FOOD SECURITY

THE GROWING THREAT TO UK FOOD, LAND AND WATER RESOURCES

February 2015, Woods B.M. and Warren G.D.

Summary

Britain's population is increasing faster than ever before. The world's population is expected to rise from 7 billion now to over 9 billion by 2050. All will need food and water. But increases in world food production are not keeping pace with global population increase.

Britain now imports over 60% of the agricultural products it consumes. In 2009, the British government set the target of doubling food production in Britain by 2040. This is an immense challenge, requiring the use of all our existing farmland. At the same time, irreversible loss of agricultural land is being caused annually on a huge scale by construction of houses and associated educational, health, recreational and employment-related facilities and transport infrastructure required by the growing population. Meanwhile, 40% of all food purchased in Britain is currently wasted.

Substantial increases in plant and animal production require corresponding increases in available water. Britain's south eastern counties are major food producers; they are also the driest counties where available water and increasing conflict between agricultural, domestic and industrial demands for water will become an increasing constraint on greater crop and livestock production.

Changing food tastes with rising incomes in emerging economies are creating new markets for many food products which Britain imports - but without the necessary increases in production of those products. Prices of those foods are already rising in Britain. They will rise at an accelerating pace in the future as new demand worldwide outstrips increase of those crop and livestock products. Substantial and rapid rises in food prices in Britain are likely to threaten our social, economic and political stability.

The overriding need in Britain now is to create the awareness and understanding at all levels of society country-wide of: i. the nature, urgency and practical implications of the approaching food and water crises, and ii. action needed to address these. This calls for a national communication initiative and for appropriate action by all planners and policymakers responsible for the conservation of farmland, water and biodiversity. This is a pre-requisite to driving food, land and water issues up the political agenda.

The nature and causes of the general lack of awareness and understanding of the prevailing food, land and water situations are discussed and the critical steps outlined for addressing the necessary changes in awareness and policies at national, county and local levels now needed urgently for Britain's food security.

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THE GROWING THREAT TO UK FOOD, LAND AND WATER RESOURCES

1. FEEDING BRITAIN

For over 200 years, Britain has imported more and more food and other agricultural produce from abroad to the point where we now import over 60% of our annual needs - 40% of our food, including some 85% of our the fresh fruit and vegetables. We cannot continue to do this. Causes for this are the combination of the rapidly changing global food situation, the effects of the continuing loss of farmland in Britain, and the growing water shortages - in the southeastern counties in particular.

A. The Global Situation:

In 2010 the world's population was 6.82 billion and is projected to rise to 9.1 billion by 2050 - with corresponding increases in demand for food. Changing food tastes, associated with higher incomes, are rapidly creating new demand and new competition from increasing numbers of people in the more advanced developing countries for the types of foods Britain is importing. The new 'mega-economy' countries now emerging (e.g. Mexico, Brazil, Indonesia, Malaysia, Ubekestan, Nigeria) will quickly add to this growing demand for increasingly scarce export crops.

The causes of this growing global food crisis are set out in Annex 1. They include:

i. widespread loss of soil fertility;
ii. reduced rainfall and soil water levels;
iii. inability of increases in crop and livestock production to keep pace with increases in population;
iv. big increases in prices of oil-based fertilisers leading to reduction of use by poorer farmers and consequent falls in yields;
v. sea level rises causing increasing flooding of highly fertile and heavily populated river deltas, and
vi. the rate of global increase of many of the most important food crops peaked between 1980 and 2010 and their rate of increase is now falling.

All of the above, combined with the global population increase referred to earlier, combine to create an accelerating increase in demand for food worldwide without corresponding increases in supply. All combine to have profound implications for rapid, worldwide food price rises, particularly for imported foods on which Britain so heavily depends.

