification

The economic analysis of BMV land loss indicates that the cumulative loss of agricultural Gross Margin Value in 2065, for the each of the low, medium and high growth scenarios will be around £4.46, £7.44 and £11.18 million respectively. Figure 2-2 shows the cumulative annual gross margin loss for each of the BMV land grades (ALC 1 to ALC 3a) under a high urban growth scenario.

The results of the analysis also indicate that the total annual increase in Gross Margin Value loss from the transformation of BMV land due to urbanisation diminishes in direct response to the ADAS forecasted scenarios of land-use change (Figure 2-1). They also indicate that the loss of ALC grade 2 land has the largest impact on agricultural Gross Margin Value loss (~48%), closely followed by ALC grade 3a land lost (~44%). The loss of ALC grade 1 land makes a minimal contribution (<10%) to the total agricultural Gross Margin Value loss from the transformation of BMV land under all scenarios.

Area of ALC grade 2 lost is smaller, but due to its assumed more intensive use (i.e. higher Gross Margin agricultural activities), its contribution to total Gross Margin Value lost is higher.

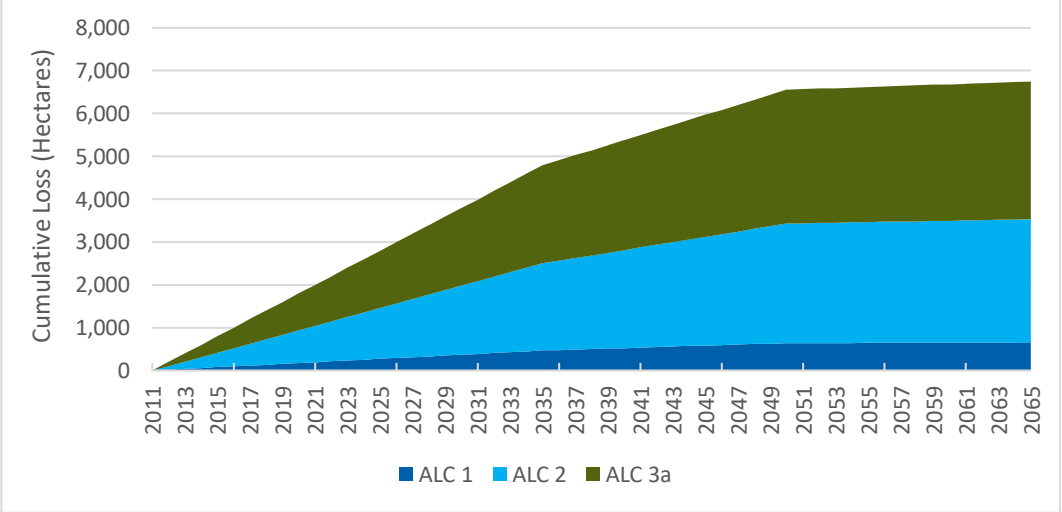

Figure 2-1: Cumulative loss of BMV land (hectares) by ALC grade for High Growth Scenario

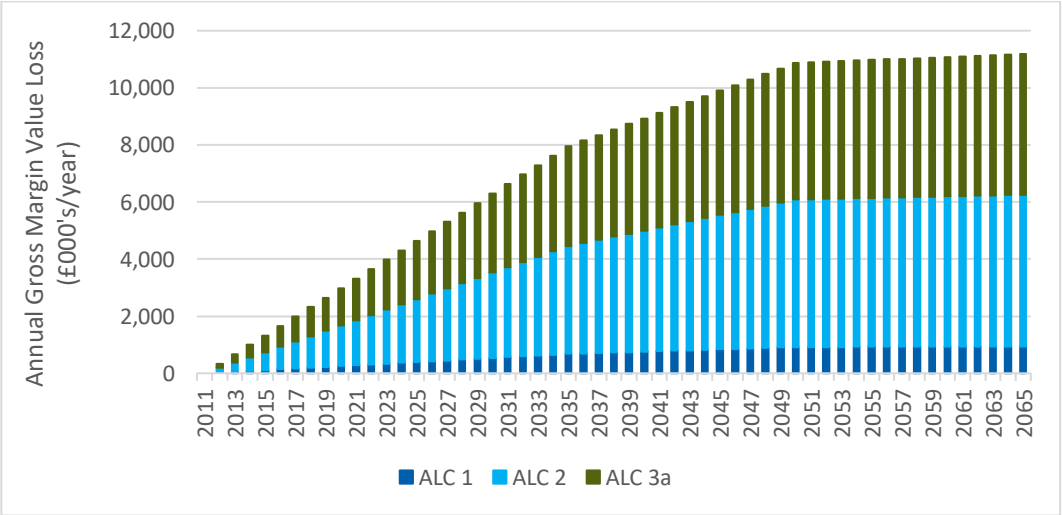

Figure 2-2: Annual Gross Margin Value loss (£000's/year) by ALC grade for High Growth Scenario

Net Present Value of Total BMV Land Loss

Table 2-1 shows the net present value (NPV) and net present value as an annuity (NPVa)[30] of cumulative BMV land loss due to urbanisation under each of the predicted growth scenarios. Under a high growth scenario, the net present value as an annuity is expected to be around £5.74 million per annum. This equates to a net present value of £138.37 million.

Table 2-1: Net present value of cumulative loss of BMV land to urbanisation under the different growth scenarios.

Growth Scenario	NPV	NPVa
LOW	£61,201,037	£2,538,062
MEDIUM	£101,413,017	£4,205,689
HIGH	£138,374,459	£5,738,513

The loss of BMV land will continue to be an important consideration for future planning and sustainable management of land in Wales based on economic, environmental and social objectives. Land management strategies will need to balance the requirements of sustainability over time to ensure fairness for land managers, and resilience for society and the environment.

As the total economic value of the BMV land resource in Wales was not possible to determine in the scope of this report, consideration should be given to further research and analysis in this area. Understanding the total economic value will help identify whether preserving BMV land is the best option for WG policy or whether efforts should be focused towards the potential for ALC grade 3b or other grades to provide goods and services that meet future societal demands.

Commissioning of further research and analysis aimed at determining the total economic value of the BMV land resource in Wales should be given due consideration.

[30] NPVa represents the net present value as an equivalent annuity. That is, it represents the expected equivalent amortised annual monetary value over the entire analysed period, in this case 54 years.

3 SUSTAINABLE BMV LAND USE

3.1.1 Matching Land Use to Capability

It is important for farmers, advisors and regulators to be able to broadly classify land capability so that land use can be matched to land capability and a sustainable level of production achieved. As mentioned previously, land capability is the ability of the land to sustain a type of land use permanently. The key to sustainable use is matching the type and intensity of land use with its natural capability.

In multifunctional landscapes, matching land use with capability is not always straightforward. In grazing areas, for example, choices need to consider such things as the suitability of the pasture for livestock, the level of soil fertility, the targeted level of production and whether the overall grazing strategy compliments or inhibits other land use objectives.

Agricultural production in Wales remains a principal force in sustaining economic growth and well-being. Figure 3-1 shows that historically, land use in Wales has been dominated by permanent pasture (approximately 1.1 million hectares). On an annual average basis, permanent pastures have made up 67% of the total land farmed in Wales. Of the 296,897 hectares classified as BMV land, only 95,500 hectares are used to grow crops and high value horticultural products. The high valued horticulture products such as fruit, flowers and vegetables, on an annual average basis, only take up of 0.10% of the total land farmed.

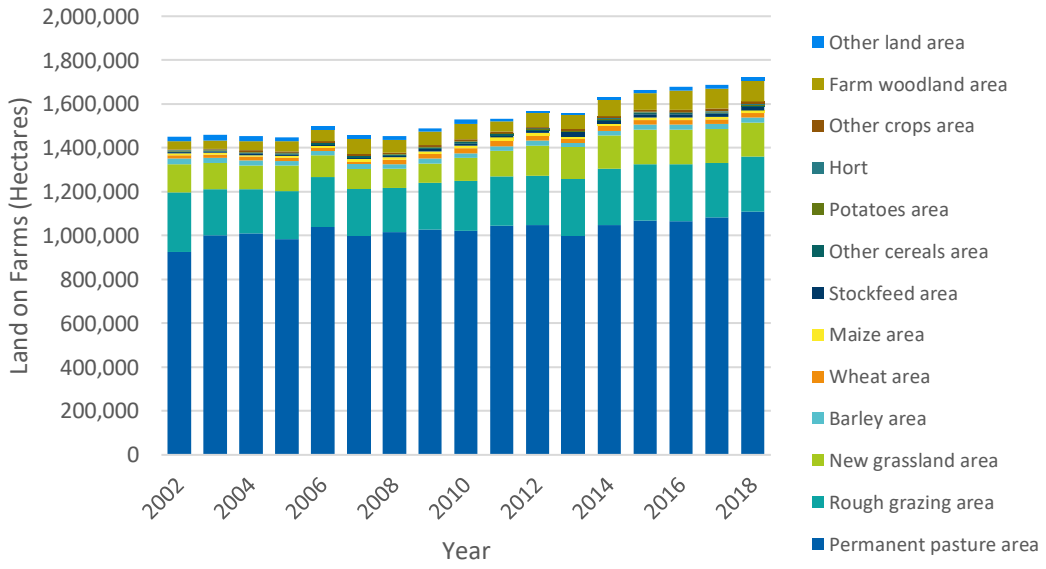

Figure 3-1: Historical land use in Wales 2002 – 2018

The remaining ~200,000 hectares of BMV grade land is likely to be predominantly grassland. As such, any shift in land use potential could have significant implications for carbon, soil protection (in a high rainfall area), water quality and soil organisms. These in turn, would have implications for both strategic resource planning and for developing climate change adaptation actions if some of the potential land use options are not, at present, being actively considered and deliberated. At the moment the ALC system in Wales is firmly embedded within land-use planning. However, potential changes in agricultural land grades, should they occur in the near future, will have implications beyond farming. It is likely that any such change will be more noticeable in areas of lower grade land that are currently being

