Sir George Stapledon FRS and his international grassland legacy

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Abstract

Sir George Stapledon (1882–1960) was one of the greatest agricultural scientists of the early and mid-20th century. His work profoundly affected grassland science and agricultural production in the UK and beyond. He has an enduring legacy from the institutions he helped found and through the trust that carries his name. This article considers his early work on ecology and agronomy, progress on forage plant breeding, ley farming, and the influence of his later writings on land use policy and wider philosophical implications of the role of the land in terms of human wellbeing.

Introduction

Sir George Stapledon was a scientist, botanist, ecologist, teacher, philosopher, poet and visionary. He was a true polymath. In his lifetime, he was widely recognised for his contribution to grassland science in Britain and particularly for his role in lifting British agriculture in the first half of the 20th century. His influence was also recognised in his lifetime, not only in Britain but throughout the British Empire and Commonwealth and beyond. As the founding Director of the Welsh Plant Breeding Station (WPBS), he was instrumental in developing the scientific breeding of grasses and forage legumes in Britain. He greatly advanced our understanding of grassland agronomy and recognised that a vigorous agriculture was not just a means of food production and national food security, but also provided a route to raising rural living standards. Although he wrote about agriculture, and greatly advanced agricultural science and influenced policy and adoption in practice, he also empathised with farmers and thought philosophically about the role of agriculture and the countryside for the population as a whole. Today, his achievements have largely become forgotten. His name does not appear among the lists of 20th century thinkers as studied in today's philosophy degree courses, though this is probably for no other reason than he was primarily a scientist. Yet, as we shall see, many aspects of his thinking were ahead of his time. He saw the need for research to extend across disciplines, an approach that was followed in the establishment of the grassland research developed at Hurley and Aberystwyth in the UK, and emulated notably at many successful research institutes in the Commonwealth. He also advocated the need for holistic approaches to deliver harmony between the science of agriculture and the wider environment, and the role of people as part of wider ecosystems – human ecology. The practical relevance of his work, especially in his earlier writings on hill land improvement, ley farming, seed varietal improvement and the importance of land surveys, was clearly carried out in the context of the UK in the first half of the 20th century, but he also saw their worldwide application for a growing global population. He had an instrumental role in the establishment of many international organisations, and his international legacy continues through the awards made to scientists and practitioners by the Stapledon Memorial Trust that was set up in his honour.

Background and early career

The early life of Reginald George Stapledon is relevant in terms of how his upbringing influenced his later

career and philosophical thinking. Two important sources of information are his biography by Robert Waller (Waller, 1962) and a Royal Society biographical memoir (Russell, 1961).

He was born in 1882 into a Devonshire family that ran an international shipping company. We can regard him as being a Victorian in the sense of having a Victorian upbringing, with leisure time to study nature and practise gardening. He attended the nearby United Services College and then read Natural Sciences at Cambridge, but his career then went through some false starts. Two years at the family firm's offices in Suez may have given useful experience in recordkeeping, but did not inspire him to continue in commerce. His entry to agriculture was through working for a fruit grower in Kent, which was followed by a return to Cambridge in 1907 to take a Diploma in Agriculture. This was sufficient to launch his agriculture career proper and he obtained a post at the Royal Agricultural College, Cirencester, where he stayed for three years working in agricultural ecology. This was a discipline that he largely developed himself, and which alerted him to many of the problems of British agriculture at the time, such as the use of unsuitable and poor-quality seeds. This was a challenging period to develop a career in agriculture. Decades of cheap food from the late 19th century had resulted in massive agrarian change, with the abandonment of much of Britain's arable farming to extensive grazing and associated rural depopulation.

George Stapledon was then fortunate in 1912 to be offered a post as botanical adviser at the University College of Wales Aberystwyth, to conduct a botanical survey in central Wales, to give advice to farmers, and to teach. Later, during the First World War (WW1) emergency, he served the Board of Agriculture in London and succeeded in establishing a seed testing station to address the scandal of inferior seed then being sold to farmers. The war had exposed the importance of food security and the risks of relying on imports while vast tracts of land were seriously under-utilised. His views clearly gained the attention of those in authority. A grant from Lord Milford led to the establishment of WPBS at Aberystwyth in 1919, with George Stapledon being appointed as its Director, a post he held alongside that of Professor of Agricultural Botany, until 1942.