B. The Situation in Britain:

Land

The maximum population Britain can now sustain from it's own food production capacity is estimated to be 30 million people. In 2010, the UK population was 68 million and is projected to reach 73 million by 2040[1]. In 1900 there were 20 acres of agricultural land

[1] Food industry in Kent, draft evidence base 2010. Report by Kent Rural Board.

per person in Britain. As a result of the combination of population increase, house building to accommodate this increase, and other forms of infrastructure and commercial construction, there is now less than one acre of farmland per person. This will drop further by mid-century[2] if we continue to: (a) lose our quality agricultural land for 'development' purposes, and (b) permit the current annual influx of immigrants into our crowded island to continue. For an in-depth assessment of Britain's land and food crop situation, see the recent study by the Cambridge University Natural Capital Leadership Programme, 2014.[3] This study's demand-supply analysis findings showed a potential additional demand for up to 7 million hectares (61 million acres) to meet a growing UK population's food, space and energy needs while protecting the nation's natural capital. (This more than 35% of the UK's existing agricultural land area.)

Following the Oxford Farming Conference, 2009 the government accepted recommendations from its Chief Scientific Adviser and agricultural and other scientists that Britain should set a target for doubling food production in Britain by 2040. Crop yields in Britain are already high by international standards already. To double them from the same acreage in 25 years' time is an immensely ambitious target. To achieve a doubling of output with an annual reduction in our farmland is likely to prove unattainable. While Britain has been able to buy food from abroad, the annual loss of more and more of our quality farmland has been sustainable. That option is rapidly fading.

Very large numbers of houses, with planning permission, remain unbuilt; large areas of brownfield sites are not built on because of the relative ease, convenience, lower cost and higher profitability of building on agricultural land. New housing developments are being designed (and approved) as though the supply of land and water in Britain were infinite. Centralised projections of new housing needs have been based largely on linear projections from past data and to satisfy political goals. The land required for the houses and other construction included in the current Local Planning exercise runs into hundreds of thousands of acres - most of which will be agricultural land. Planners must now recognise and accept the new confines on planning which the preservation of agricultural land, water and biodiversity impose.

A new factor with serious implications for our farmland: The value of agricultural land in Britain has risen over 200% in the last ten years. This value will continue to increase as more land is lost while more, not less, is needed. Foreign investment companies have begun to see farmland in Britain as a profitable investment option. Strict regulations are called for to ensure that foreign owners of British farmland can only use that land for farming purposes.

Specific action needed, and new scientific advances with potential for increasing agricultural production are shown in Annex 2.

2. Food

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2 'Investing in the Global Food Chain; it is no longer Business as Usual.' Themeresearch, 2012

3 Cambridge University Natural Capital Leadership Programme: cisl.cam.ac.uk/NatCap

Solutions call for, among other things, major emphasis and priority on the following:

- a big increase in investment in agricultural research;
- confine new construction of buildings and solar 'farms' to brownfield sites and only the poorest agricultural land;
- rationalise projections for new housing in the context preserving agricultural land and local water availability; (See Section 4. below and Annex 3.)
- new investment to convey water from the wet northwest of the country to the water-starved south east. East Kent is now categorised as a Water Crisis Area; (See Section 3. below and Annex 3.)
- replacement for retiring farmers. The average age of farmers in Britain is over 50. Almost 60% are expected to retire or to leave farming in the next 15 years. Experienced farmers are not immediately available; they require an appropriate educational background plus a number of years of practical farming and farm management experience;
- preserve our biodiversity to maintain sustainable conditions for plant and animal growth;
- reduce population increase in Britain - including drastic review of the benefit system to eradicate the incentives it currently provides which encourage single parenthood, teenage pregnancy, and the 'safe haven' Britain offers to immigrants, and
- reduce drastically the food wastage in Britain. 40% of the food bought annually is wasted.

40% of the food bought in Britain annually is wasted. There is further wastage on farms, mainly in storage, and wastage due to excessively strict purchasing criteria by supermarkets relating to size, shape, or colour of fruit and vegetables causing discard of perfectly edible products. Substantial reduction of this wastage would make a significant contribution to food availability.

Britain must produce more – much more – of the food we need, and reduce drastically the amount we waste. If we fail to do these two things, food costs in this country, which are rising already, will rise ever more rapidly in the coming years with profound implications for the costs of living, for hunger and for future social, economic and political instability. Specific action needed, and new scientific advances with potential for increasing agricultural production are shown in Annex 1.