used for woodland or maintaining biodiversity. Any change in the current ALC grade 4[31] or ALC grade 5[32] land area could significantly influence environmental priorities because some of these areas have experienced less disruption from either frequent cultivation or intensification; therefore, tending to have a higher biodiversity value. These areas also tend to store large amounts of carbon in organic soils.

3.1.2 Cropping and horticulture

Figure 3-2 highlights the breakdown of cropping enterprises across each of the Small Areas in Wales. Without the aid of detailed land use and cadastral data[33] that correlates land parcels to ALC grade map data, the exact area and extent of cropping and horticulture that takes place on BMV classified land is difficult to determine. Further work to match land use with ALC grades using BPS crop code data and earth observation techniques would aid this type of assessment.

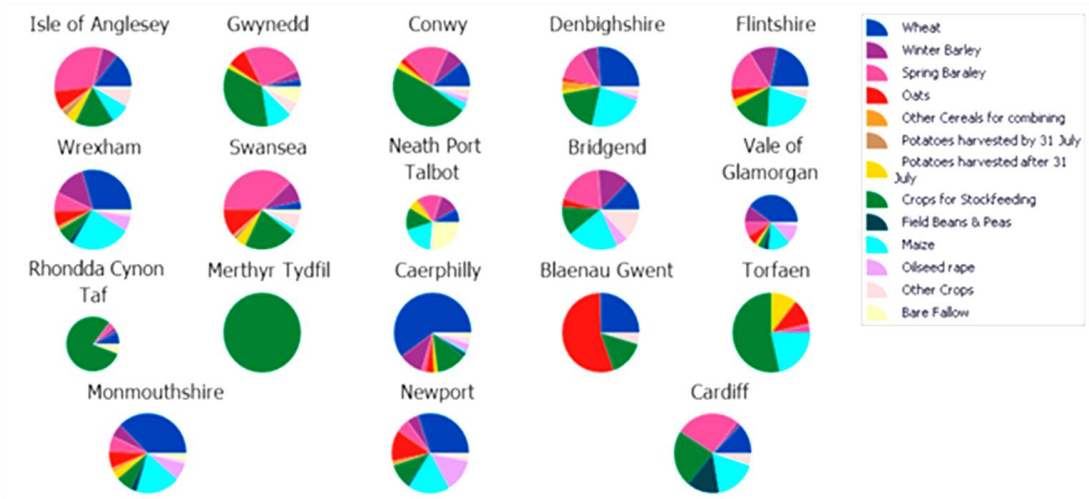

Figure 3-2: 2017 Agricultural Survey – Crops (Hectares) by Small Area[34]

As BMV land often contains lighter and easy to work soils, it requires fewer "passes" by agricultural machinery to establish seedbeds. The reduction in the amount of time machinery spends on the land helps reduce fuel, labour and maintenance costs. It also reduces the potential for damage to soil organic matter. Horticultural and root crops grown on BMV land can also be harvested in a cleaner condition reducing loss of soil, water usage and crop wastage. In terms of the economic and environmental impact of food production, the reduction in costs, water usage and soil damage on BMV land will be important in terms of future sustainability at both Small Area and National levels.

3.1.3 Livestock

Livestock grazing is an important part of the Welsh landscape, with sheep production being the dominant livestock enterprise in Wales. A majority of this production takes place in the uplands and more mountainous areas of Wales. Cattle and sheep grazing on LFA land account for approximately 29% of farm holdings in Wales reflecting the dominance of new

[31] Poor quality agricultural land with severe limitations to agricultural use.
[32] Very poor agricultural land with very severe limitations to agricultural use.
[33] Cadastral data shows the extent and ownership of land, usually by land parcel and title.
[34] https://statswales.gov.wales/Catalogue/Agriculture/Agricultural-Survey/Area-Survey-Results/crops-in-hectares-by-area

grassland and permanent pastures. Rough grazing takes up approximately 10% of the land in Wales. Figure 3-3 highlights the spatial distribution of livestock across Wales. Blue shaded areas are predominantly dairy cattle, pink areas other cattle, green areas sheep, purple areas other livestock and yellow areas crops. The areas of more intensive farming practices (dairy and crops) tend to correlate to the areas of BMV land shown in Figure 1-6 (Section 1).

Dairy production that is located on the more geographically and climatically productive areas, including areas of BMV land, accounts for around 4% of total farm holdings in Wales. Grazing land that has not been intensively farmed supports a well-established sward of grasses, herbs and other plants. Although the majority of grazing land falls into ALC grade 3b and below, the importance of livestock and grazing in future land use planning and sustainability should not be underestimated. Grazing land such as permanent pasture and new grassland that have been undisturbed by ploughing allows the roots of vegetation to reach deep minerals and trace elements. Grazing livestock can then convert this into meat that is of a high nutritional value. In addition, perennial plants on permanent grasslands help regenerate the structure and nutrient availability in soils.

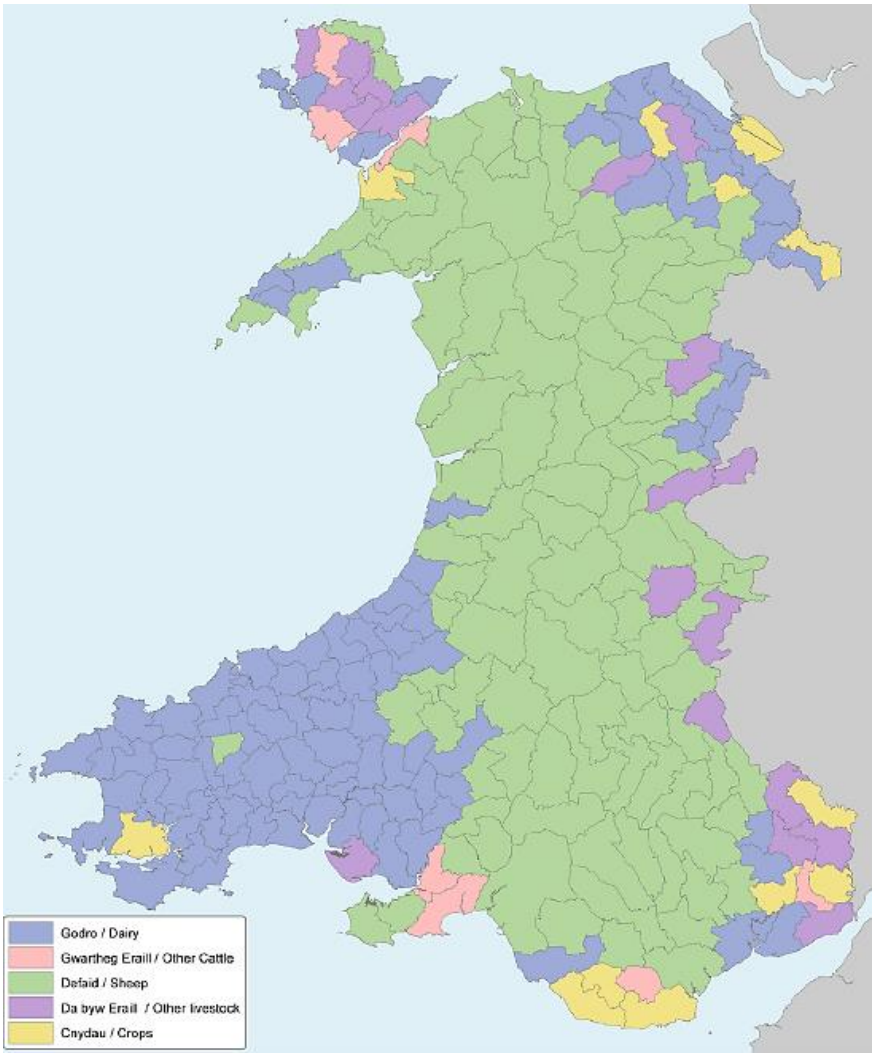

Figure 3-3: Spatial representation of land use activities by Small Areas, Wales, 2017.[35]

[35] Welsh Government, *Agriculture in Wales 2019*, pg. 27

3.1.4 Predicted Agricultural Land Utilisation

Modelling work undertaken by CEH[36] for the Glastir monitoring and evaluation programme highlights the potential utilisation of land for agricultural production based on landcover, soil and slope conditions. Figure 3-4 highlights the areas of Wales that have been over utilised or appropriately utilised. Approximately 76% of land is being optimally utilised for agriculture, including areas classified as BMV land. However, some small pockets of BMV land in the south east and south west of Wales appear to be underutilised while small pockets of ALC grade 5 land in the North of Wales appear to be over utilised. Over utilisation can have significant environmental impacts, including possible degradation and loss of valuable soil resources. The accuracy and resolution of the maps shown in Figure 3-4 have not been validated so any comparison of utilisation on areas of known BMV land at this time would not be precise.