The Aberystwyth period (1919–1940s)

Until the 1920s, clovers and grasses were novel subjects for plant breeders. Available varieties were essentially landraces, often selected for their ability to produce harvestable seed rather than for attributes of persistence, yield or high-quality forage, and many had been produced in countries where growing conditions were different to those of Britain. In 1922, Stapledon set out his *Book of Words* describing the methodology and procedures relating to the selection and breeding, and recording and evaluating of trials (Duller *et al*, 2019). Over the following decades, he and his team followed an ecological approach to developing new varieties, sourcing promising parent material from permanent pastures of repute for fattening livestock, and leading to the release of the improved 'S' strains. The approach was based on clear agronomic objectives, with assessments that also took account of chemical analyses of herbage and their utilisation by the grazing animal (Duller *et al*, 2019).

The development of improved grasses and clovers through scientific plant breeding was part of an overall strategy to improve the UK's farmland and address a fundamental national problem: the country could not feed itself. His experience of the effects of food shortages during WW1, while much of the countryside lay derelict, convinced him of the need to combine plant breeding with scientific agronomy. The hills and uplands, accounting for a third of the agricultural land area, were identified as having potential to carry greater stock numbers if pastures were improved by applications of lime and phosphate fertilisers, and with reseeding where feasible. Here we must mention the Cahn Hill Improvement Scheme (1933–1947), over 1,000 ha of agriculturally poor steep land rising to 600 m elevation near Devils Bridge. This presented Stapledon with an immense challenge to test his ideas for land improvement, which greatly exceeded those of the Ministry of Agriculture, and which, despite opposition from economists, would provide practicable results that would show Britain's food potential and that of its rural communities. His zeal for this scheme inspired many in their efforts to raise production during WW2.

Hill land improvement provided additional acres so that similar numbers of livestock were carried nationally, while at the same time releasing poorer lowland grassland for arable cultivation. This brings us to another of the pillars of his work and one with which his name is inextricably linked: ley farming. George Stapledon did not invent ley farming – that attribution may go to Robert Elliot of Clifton Park. Stanes *et al* (2008) also argued that in the Bedford husbandry covenants the introduction of leys was legally enforced in the early 18th century and had also become part of the south-west England farming systems, and that Stapledon would have been aware of this. Nevertheless, George Stapledon and his protégé William Davies can take credit for having popularised the term 'ley farming' in the context of rotational farming systems including grass or grass–legume swards. There were some clear advantages: grassland on a mainly arable farm enabled the

accumulation of soil organic matter which could be beneficial for the land and subsequent crops, while manures from any livestock kept would fertilise the land further. Writing in the late 1930s, he was highly critical of permanent grassland farming in general, though this view was likely influenced by its current management rather than its potential: it is "an excuse for an immense amount of national and private laxity" (Stapledon, 1938) and by offering a certain return for a minimum of effort it stultifies endeavour. He was critical of the low soil pH of most permanent grassland, its short growing period and inability to produce adequate winter rations, and its weediness and poor utilisation. He recognised, however, that there was insufficient information on the state of the country's grasslands and rough grazing areas. A survey of the vegetation and soils of Wales was completed by 1936 in association with the Cahn Hill scheme (Stapledon, 1936), but English grasslands were not surveyed until several years later. The value of information from surveys of land use and agricultural potential was considered to be of crucial importance and it greatly informed the WW2 plough-up campaign. Despite this apparent success, politicians failed to appreciate the need for such intelligence in relation to agricultural improvement.

During Stapledon's period at Aberystwyth in the 1920s and 1930s, he and his colleagues succeeded in projecting their ideas and work nationally and internationally. At this time the WPBS achieved the status of a mecca for grassland-related scientists, particularly from the then British Empire and Dominions but also other countries, a legacy that the successor to WPBS at Aberystwyth University continues to this day. In the 1920s, he visited the USA, South Africa, Australia and New Zealand, where his work was particularly influential. Declining fertility in New Zealand soils, due in part to the removal of phosphorus by livestock, had reached a serious point. The overall problem was partly addressed by Stapledon through encouraging the development of selection and breeding of appropriate herbage varieties, with his colleague Dr William Davies being sent out to continue the trials. He also noted with enthusiasm the paddock grazing system of North Island dairy farmers for its potential adoption in the UK. He saw the need for individual countries to have their own grassland research stations and for proper national surveys of grassland resources to be conducted.