The cost of food as a percentage of income is highest for the poor. They will be the first to suffer from rapidly increasing food prices and costs of living. The majority of the poor in Britain are heavily concentrated in the urban areas. These now include an increasing number of immigrants with first hand experience of using civil unrest as a political tool. Rapidly rising food prices are likely to trigger unrest among these concentrations of poor people and disenchanted youth - leading quickly to social unrest and economic and political disruption.

Britain is faced with a clear choice. Either we:

a) make an over-riding priority of doubling food production by 2040 (and therefore of conserving and protecting agricultural land and biodiversity, reducing food waste and conserving water), or
b) continue to destroy our agricultural land and increase our dependence on food from abroad, irrespective of soaring costs and decreasing availability of that food.

The choice of the former at national and local levels will require, and follow from, a British population informed and understanding (i) the period of profound changes in world food supplies and available water which we are now entering, and (ii) the practical implications for all of us in Britain.

3. WATER

Any increase in the volume of crops or livestock produced requires a commensurate increase in the availability of water. Unless this need for water in drier areas of the country is addressed, a doubling of food production in Britain by 2040 will not be possible. (See Annex 3.)

The relationship between scarce water and food production has been of little or no concern in the minds of most people in Britain. However, in addition to the water that we use daily for domestic purposes, water is required to produce every type of food and natural fibre product we need, and in the manufacture of virtually every product we use.

In importing food and other agricultural products, Britain is, effectively, also importing the equivalent of the water used to grow those crops - known as **'virtual water'**. As water becomes scarcer in those countries, its costs and value to those countries rises. Inevitably, the prices of the products of that water will also rise.

The 'virtual' or 'hidden' water requirement has been calculated for growing most crops, livestock and natural fibres. Water authorities' projected daily allocation of water per household in Britain for normal domestic use is currently 130 litres per person per day. (A water-conscious population could manage on less than this amount.)

To obtain a figure for the total water required per person per day, we need to add to the domestic requirement the water needed to produce: (a) the commercial and industrial products we purchase; (b) the crop and livestock products of British origin we consume, and (c) the 'virtual water' required to produce the 60% of the agricultural products we consume which come from abroad -many of which have high or very high water requirements e.g. sugar, rice, tea, bananas, coffee, cocoa, and most tree fruits, rubber, palm oil, cotton, and many others.) The sum of all of these for the people of Britain is calculated at approximately 4,600 litres per person per day.[4] Thus we are heavily dependent on other countries' water. (Britain is the six highest 'virtual water' importing country in the world.)

Much of the fresh fruit and vegetables we import comes from relatively dry areas using irrigation. Countries include Spain, Morocco, Egypt, Israel, South Africa, Pakistan, Uzbekistan and USA. Many of the producing areas are rapidly depleting their groundwater reserves. (For example, in coastal areas of Spain, groundwater levels have fallen by up to 65

[4] 'Virtual Water' by The World Water Council at: worldwatercouncil.org

ft. and the groundwater is becoming saline.) By continuing to export these fresh products, countries are depriving themselves of that water and it's alternative uses. Thus water in most of those areas is becoming an increasingly scarce resource and the products of that water are becoming more expensive for us to import.

None of the above takes account of climate change in Britain. Farmers' greatest challenge is uncertainty. Farming in Britain is already an uncertain business due to the vagaries of our weather. This will only increase with climate change and impose more risk on farmers attempting to maximise production from their land. This will have potentially serious implications for increasing food production in Britain unless some form of government-backed security scheme can be devised to enable farmers to spread their risks over several growing seasons.

Annex 3 outlines:

i. the process now in use for calculating available water reserves in any given area and how this needs to become an essential tool for planners in assessing water availability for any new, water-demanding development being proposed. (Its use in Kent has shown the water crisis situation developing in that county);
ii. the global water situation and its profound implications for future food production worldwide - and for Britain, and
iii. information for Kent on projections for water availability over the coming 25 years.