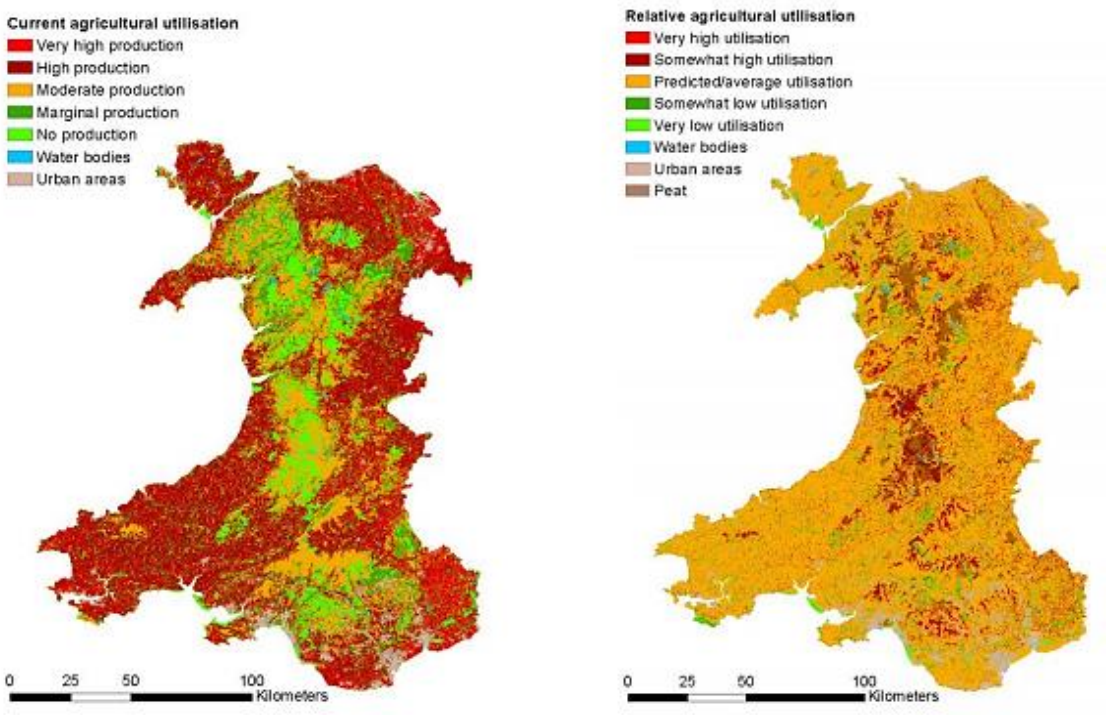

Figure 3-4: Current and relative agricultural land utilisation.

Matching land use to land capability on BMV land with the highest flexibility and greatest options, should continue to be a key requirement for any future land use planning to ensure optimal utilisation of agricultural land and the achievement of sustainable development goals.

[36] Emmett B.E. et.al, 2017. *Glastir Monitoring & Evaluation Programme*. Final Report to Welsh Government

4 IMPACT ON SUSTAINABILITY

As the focus of this chapter is on sustainability, it is important to clarify the definition of sustainable to which we are adhering. From an agricultural production perspective, a sustainable system is one that is able to consistently and predictably deliver a desired output during a period of no disturbance or change. By comparison, resilience refers to the capacity of systems to return to (a new) equilibrium after disturbance (e.g. extreme climatic event). Given the policy framework (WBoFG, SMNR, SONaRR, SMNR) within which the ALC system sits, we believe it is important to view BMV soils through the lens of a sustainable agricultural system; one that combines the concept of resilience and sustainability. It is through this lens that the significance of the risks and opportunities to the sustainability of BMV soils in Wales, and further afield, can be properly assessed.

4.1 Food security – a shifting focus

The ALC system is based on long term physical limitations to agriculture that farmers cannot easily alter (e.g. gradient, clay contents, wetness, droughtiness). Better quality land is more flexible in potential crop types, more consistent and higher yielding. The long term agricultural capability and suitability of Welsh soils to support a range of crops types (~120) in a range of future climate scenarios is currently being explored by ADAS, Cranfield University and Environment Systems through the Capability, Suitability & Climate Programme. Fundamental to this long term capability to soil quality, and consequently the ability to produce food, are the level of soil organic matter (SOM) and soil biodiversity[37]. Cranfield University (2011) have suggested that the primary risk to these two indices is type of land use, with urban, horticulture and intensive arable systems representing the largest threat[38]. This risk of 'soil sealing', with particular reference to the impact of urban expansion onto peri-urban soils, is not only a UK consideration but has been deemed to be significant threat across Europe[39]. However, a recent paper delivered at the 2019 Soils and Sustainable Development Goals conference stated that 'soil sealing' (urban) only represents a negligible threat to soils in the Atlantic north region[40] (within which Wales sits). This suggests that the primary risk to the BMV resource is not necessarily development (although housing pressure as highlighted in Section 1.3.3 will continue to be feature in some areas of Wales) but is instead the manner in which we manage our existing resource.

In the vast majority of cases, soil management for arable and horticulture systems typically utilises cultivation practises that may compact soils, influence soil erosion rates and lead to reductions in organic matter content. As a consequence, if BMV soils in Wales are to be considered in terms of their short and long term food producing potential, an environmentally friendly intensification of agriculture, which considers the capacity of soils to fulfil additional ecological functions besides the provision of food must be considered. An example of this is the work undertaken by Schiefer *et al.* (2015) which assessed the capability of German soils to support sustainable intensification of agriculture using a range of indicators. The criteria for the selection of indicators reflect a suite of ecosystem processes

[37] The Royal Society (London), B.A.(2009). Reaping the benefits science and the sustainable intensification of global agriculture. London: The Royal Society.
[38] Cranfield University (2011). Cost of soil degradation in England and Wales. Defra Project CTE0946.
[39] Since the mid 1950's the total surface area of cities in the EU has increased by 78%, whereas the population has grown by only 33%.https://ec.europa.eu/environment/soil/sealing_guidelines.htm
[40] Saskia et al (2019) Providing support in relation to the implementation of soil and land-related Sustainable Development Goals at EU level https://4016c5ae-e69f-47f2-b727044b42c4790d.filesusr.com/ugd/db6e0f_3d25d9d2b9394f82a3214e1f4d8bb5d5.pdf

(beyond short term food production capability), integrating physical, chemical, and biological properties and their sensitivity to management and climatic variations. To enable policy and grass roots decision making, the indicators were also selected based on how easily they were measured and understood. The key principle of the study is the fact that fertile soils with specific characteristics have a high resilience against physical, chemical and biological disturbances whilst also being capable of sustained high levels of agricultural commodities (if managed safely).

As stated previously, the current focus for BMV soils is purely on their agricultural production capability, irrespective of the sustainability of the practises employed. There is an argument that an expansion of the policy to include the wider delivery potential to these soils might complicate and therefore reduce the utility of the current system. However, given the wider WG policy framework, the sustainability focus of the future Welsh farming payment systems and the level of technical support provided by the ALC team there is the opportunity to create a system in Wales that could act as one of the frontrunners in Europe for the delivery of the UN Sustainable Development Goals (SDG). This will be explored further in Section 5.

4.2 Diversification and Land Competition

4.2.1 Horticulture

BMV land is recognised as the most productive and versatile land in terms of the range of crops that can be grown. For the growth of vegetables, soil quality is key. This is, however, not the case for soft fruit which is said to have 'retreated from BMV soils[41]' and is instead grown under cover, in substrate. As such, the diversification opportunities associated with horticulture rely much more heavily on the presence of supporting infrastructure (access to high quality water supply, road networks, labour, and 'pick your own' customer base) than on the quality of the soil. A significant Welsh horticulture farmer has recently moved entirely to substrate and table top production as this mitigates the impact of weather on yield and also reduces labour cost through easier picking systems. The boom and bust nature of both production and profit margins in horticulture have, in reality, seem some farmers return to the more stable guarantees associated with arable production.