On his return to Britain he co-wrote one of his more practical works, *Grass land: its management and improvement* (Stapledon & Hanley, 1927). This period also saw the development of the Imperial Agricultural Bureaux (subsequently the Commonwealth Agricultural Bureaux, and now known as CAB International) from its progenitor the Entomological Research Committee, which had been established in 1909. The first Imperial Agricultural Conference in 1927 recommended the establishment of Imperial Agricultural Bureaux for the dissemination of information on their respective agricultural subject areas throughout the countries of the British Empire. The Bureau of Pastures and Field Crops began in 1929 as the Imperial Bureau of Plant Breeding (Herbage Plants) at the WPBS Aberystwyth with Stapledon as its Director, where it remained until 1949 shortly after the start of publication of the abstract journals *Herbage Abstracts* and *Field Crop Abstracts* (Blight, 2010).

The 1930s saw the publication of one of his most influential books, *The land now and to-morrow* (Stapledon, 1935). This was to mark him out not just as a grassland scientist concerned with improving the agronomy and plant science needed to support a more productive national agriculture, but also as an interdisciplinary and multi-faceted thinker. He considered the whole management and prosperity of the countryside in ways that would benefit the wellbeing of the rural and urban populations alike, not just for the present but also for the future: "the land is ultimately the property of posterity". Many of his themes resonate today, and not just in the context of the UK. Mixed farming can enable better land improvement through integration of enterprises, therefore "what a nation should demand of its agriculture is flexibility". This support for mixed farming was at odds with other, more official, agricultural planners of the period (*eg* Astor & Rowntree, 1946). He also advocated the siting of more industry in rural areas to increase working opportunities, and for improvements in amenities to help halt the decline in the rural population that he held in high esteem. While he also argued for greater food production, "with regard to the land surface, more weight should be given to its use relative to health, pleasure and mental balance than even for food production". He proposed new ways to facilitate the urban population to use the countryside for recreation. He also proposed extending the garden city ideal to include smallholdings and food production within urban areas. At the same time, he argued for "a great return to nature for the country as a whole". The need for national parks was considered (and developed further in *The way of the land*, Stapledon, 1942), but in ways that differed from others with the more conventional approaches that were to emerge after the war.

In 1937, the International Grassland Congress held its fourth meeting in the UK. This was held at Aberystwyth, in recognition of its pre-eminence for research in the science and technology of grassland and upland improvement. Professor Stapledon served as President of the Congress. In his Presidential Address, he described in detail the potential for ley

farming, incorporating the improved grass and clover varieties developed at the WPBS (Stapledon, 1937).

Professor Stapledon considered grasslands to be of vital strategic importance. If Britain needed to be prepared for a future war, its grasslands could provide a reserve of fertility – but they would require great renovation to accomplish this. The scheme that he implemented for renovation of the uplands of Wales had shown the practical feasibility of land improvement. This also provided a template for the post-war programme of land improvement.

In 1939, the first national grassland survey, which he had advocated in *The land now and to-morrow*, commenced and its findings greatly informed the wartime plough-up campaign during which the improved varieties bred at Aberystwyth were important to the success of the whole ley farming system. The surveys provided the basis for an Ordnance Survey grassland map of England and Wales at 1:6,300 scale (Davies, 1941; Green, 1974) and some 9 million acres of permanent grass were identified as potentially suitable for ploughing. Above all, it was Stapledon's writings on ley farming that influenced many landowners and those employed by the wartime agricultural executive committees charged with tackling the serious food shortages. In 1942, Stapledon's work on grasslands was expanded when he took up the directorship of a new Grassland Improvement Station on the site of derelict farmland at Drayton, near Stratford-on-Avon. For him this site was the epitome of all that was wrong with rural Britain. Following the war, the Minister of Agriculture stated that "without the achievements of Stapledon, Britain would have starved and could not have been capable of mounting any military challenge" (IBERS, nd).