Brexit and the heightened awareness of the impact of meat based agriculture on the global environment have both been suggested as representing an opportunity for horticulture production systems in the UK in the short term. However, given the reliance of the industry on labour and direct access to storage and transport infrastructure, those that have the capability to participate in the wider horticulture supply chain are typically already doing so.

This is also reflected in viticulture. Over two thirds of UK vineyards are reliant on external partners to process and store their wine. This significantly limits the ability of the wider industry to expand beyond small niche markets. In South Wales, significant investment has been made in winery infrastructure and it is recognised as a potential growth area. WG currently has no horticulture strategy but reflects the location and infrastructural requirements of the industry through support for the concept of short supply chains and opportunities associated with advances in agri-technology.

This existing infrastructural requirement alongside the tight control on the supply chain held by both the biotechnology firms (e.g. rootstock) and supermarkets (e.g. Category management), significantly limits the opportunity for expansion of the UK industry, and as a consequence, the horticulture opportunity for BMV soils.

[41] Personal communication from Janet Allen, ADAS Horticulture specialist

Despite this limited market opportunity, it is important to highlight the value associated with the versatility of this resource and the role it may play to produce food and energy during times of shock (e.g. war, pandemics, extreme weather events, population shifts as a result of climate change). Globally soil health is under threat as a result of unsustainable management practises. The current Welsh BMV resource may seem insignificant when viewed from a UK, European or global perspective, but when compared with how the global resource is currently being managed, the long term viability and availability of this resource may be far more certain within a Welsh context than elsewhere. As a consequence, the capability of the Welsh resource should not simply be viewed through the lens of the current limitations of the market but also in how this important resource is being managed and protected in order to secure its availability for the future.

4.2.2 Farm Woodland Area

Woodland is defined in UK forestry statistics as land under stands of trees with a canopy cover of at least 20% (25% in Northern Ireland), or having the potential to achieve this. The definition relates to land use, rather than land cover, so integral open space and felled areas that are awaiting restocking are included as woodland.[42]

Productive private woodland in Wales is been based around the planted conifer woodland established during the twentieth century. Historically, farmers saw woodland as an alternative to agriculture, rather than a part of it. A perception that has been enhanced by the removal of farm subsidy from land assessed as being beneath tree canopy. Native woodland tended to be managed to provide timber and fuel and a lack of farm support payments generally provided an incentive to overgraze farm woodlands, leading to habitat loss and lack of regeneration.[43] Despite this, the area of farm woodland in Wales increased from 68 thousand hectares in 2007 to 89 thousand hectares in 2016 (Table 4-1).

Table 4-1: Change in area of farm woodland in Wales 2007 – 2016.[44]

Year	Area of Farm Woodland (thousand hectares)
2007	67.9
2008	59.2
2009	60.8
2010	69.1
2011	44.2
2012	62.6
2013	63.4
2014	75.7
2015	78.0
2016	89.2

[42] https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2017/woodland-areas-and-planting/woodland-area/
[43] Welsh Government, 2018. *Woodlands for Wales,* pg. 17
[44] https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2017/woodland-areas-and-planting/area-of-farm-woodland/

In 2016, farm woodland in Wales only made up 9% of the total area of farm woodland in the UK. Figure 1-6 shows the historical area of farm woodland across each of the UK countries.

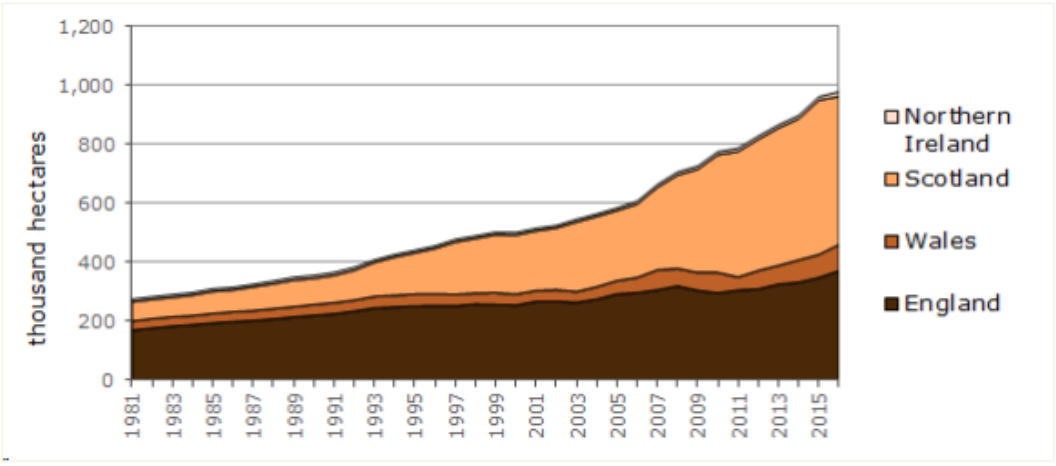

Figure 4-1: Area of farm woodland in the UK, 1981 – 2016.[45]

Since 2011 there has been a significant increase in the area of farm woodland in Wales. As changes in policy related to public money for public goods come into effect and as farmers adopt new land management strategies focused on providing important ecosystem services, the area of farm woodland is expected to increase even further. Woodland creation and tree planting on farms should be encouraged in future land use planning policies and promoted as integral to future land management systems. The flow on benefits from increased woodland on farms will provide significant benefits to the Welsh economy and people. This includes reducing the carbon footprint of Wales and providing opportunities for commercial investors and others to be involved in the creation and management of farm woodland.

The benefits of farm woodland and trees have been well documented. According to the Committee on Climate Change (CCC) report on '[Land use: Policies for a Net Zero UK]', 6 MtCO2e savings will be delivered across the UK by 2050 through agro-forestry practices (planting of trees on agricultural land), while still being able to maintain agricultural land, which includes BMV land, for its primary use. The modelling work commissioned by CCC in relation to future woodland found that the CCC ambition for planting 152,000 hectares of additional woodland in Wales by 2050 may be achievable but it would require utilisation of land that is biophysically limited or could become so in the future. It may also require the selection of different tree species to those modelled for the purpose of the CCC report.

In addition to sequestering carbon in the biomass and soil, other benefits include:

- non-CO_2 savings from reduced fertiliser use due to the recycling of nutrients that arises from leaf litter and the rooting system;
- improved water quality from reduced nitrate leaching into water courses;
- improved soil structure and fertility from litter fall and enhanced biodiversity; and

[45] https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2017/woodland-areas-and-planting/area-of-farm-woodland/

- improved productivity and animal welfare due to shade and shelter provided by trees. [46]

There are no official estimates of the area of BMV land that is used for farm woodland purposes. Silvo-arable (cropland planted with trees) and silvo-pastoral (permanent grassland planted with trees) are potential production systems that could be effectively managed on BMV land in Wales. There is no data on the area of land currently under either of these production systems. Further research into the potential for these on BMV land would benefit future planning strategies and decision making. This research should include an assessment of the economic and social costs and benefits of undertaking different types of farm woodland projects on BMV land to enable quantification of the impacts to the Welsh society, and to the private land owner or business, from the potential land use changes.

4.2.3 Beyond primary production

The greening of the European economy, which concerns the transition from fossil fuels towards bioenergy and a more biobased economy, will have strong impacts on large-scale land use, biodiversity and the sustainability of soil systems. Substantial areas of land across Europe are likely to be required for biofuels in the future. CCC has suggested expanding UK bioenergy crops by around 700,000 hectares or 23,000 hectares each year until 2050 in its '[Land use: Policies for a Net Zero UK]' report. This will not necessarily result in competition for agriculturally productive land resources; however, it does represent a significant expansion alongside expectations for tree planting, habitat, housing and infrastructure need.

Landsat images taken in 2000 and 2006 across 36 European countries have found that the most important land use trend in Europe is the expansion of built-up areas and forests at the expense of arable land, grasslands and semi-natural vegetation[47]. However, the researchers acknowledge that these conclusions are dependent upon the assumption that agricultural yields will continue to increase in the future at or above historical rates (resulting in less land required for cultivation to produce the same yield). This assumption is undermined by the fact that global soil health is under threat as a result of unsustainable management practises. Where the project modelled areas of grassland and permanent crops, both of these land uses declined whereas urban areas, forests and areas used for biofuel production increased.

The production of bioenergy on soil health, like other forms of intensive land management, typically results in soils that are less efficient in storing nutrients and carbon than extensively managed soils. There are clear differences however in soil community diversity and soil functions for different land use types. Significant declines in diversity and ecosystem services occur if permanent grassland is converted to arable land. Conversely, if arable land is converted to extensive land uses such as fallow, grassland or broadleaved forest, the soil diversity and SOM slowly improves over time[48]. These alternative land uses represent an interesting challenge to the recognition of the wider ecosystem services provided by BMV soil; especially in the Welsh context where BMV soils make up a relatively small proportion

[46] https://www.theccc.org.uk/wp-content/uploads/2018/11/Land-use-Reducing-emissions-and-preparing-for-climate-change-CCC-2018-1.pdf
[47] https://cordis.europa.eu/project/rcn/87816/reporting/en
[48] Emmett, B.E. and the GMEP team (2017). Glastir Monitoring & Evaluation Programme. Final Report to Welsh Government. Contract reference: C147/2010/11. NERC/Centre for Ecology & Hydrology (CEH Projects: NEC04780/NEC05371/NEC05782)

of the food producing capability of the UK as a whole[49]. However, it also represents the necessity to view a soil system from a multifunctional perspective rather than a single narrow focus. The food production capability of BMV soils is a reflection of the versatility of the system and should be considered as essential an aspect of the Welsh resource as the carbon safeguarding and sequestration, water holding and purification, climate and air quality regulation capabilities.

There a various metrics available which enable the assessment of natural systems from a multifunctional perspective. A natural capital accounting programme which mapped, assessed and valued the natural capital delivered by Welsh soil may be a next step to further understand and evidence the value of Welsh soils and their associated services.

4.2.4 Demand for Rural Amenity

The perspectives of different consumers and citizens relating to BMV land development and change often depend on their preference for ecosystem services. Urban consumers, for example, tend to prioritise the recreational, cultural or amenity value of BMV land ahead of its productive value. That is, they prefer goods and services that provide rural amenity and lifestyle utility rather than those that are seen as raw materials used in production.

In many areas of Wales, the preference for rural amenities is changing the role of agricultural land from that of traditional commodity production to that of potential tourism, recreation or lifestyle consumption. This change is seeing an increase in residential development as people move out of the cities and into rural areas in search of clean, quiet and aesthetically pleasing living spaces. The fragmentation of agricultural land that results from this increased development alters the way decision-makers need to manage and maintain the multiple functions provided to society. Roads and transport facilities, for example, may need to be improved or open spaces might need to be preserved. In any case, changes in societal goals and preferences need to be assessed and properly incorporated into appropriate land management policies for the sustainable and balanced provision of the various types of goods and services.

The increasing demand for rural amenities raises concerns about how the market in the longer term can maintain appropriate levels of land in agriculture, and whether this market allocation will continue to meet social welfare objectives. Generally it is accepted that the free market will allocate the socially optimal quantity of land to competing uses as long as product and factor markets are perfectly competitive, goods are private, and no externalities exist (Gardner 1977). However, when non-market goods such as rural amenities are considered part of the agricultural landscape, the criteria for a public good, non-excludability and non-rivalry, are met.

This public good character renders the land market a suboptimal mechanism for land allocation (Fleischer *et al.* 2009). As most of the benefits of using and enjoying rural amenities accrue to those who have not produced them, such as residents or tourists, and because it is generally difficult for farmers to charge for the costs of supplying rural amenities, the market is unable to match supply and demand. The fact that farmers may not

[49] Predictive modelling of ALC grade lands undertaken by ADAS in 2019 estimated that in 2018 there were 296,897 hectares of BMV land in Wales. This equates to 17.6% of the total agricultural land in Wales. By contrast, modelling undertake by Natural England in 2012 estimated the area of BMV land in England at 42% of all farmland; approximately 3.8 million hectares

be willing to bear the cost of providing the public goods that are most valued by society means that the allocation of land to competing uses will not be socially optimal. However, some farmers may be willing to undertake certain conservation programmes in an attempt to find 'equilibrium' so they too can enjoy the benefits of living and working in an attractive, amenity rich landscape.

The suboptimal allocation of land also raises arguments for policy intervention, usually in the form of planning regulations such as zoning restrictions, or incentive-based approaches such as PES that generate an income stream for rural landowners related to the provision of amenity goods and services. It is well acknowledged, however, that land is heterogeneous and as such, spatial and temporal influences can potentially alter the efficient allocation of land between multiple functions and uses.

4.3 Climate change

It is not yet clear how BMV land and its soil resources are responding to a changing climate, with much debate over whether measured declines in UK soil carbon concentrations over the last few decades are a result of climate change or other factors such as changes in land management or recovery from acidification. However, given the predicted increases in temperature and changes in the seasonality and magnitude of rainfall events, changes to BMV soils and the services they provide are highly likely, particularly if land-use patterns also change.

UK Climate Projections (UKCP18) set out a number of projections for climate change over the short, medium and long term covering temperature and precipitation. Three emissions scenario levels are presented – low, medium and high for each time period. Under UKCP18 climate scenarios ALC grade lands, according to climate projections, will see an increase in land use options in the lowland coastal and border regions of Wales, with greater expansion in areas classified as BMV land (in particular, ALC grade 2). Figure 4-2 demonstrates the expectation under all scenarios that the climatic envelope for agricultural activities expands across England and Wales. Many western and northern small areas may, however, remain constrained in land-use options.

The maps are based on the Cranfield 5k NSI points to represent broad range scenarios and patterns; the resolution, the predictive accuracy of scenarios and, therefore, the validity of the results means caution should be exercised in their in interpretation. It is clear, however, that the general trend is in line with previous work undertaken in the Defra report, SP1104, The Impact of climate change on the capability of soils for agriculture as defined by the Agricultural Land Classification.

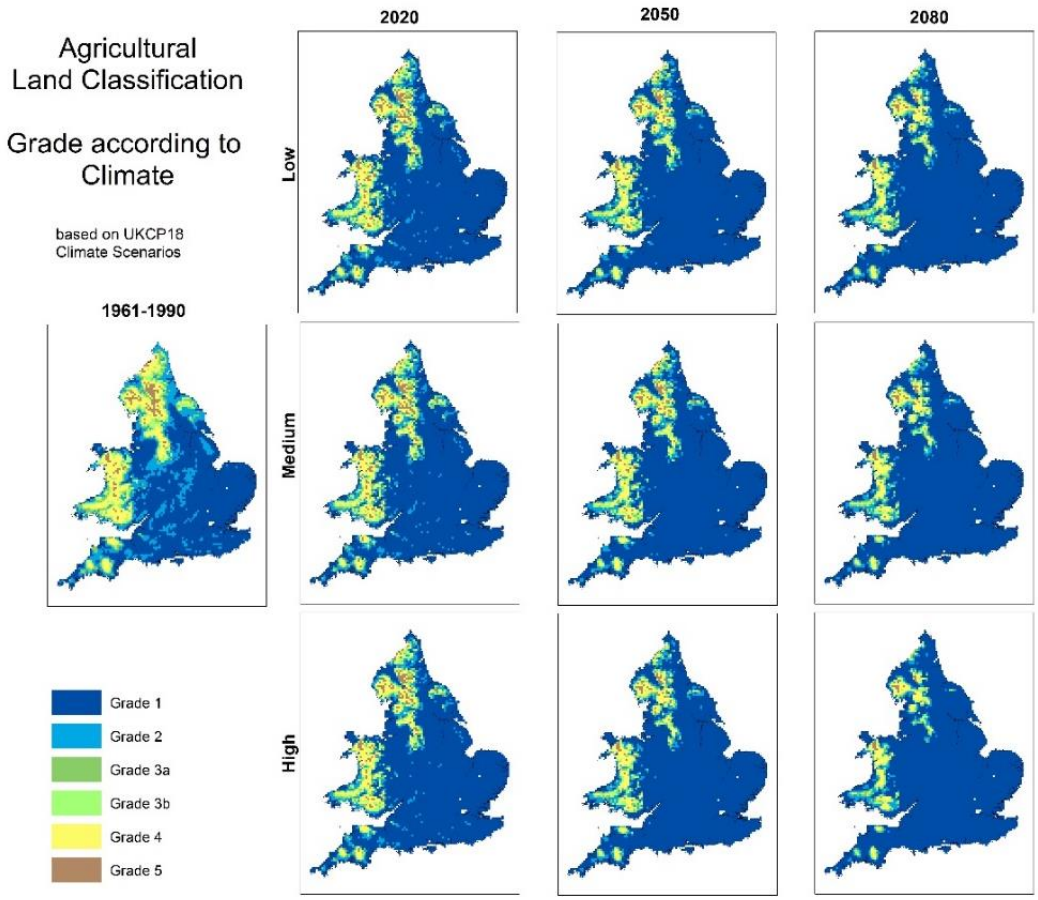

Figure 4-2: Change in ALC grades under UKCP18 climate scenarios according to climate.