Despite the urgent practical tasks presented at this time, Stapledon's philosophy developed further, and more politically, with particular reference to his ideals for a post-war Britain, for example on national parks. He found kindred spirits in some rural campaigners of the time and was a member of Rolf Gardiner's Kinship in Husbandry group and the Rural Reconstruction Association, with their links to the Soil Association and organic farming movement. In his book *Disraeli and the new age* (Stapledon, 1943) he alluded to many of Disraeli's ideas, from nearly a century before, to help crystalise his own thoughts, and he drew inspiration from Disraeli's energy and optimism. This included the role of capitalism to serve a new rural vision, particularly that of the greatness of the 'English character' (by which he meant British) and the need to maintain a vigorous agriculture. He muses on issues of spirituality, bureaucracy, health, public institutions, local self-government, art and education. The 1930s to 1940s was an era when many thinkers were drawn to ideas of central state-sponsored planning as a panacea for the problems of the time. Stapledon's writings include ideas for facilitating his own proposals, but he clearly favoured locally based systems of administration rather than bureaucratic control. In an age before social media, he was also clearly unafraid to risk controversy: "the greatest hope of reinstating human nature in its rightful position at the core of human affairs is the decentralisation of authority" (Stapledon, 1943). Although he was writing for a British readership, his ideas clearly had international relevance: "Countries should be self supporting in vital industries … International trade would further international friendship, but we should buy what we liked not what we dare do without" (Stapledon, 1943).

1940s to 1960: a period of change

The status of Professor Stapledon's work was recognised in 1939 when he was elected a Fellow of the Royal Society and knighted, and numerous other honorary awards and doctorates followed. He was an honorary member of the Highland and Agricultural Society and the academies of agriculture of Sweden and of Czechoslovakia. In 1944, while still Director of the Grassland Improvement Station, with a group of fellow grassland enthusiasts he helped establish the British Grassland Society (BGS), bringing together researchers, advisers, farmers, educators and members of the agricultural business trades. Stapledon was to serve as President of the new BGS for its first two years. The formation of the BGS had been discussed at the Fourth International Grassland Congress at Aberystwyth in 1937, and a similar organisation in New Zealand (NZGA) had been formed in 1931 after Stapledon's visit to that country. The focus of the BGS was on the exchange of information, knowledge and experience, publication, and putting research findings into practice, achieved through a combination of annual summer meetings with farm visits held throughout the British Isles, winter technical meetings and, from 1946, publication of articles and scientific papers in the newly established *Journal of the British Grassland Society*. Although at first its content had a domestic focus (articles on topics such as 'Fifty years work on grassland at Cockle Park'; 'Meadow grass silage on county Fermanagh farms'; 'The germination and establishment of red clover under conditions of direct re-seeding'), the journal soon began to include international topics with a regular 'Research and problems overseas' section. This is not the place to comment on the history and role of BGS (for which, see Powell *et al*, 1995) but rather to note Stapledon's contribution to this important achievement.

Before retiring in 1946, Sir George Stapledon was also instrumental in the setting up of what was to become

the much larger Grassland Research Station at Hurley, Berkshire (established in 1948, and a world-leading institute of its type until its closure in 1992) to replace that at Drayton. Its first Director was his former colleague William Davies.

Of course, in 1946 he did not retire completely. He continued to work as a scientific adviser for the Dunns Farm Seeds company and to pursue his writing and philosophy. His concerns about the adverse impacts of science and technological control over nature, and despair over modern trends and specialisations, and reliance on chemicals, as he sought to reconcile competing aims of expediency, environment and traditions, were not always well received. It was at this time that he wrote, though left unfinished most probably because of his failing health, his most philosophically challenging book, *Human ecology*, published posthumously (Stapledon, 1964). The subject of human ecology had been recognised as a branch of ecology for many decades, with various interpretations from the simple idea of humans as one of the many species in a closed ecosystem, such as hunter–gatherer societies, to more global assessments of the ecological role of humans. Today this has developed greatly with recognition of anthropogenic impacts, and the ideas of ecosystem services and coupled human and natural systems.

Stapledon's interpretation was a blend of science and philosophy, essential for the survival of civilisation. Some of his proposals were as controversial then as now: for instance, in questioning the wisdom of improving output and efficiency of workers and of the rate of technological progress. Many others, such as his near-contemporaries Bertrand Russell, Albert Schweitzer and DH Lawrence, had shared his concerns for the dehumanising effects of modernity. Stapledon himself had contributed greatly to the immense changes in the countryside during the wartime campaign for more food at almost any cost, and now saw a need to step back and pause. Perhaps here was recognition that the wartime ploughing-up campaign had been an "end that had justified the means", but it had greatly reduced what we would now regard as farmland biodiversity. Furthermore, reliance on inputs of chemical fertilisers and herbicides was having detrimental effects on the environment. Although some of Stapledon's views may now appear unfashionable, *Human ecology* can be seen as a real *tour de force*, full of imaginative ideas that now remain as intellectually stimulating and relevant to the future as they were when they were written. He was writing in the context of his vision for a better Britain, in which agriculture and high-quality food were seen to be at the heart of a better world, as one part of a balanced system. Concepts that could be applied to almost any country in the world.