4.3.1 Soil wetness and workability

Figure 4-3 indicates that soil wetness and workability under UKCP18 climate scenarios is likely to improve leading to more land use options as the soils become more workable. However, changes in the seasonal distribution of rainfall may lead to greater risk of soil erosion if more land is cultivated and water stress in summer months as drought becomes an ever increasing risk. The basic expectation through the scenarios is one of intense wider rainfall, low summer rainfall and increased summer temperatures.

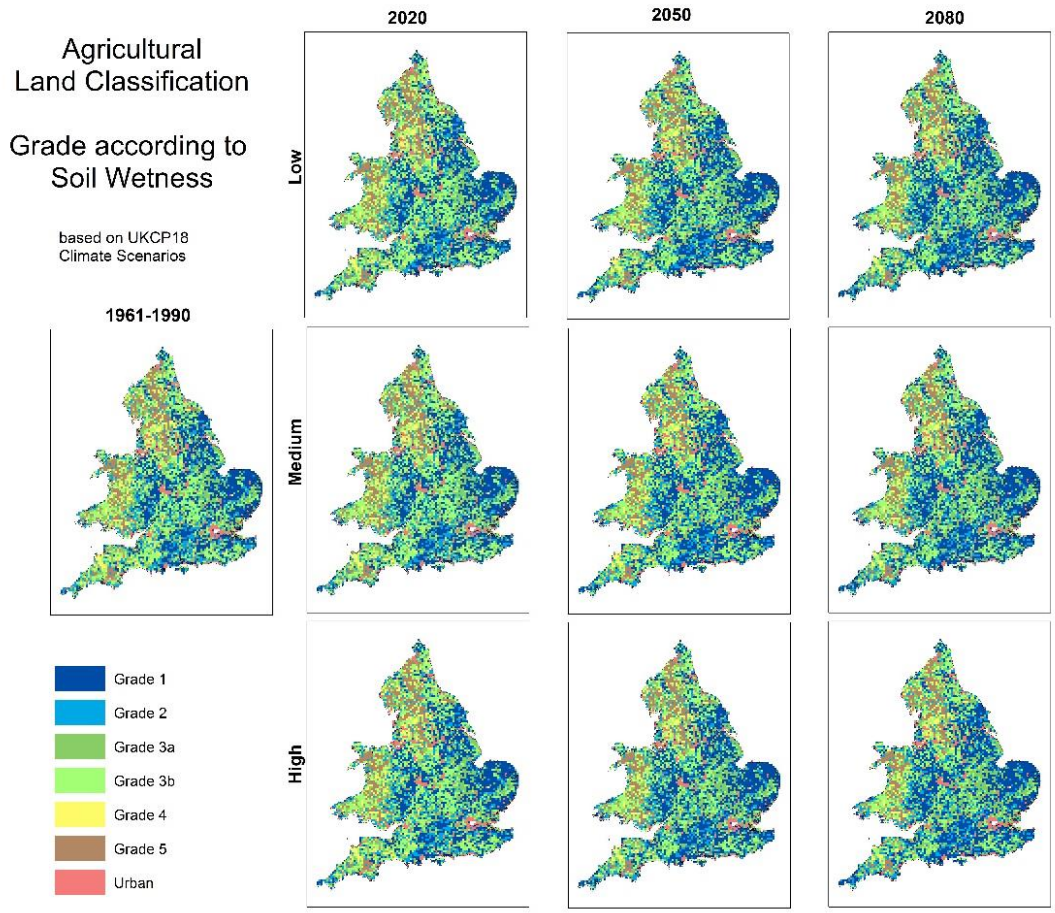

Figure 4-3: Change in ALC grades under UKCP18 climate scenarios according to soil wetness.

4.3.2 Droughtiness

Currently, soil droughtiness does not affect many Welsh soils, although UKCP18 maps suggest that this may alter under modelled climate scenarios (Figure 4-4). Seasonal drought risk appears to be increasing which implies down grading of BMV land, especially around the coastal and Border regions, and an increase in BMV land in parts of Pembrokeshire.

The supply of irrigation water to counter soil moisture deficits is currently a relatively minor issue in Wales and is used only on a few crops (e.g. potatoes). Projected changes in seasonal drought under climate change scenarios (Figure 4-3) implies that irrigation may become more important in the future to maintain soils within the BMV category. There are also questions over the availability of water supplies, water competition and the severity of the moisture deficits.

How particular soils and land use activities respond to this change in terms of carbon storage and microbiological activity remains an area for further research.

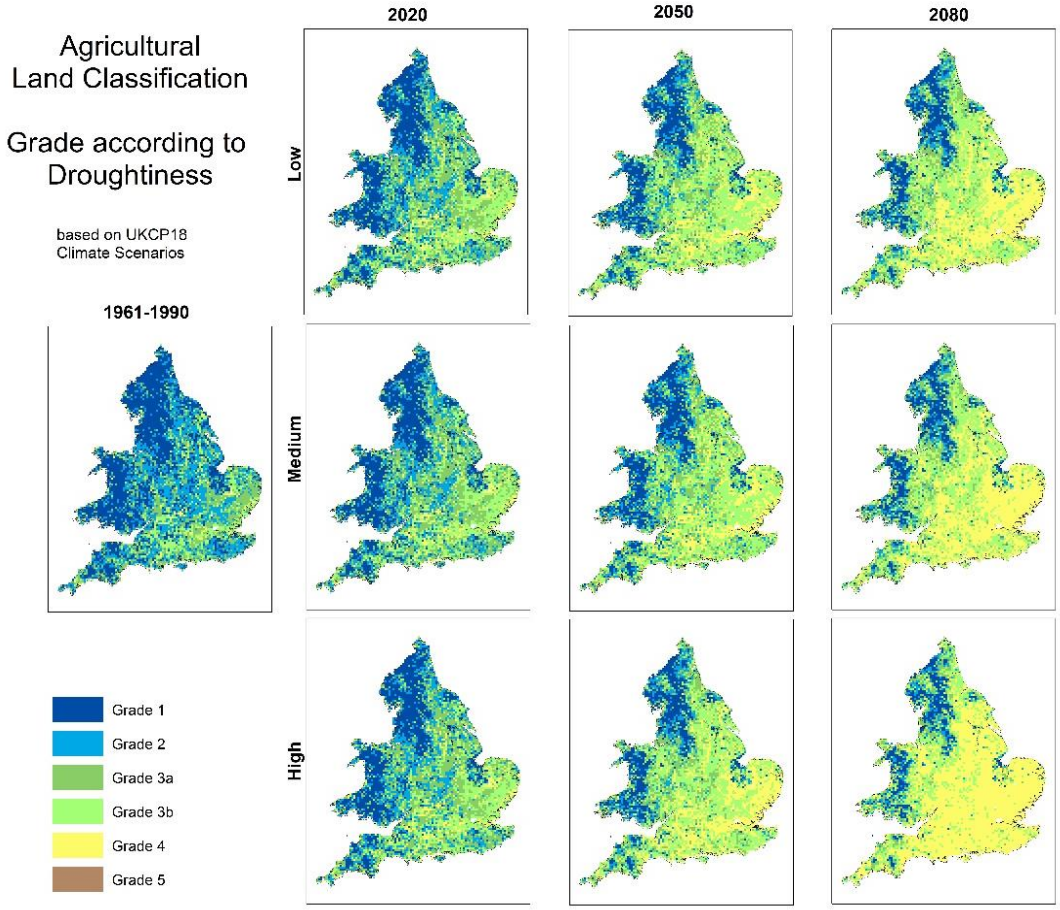

Figure 4-4: Change in ALC grades under UKCP18 climate scenarios according to droughtiness.

4.3.3 Impact of flooding on BMV land

According to the UK Climate Change Risk Assessment 2017 evidence report approximately 9,000 hectares of BMV land in Wales is at 1 in 75 year or greater risk from river flooding. A further 7,000 hectares is at a 1 in 75 year or greater risk of surface water flooding. A relatively small area (~2,000 hectares) is currently at 1 in 75 year or greater risk of coastal flooding. Inundation of agricultural land by saltwater can cause significant damage to crops and over time results in salinity which can reduce the viability of agricultural production. The area of BMV land at a 1 in 75 year risk from all sources of flooding is projected to increase by 35% by the 2050s, assuming global mean temperatures continue on the current trajectory which will see a 40°C rise by the end of the century.[50] It should be noted, the Welsh Government has commissioned work to re-assess the current risk from fluvial flood risk and UKCP18 sea level rise.

Recent flood events have highlighted the impact of climate variability and the need to understand and manage risks associated with potential flood events. The scale of flooding in a Welsh context and the future possibility of using flood plains to control flooding would impact significantly on BMV land. Flooding may result in soil erosion, loss of nutrients and deposition of other material that could reduce BMV land's capability for future agricultural

[50] ASC (2016) UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Wales. Adaptation Sub-Committee of the Committee on Climate Change, London. <https://www.theccc.org.uk/wp-content/uploads/2016/07/UK-CCRA-2017-Wales-National-Summary.pdf>

production. Increased flooding will also influence the type and extent of future cropping activity on BMV land. The decision to plant high value crops such as potatoes, for example, may be influenced by the potential loss of income that would result from a flood event. So, while the land may be classified as BMV it may not be able to be utilised to its maximum food producing potential.

4.3.4 Loss of soil organic matter

Soil organic matter (SOM) is vital for sequestering of carbon, absorbing, cleaning and storing water, supporting micro-organisms and providing nutrients for plant growth. Managing SOM on all ALC grade lands will promote soil biodiversity and hence soil ecosystem services. For BMV land in Wales, which is the most flexible for cropping, two thirds of the resource is estimated to be predominantly grass, so land use change presents a risk to SOM loss due to soil disturbance from tillage. Tillage breaks up soil aggregates and exposes protected soil carbon to the oxidising atmosphere. The leads to erosion and results in increased outputs of carbon from the carbon pool. While erosion may be viewed as a loss of Soil Organic Carbon (SOC) at a local level it has been suggested that the majority of the eroded carbon is deposited at other sites (Van Oost et al., 2007). Sequestering carbon in soils through increased levels of SOM improves the productive capacity of the soil, leading to higher overall productivity and economic competitiveness; however, the degree to which Welsh grasslands, whether BMV or otherwise, have the potential to sequester more carbon is uncertain and requires more research.

A survey undertaken by SOILSERVICE across the EU indicated that farmers would be willing to maintain soil organic matter/carbon if paid to do so. Rewarding farmers for maintaining or increasing soil organic carbon would ensure cost effective conservation of soil biodiversity, given a relevant control of carbon content.[51] However, the mechanism for measuring, monitoring and reward is complex due to the slow formation rate of organic matter; sampling techniques and traditional 5 year scheme cycles. As outlined in the report on the Assessment of the Welsh Soils in Context, a comprehensive soils policy should not just focus on preserving/improving the (physical, biological, chemical) condition of soils, but rather on enhancing the services they support.

As discussed above, climatic and soil constraints (i.e. soil wetness, droughtiness and erosion potential) are key metrics that influence land use capability. Timing of activities such as ploughing or sowing, for example, can be influenced by changes in climatic conditions. Likewise, plant growth can be restricted under certain climatic constraints. Both of these examples are key considerations on BMV land. A change in climatic and soil constraints implies that new opportunities for, or risks to, BMV land use could become more evident over time, based solely on inherent conditions. To identify and understand the areas of BMV land where the range of land use options is changing, or may change in the future, (either increasing or decreasing) would require detailed analysis of how climate change impacts BMV land in Wales. The information gained from such analysis could then provide a policy base from which to explore the wider social and economic implications of climate change, including other pressures and drivers that may impact on the overall capacity of BMV Land to provide goods and services to society.

[51] SOILSERVICE, 2012. *Conflicting demands of land use, soil biodiversity and the sustainable delivery of ecosystem goods and services in Europe. Accessed Jan 2019* <https://www.biology.lu.se/research/research-groups/soil-ecology/research-projects/soilservice>

Consider further exploration of the impact of changes in climatic constraints on BMV land. This could involve integrated analysis across different spatial (local vs regional vs national) and temporal scales (historical and predicted timeframes) that would allow efficient land allocations, trade-offs and co-benefits to modelled in greater detail.

5 BMV LAND ISSUES AND POLICY RESPONSES

Healthy soils with a rich biodiversity, safeguards and sequesters carbon, cleans and slows the flow of water, helps to regulate the climate and air quality and produces a sustainable supply of food. Making soil management decisions which support all of the services is not always straightforward as a focus on long term productivity and protecting overall soil health can result in reduced yields in the short term. As a consequence, understanding the ecological, economic and social drivers of soil threats in the context of production of primary production (e.g. food and biofuel) has been deemed by the EU as essential in the formulation of the Common Agricultural Policy and as a consequence the future development of the oft proposed EU Soil Framework Directive (SFD).

The slow progress towards the SFD is explained by the challenging situation this presents both to those who derive their living from managing the land and those policy makers who wish to implement mechanisms which recognise and facilitate socially desirable outcomes (e.g public goods) from land under private management. This is further complicated by the absence of defined markets for these public goods. As such, it is understandable that land managers will tend to focus their soil management decisions on the short term production of goods that have a defined market value, rather than supporting ecosystem services that are for the benefit of wider society and as yet, unpriced.

Rather than undermine the need for an SFD, this represents a strong case for policy intervention in the management of intensively farmed soils, of which the Welsh BMV resource forms a part. Policy analysis undertaken by the SoilService[52] project highlighted two complications which require consideration in the formulation of any soil policy; timelines and defined metrics. The long term nature of soil natural capital requires any policy to have a forward facing perspective and the policy must also be targeted at a variable for which a baseline can be set and which is strongly correlated with multiple services; soil carbon content[40] and SOM[53] have been proposed as good examples.

The lack of consensus around agreed targets represents a stumbling block for policy and regulation. To regulate soil effectively there is a need to establish both baseline and target values for soil that can be included in legislation. The creation of this baseline, with particular reference to a clearer regional understanding, is essential in order to understand the 'risks' associated with loss of the BMV resource (locally and nationally), the impacts this has on primary production, wider ecosystem services and how best to reflect its' value within regional and national policy priorities (e.g. Area statements). The Land Degradation Neutrality target associated with the Sustainable Development Goal (SDG) 15 (Life on Land) has been proposed as one such target.

Sustainable Development Goals – An integrated ambition

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by all United Nations Member States in 2015[54]. Comprised of 17 integrated goals, they have been designed with the recognition that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

Prior to the adoption of the SDGs, the EU had implemented a suite of strategies which focussed on the sustainable management of natural resources. These include the Soil

[52] https://cordis.europa.eu/project/id/211779/reporting

[53] Williams, J., and A. Rollett. 2019. Welsh Soils in Context. A report prepared for ADAS for the ALC & Soil Policy Research & Development Programme

[54] https://www.undp.org/content/undp/en/home/sustainable-development-goals.html

Thematic Strategy adopted in 2006, a cornerstone of the EU soil policy, the 'Roadmap to a Resource Efficient Europe' in 2011 (aimed at the achievement of sustainable resource management, including land and soil management, by 2050, it also set a target of no net land take by 2050) and 7th EU Environmental Action Programme adopted in 2014. All of these strategies were designed to enable EU wide efforts to reduce soil erosion, to enhance soil organic matter, and to integrate land use aspects into coordinated policies involving all relevant levels of government.

Despite these agreed high-level initiatives and widespread political leadership in support of the implementation of soil and land-related SDGs, individual member state policies targeted at prevention of land and soil degradation remains fragmented. This has been largely attributed to the absence of clear objectives and targets relating to land and soil and the absence of measurable and easily monitored assessments of their effectiveness.

Land Degradation Neutrality is an example of a target linked to the SDG 15 (Life on Land) that can be monitored. The LDN target sets an objective of striving to achieve a land degradation-neutral world by 2030 through taking actions such as combatting desertification and restoration of degraded soil and land. Globally an indicator for 15.3.1 has been set up by the UNCCD for monitoring of this target, consisting of three sub-indicators focusing on land cover, land productivity and carbon stocks.

However, to date, no standard approach exists regarding collection and interpretation of data and information needed to calibrate this indicator in a consistent manner across countries. Among the EU Member States, only Italy has so far set up a national plan to reach Land Degradation Neutrality. It has been proposed that if more European nations were to adopt this target, it would be a good step towards making soil and land-related SDGs more operational. The experience of 'frontrunners' in setting up the LDN can then be used as a demonstration of proof of principle with best practise shared with other nations.

A Welsh context

The integrated nature of the Well-being of Future Generations Act (Wales) 2015, the Environment (Wales) Act 2016 and the current PPW with respect to the resilience of Welsh ecosystems are already an example of an interdisciplinary land policy framework. If the drivers behind the protection of the BMV resource were expanded to encompass the wider objectives of productivity (social, economic and environmental), cover and carbon stocks, this could enable Wales to become one of the European frontrunners alongside Italy. This could be achieved through a number of means, such as the development of a fully integrated soil policy across all WG policy area and a natural capital accounting programme which mapped, assessed and valued the natural capital delivered by Welsh soils.

The current commitment of resource (supporting evidence (ALC map / surveys), advice from government specialists, and the ability of Government to express a view in planning applications) is quite significant (Refer to Appendix Two). The WG is already committing additional resources in order to gain a better understanding of what has impacted upon historical and future loss of soils, how soils function and how best to use this existing and emerging data to inform policy development and implementation. Given this resource allocation and the emerging knowledge base, operationalising an SDG such as the LDN by contrast with the other UK member states, is well within the grasp of the WG. If WG is to deliver against the ambitious goals outlined in the Well-being of Future Generations Act (Wales) 2015, and all subsequent legislation, it is important for the future of a natural

resource rich nation such as Wales to fully commit to a transition towards sustainable land and soil management for every stakeholder involved in land and soil related activities.