The legacy of Sir George Stapledon

One of Stapledon's enduring legacies has been the Stapledon Memorial Trust, established following his death in 1960. From donations raised in the early 1960s, an investment fund was set up, the income from which supports the Trust's aims of "the promotion of agricultural research and education in memory of the late Sir George Stapledon". Its main activity is to provide travelling fellowships for researchers in grassland and forage in order to gain experience and learn new approaches by conducting research in another country (www.stapledontrust.org.uk). To date, over 160 travelling fellowships have been awarded, of which about a third have been to UK-based researchers for visits mainly to Australia, New Zealand and North America, and a similar number from these countries to the UK. A small number have been made to researchers in Europe, but nearly a third of the total has been made to recipients in Africa, Asia and Latin America to support travel for research at UK universities and institutes. Over the years, the Trust's committee has introduced some flexibilities to the terms (at first restricted to travel between Commonwealth countries, but now allowing for travel between UK and any other country). Although travelling fellowships remain the main focus of the Stapledon Memorial Trust, it also makes other types of awards, including bursaries to support research experience by young scientists, innovation awards to practitioners, grants to support grassland-related conferences, and support for publications.

We noted earlier the formation of the British Grassland Society which continues to flourish, with its balance of members from different sectors, and probably now has a greater focus on reaching out to farmers than it did in the past. The *Journal of the British Grassland Society* became *Grass and Forage Science* in 1979, and was placed under commercial journal publication. From around 20 papers annually in its early years, mostly from UK authors, it now publishes around 70 papers each year from around 300–400 submitted. Of particular note is its international scope, with a high proportion of contributions from authors in countries with tropical, sub-tropical and Mediterranean climate zones, as well as from authors based in temperate zones throughout the world. From 1996, *Grass and Forage Science* also became the official journal of the European Grassland Federation (EGF), as well as of BGS. The EGF itself was formed in the early 1960s at the request of delegates of the BGS, and its founding father was Dr William Davies, one of Professor Stapledon's closest colleagues (Prins, 2004).

The year 2019 marked 100 years of forage plant breeding at Aberystwyth (Duller *et al*, 2019). This milestone is a testament to Sir George Stapledon for the meticulous and objective procedures in plant biology that he developed

and which have continued, albeit with changes in methods to include gene sequencing and genome-wide selection. The former WPBS, now absorbed within the Institute of Biological, Environmental and Rural Sciences of Aberystwyth University, has continued to host and extend its opportunities to successive generations of scientists from around the world.

Many other legacies of his achievements are difficult to quantify. However, throughout the world, procedures for evaluation of novel varieties can be seen in field trials laid out according to methods similar to those of Stapledon. His recognition of the role of varietal improvement of grasses and legumes, and particularly of legumes as the fertility builders in grasslands, has achieved wide application throughout the world. Stapledon hated compartmentalised thinking; in education, as one who campaigned against specialisation in degree courses, he would have welcomed the growth of multidisciplinary science courses that emerged in many universities, particularly from the late 1960s. Similarly, in research he saw the need to join up soils, plants and animals, and to extend this by linking with physical and biological sciences. This was an approach adopted in the research carried out at the Grassland Research Institute Hurley, and was a model adopted elsewhere.

Professor Sir George Stapledon was one of the greatest agricultural scientists of his generation. As an agronomist, plant breeder and communicator, his impact on raising agricultural production was enormous. But his scientific knowledge was never considered in isolation, and concepts such as sustainability and ecosystem services run through much of his later writings, though without the modern-day terminology. Although he remained true to science, he was ahead of his time in terms of his philosophy with regard to the need to question the wisdom of science and progress, and to consider human interactions, in terms of food, culture, wellbeing and rural socio-economics.

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TAAF 2019 reports

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Are the industrial parks a new route out of poverty for working women in Ethiopia?

This study considers the impact on young women who have migrated from their rural homes to seek employment in Ethiopia's industrial parks. The industrial parks have recruited thousands of rural women who had previously worked on their family farms or at home, to work as garment and textile operators located at one of the six fully operational hubs in Ethiopia. While policy makers and donor agencies have analysed the macro-economic and trading benefits resulting from the production of goods supplied by the parks, very little is known of how these parks impact rural women and their communities.