Consider the relevance of the Land Degradation Neutrality targets (land cover, land productivity and carbon stocks) as a mechanism for delivery and monitoring SDG goals (e.g. 15 - Life on Land) and associated Welsh legislation.

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APPENDICES

Appendix 1: Description of Agricultural Land Classification (ALC) Grades:

The grading guidance and cut-offs for limitation factors in the MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land[55] enable land to be ranked in accordance with the general descriptions described below. The ALC grades and subgrades are described in terms of the types of limitation which can occur, typical cropping range and the expected level and consistency of yield. In practice, criteria for grading are based on the long term physical limitations of land for agricultural use, such as climate (temperature, rainfall, aspect, exposure and frost risk), site (gradient, micro-relief and flood risk) and soil (texture, structure, depth and stoniness, and also chemical properties which cannot be corrected), and interactions between these factors such as soil wetness, droughtiness and erosion.

Descriptions are also given of other land categories which may be used on ALC maps.

Grade 1: Excellent Quality Agricultural Land

Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.

Grade 2: Very Good Quality Agricultural Land

Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural or horticultural crops can usually be grown but on some land of this grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1 land.

Grade 3: Good to Moderate Quality Land

Land with moderate limitations which affect the choice of crops, the timing and type of cultivation, harvesting or the level of yield. When more demanding crops are grown, yields are generally lower or more variable than on land in Grades 1 and 2.

Subgrade 3a: Good Quality Agricultural Land

Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.

Subgrade 3b: Moderate Quality Agricultural Land

Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass, or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.

[55] Source: Section 2, MAFF (1988) Agricultural Land Classification of England and Wales Revised Guidelines and Criteria for Grading the Quality of Agricultural Land.

Grade 4: Poor Quality Agricultural Land

Land with severe limitations which significantly restrict the range of crops and/or the level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.

Grade 5: Very Poor Quality Agricultural Land

Land with severe limitations which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.

Descriptions of other land categories used on ALC maps

Urban

Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

Non-agricultural

'Soft' uses where most of the land could be returned relatively easily to agriculture, including golf courses, private parkland, public open spaces, sports fields, allotments and soft surfaced areas on airports/ airfields. Also, active mineral workings and refuse tips where restoration conditions to 'soft' after-uses may apply.

Woodland

Includes commercial and non-commercial woodland. A distinction may be made as necessary between farm and non-farm woodland. Includes the normal range of agricultural buildings as well as other relatively permanent structures such as glasshouses. Temporary structures (e.g. polythene tunnels erected for lambing) may be ignored.

Open water

Includes lakes, ponds and rivers as map scale permits.

Land not surveyed

Agricultural land which has not been surveyed. Where the land use includes more than one of the above land cover types, e.g. buildings in large grounds, and where map scale permits, the cover types may be shown separately. Otherwise, the most extensive cover type will usually be shown.

Appendix 2: Policy procedure for handling BMV development applications

Planning procedural advice is given in the Development Plans Manual[56] and Development Management Manual[57] as well as Welsh Government circulars and letters. These documents outline the procedure for handling BMV development applications.

Technical Advice Note 6 – Annex B – Consultation Arrangements with Welsh Government:

Consultation on development plans

B1. Planning authorities preparing development plans should consult the Planning Division WAG who will co-ordinate consultation within WAG. LPA's are advised to contact Sustainability and Environmental Evidence Division SEED (formerly Technical Services Division, TSD) within Department for Rural Affairs (DRA) for information on the quality of agricultural land within the plan area and, in particular, the location of the best and most versatile agricultural land.

Consultation with DRA: planning applications for non-agricultural development

B2. There may be proposals for development for non-agricultural purposes requiring significant amounts of the best and most versatile agricultural land. In such cases, DRA has the statutory right to be consulted, so that planning authorities are made fully aware of the agricultural implications. Article 10(1), paragraph (w) of the Table to the Town and Country Planning (General Development Procedure) Order 1995 (GDPO) (S.I .No 1995/419), requires planning authorities to consult WAG before granting any planning permission which is not in accordance with the development plan, and would involve the loss of 20 hectares or more of grades 1, 2 or 3a agricultural land or a loss which is less than 20 hectares but is likely to lead to further losses amounting cumulatively to 20 hectares or more. If the planning authority is uncertain whether the land involved is grades 1, 2 or 3a they may seek advice from SEED on its classification.

Non-statutory consultation with DRA: Planning applications for non-agricultural development

B5. There may be other planning applications with significant agricultural implications which come to the attention of DRA but which are not subject to the statutory requirements described in the paragraphs above. DRA may on occasion wish to take the initiative in commenting to the planning authority on applications of this type.

B6. In circumstances which do not require the specific consultations with DRA outlined in above, it is expected that planning authorities should be able normally to determine applications for development on agricultural land in the light of evidence before them. Where they do not feel able to determine the application satisfactorily, it is open to them to seek more information or technical advice (e.g. on agricultural land quality implications) either from SEED or from other agricultural consultants. Such consultations should be confined to matters of technical detail and not relate to the merits or otherwise of the application, on which it is for the planning authority to take a view.

[56] https://gov.wales/topics/planning/policy/policy-and-guidance-on-development-plans/?lang=en
[57] https://gov.wales/topics/planning/policy/development-management-manual/?lang=en

Appendix 3: Brief history of land classification and land use planning in Wales

The protection of high quality agricultural land as a national resource has been embedded in planning policy in Wales for more than 60 years. With the rapid expansion of urban areas in Great Britain in the 1930s, Professor Dudley Stamp recognised the need for a systematic assessment of land use as the basis for future planning and conservation. By autumn 1931 practical arrangements for the first systematic land utilisation survey were in place across most English and Welsh counties. The resulting Stamp maps are said to have saved Britain from starvation during the Second World War and played a critical role in the Dig for Victory campaign. By the 1960s, however, the Stamp maps had become increasingly outdated as they were only able to identify land use at a single point in time. The Stamp maps were not able to identify what the land was capable of growing over time. In 1966 the Agricultural Land Service recommended that a new, three-stage process of evaluation should be set in motion:

1. A physical classification of agricultural land;
2. An economic classification; and
3. A marrying up of the first two stages.

Only stage 1, the ALC map was progressed. Since this time, planning decisions based on the capability of agricultural land in the United Kingdom have relied on the Agricultural Land Classification (ALC) system. This divides the typical cropping range and the expected level and consistency of yield into a number of land classes based on the natural capability of soil and its interaction with the local climatic regime.

Land *capability* is the founding principle of the ALC system and refers to the general potential of land to grow a combination of crops (e.g. arable and horticulture). Land *suitability* refers to the potential of land to undertake specific activities (e.g. grow a specific crop such as linseed or grapes or graze sheep). There may or may not be a link between capability and suitability, depending on the production requirements. Champagne, for example, grows on very poor quality land from an ALC standpoint (shallow, stony soils) but produces an extremely high value crop. Generally, the *capability* of a particular parcel of land will not change over time while the agricultural *suitability* may well change if product demand or other demands relating to its location change, such as housing or recreational demand.

The ALC system became the formal method for guiding future land use following recognition in the 60s and 70s that the ALC maps would help the then named Ministry of Agriculture, Fisheries and Food (now Defra) and local planning authorities to reduce the significant amount of high quality agricultural land being lost to development.

The production of the Provisional ALC maps was initiated as part of a national survey by the Agricultural Land Service (ALS) between 1966 and 1974. This national mapping programme took 120 staff years to complete involving the efforts of 15 fulltime Ministry Research Officers and unknown number of regional advisers[58]. The ALS produced 113 maps at a scale of 1:63,360 with accompanying agri-climatic reports, some of which are believed missing. The maps were then combined and rescaled to 1:250,000.

The Provisional ALC Maps were subject to a number of known design and accuracy limitations. The intention was to refine, resurvey and produce a final version. However, the refinement never happened and the maps retained the 'Provisional' title. Partly, this was due to the scale of the effort to resurvey England and Wales in details and the move to a

[58] Source: Exeter University - ALC in Britain - A Review of the MAFF New Map Series (1975)

much more field based survey assessment system. Following significant challenge through the planning system and the need for high resolution land quality information, in 1988 the ALC guidelines were subject to a significant revision, making them much more scientifically repeatable and robust. It is very important not to confuse the Provisional ALC maps with the 1988 ALC system. This is not a like for like comparison in method. Although there are consistencies in principles and some criteria, an exact match between the Provisional ALC maps and post 1988 ALC survey assessments should not be expected. Until 2017, there was no pan Wales ALC map based on the 1988 ALC Guidelines.