4. PLANNING

Local planning throughout England is entrusted to County and District Councils and, increasingly, to Parish Councils. The priority of their work is heavily oriented towards their urban populations. The Councils deal with social and physical infrastructure and services in the rural areas (including new housing) but otherwise have little involvement in rural affairs. This is apparent from their websites. Examples from several southeastern counties are shown in Annex 5. All the websites show common patterns; in none of them does the relationship between food production and available land and water appear to be seen by planners to be an issue.

The current Local Planning exercise to produce a framework for planning at county and local levels country-wide until 2031is now complete in draft form for most counties. The sum of the very large number of new houses and related physical infrastructure and services being proposed will require vast areas of land - most of it being productive agricultural land. Plans for this irreversible loss of farmland appear to have been drawn up in ignorance (or disregard) of the national and international food emergency and growing water shortages bearing down upon us.

There is great urgency for introducing, at the highest levels of government, the policy changes that these will require and before current results of the Local Planning exercise can convert more of our remaining farmland to sprawling housing estates and commercial 'parks'.

The Problem:

We have now the extraordinary situation in Britain whereby, on the one hand, the government is calling for a doubling of food production by 2040 while, at the same time it is paying councils for the building of hundreds of thousands of houses most of which will destroy permanently agricultural land needed for that food production. There appears to be an institutional blindness within planning authorities to the growing conflict in all drier counties between new water requirements related to rising populations and their housing, recreational and employment-related water needs, and the substantial, additional water needed to increase crop and animal production. (See Annex 4.)

How has this situation come about?

The problem follows from the prevailing mindset of many at all levels in the planning hierarchy. It is shared by most politicians with predominantly urban backgrounds with their short-term, often self-serving and parochial priorities. In his first government, Tony Blair appointed Margaret Beckett to be First Secretary for Environment, Food and Rural Affairs. While holding this position, she made the statement:

> "Farmers are not really needed in Britain. We are a wealthy nation and can buy in the food we want."

This view and it's practical implications are shared by a large majority of the 50 million people now living in the urban areas of Britain - and many in rural areas too who are not involved in farming and lack awareness of the global food and water situations. The solution for changing this mindset involves creating throughout the population the awareness and understandings and perceptions to enable the new decision making and practices now required. Pivotal to all of what is now urgently required is a national communication initiative to create widespread awareness in Britain of the issues outlined above.

Annex 5 sets out:

i. the objectives and nature of a National Communication Initiative;
ii. current institutional obstacles needing to be overcome in introducing this Initiative, and
iii. action needed to overcome these constraints and a role for CPRE.

By its nature, implementation of a National Communication Initiative needs to commence at both national and county/local levels. Annex 6 contains a brief outline of practical steps needed for this objective at county level.

ANNEX 1.

GLOBAL FACTORS AFFECTING FOOD PRODUCTION

The industrial revolution created unprecedented job opportunities in Britain, and increasing rural to urban migration. New income generation was accompanied by changing food tastes and new demand for food from abroad. This coincided with the growth of Britain's territories in subtropical and tropical countries; the need to develop their agriculture as a base for their economies and the growing market Britain (and other European countries) provided for their agricultural products. This process has continued with ever greater commercial and industrial development in Britain and dependence on imported food to the point where now Britain imports annually some 62% of the agricultural products on which it has become dependent.

This same pattern of progression from rural to commercial/industrial development is taking place, at varying rates, in countries around the world. But with an all-pervading difficulty from which Britain's rural to urban development did not have to face: the unprecedented rate of population growth and its universal effects on food and water demand and supply. Few countries in the world are as dependent as Britain on agricultural imports, yet few people in Britain are aware of factors affecting global food production or the nature of the looming world food crisis. These factors include the following.

i. In 2010 the world's population was 6.82 billion and is projected to rise to 9.1 billion by 2050 - with corresponding increases in demand for food and water. The new 'mega-economy' countries now emerging (e.g. Mexico, Brazil, Indonesia, Malaysia, Ubekestan, Nigeria) will join China and India and will quickly add to the growing global demand for increasingly scarce export agricultural crops.

ii. Worldwide, agricultural land, land fertility and productivity are being lost at an accelerating rate, particularly in tropical and subtropical countries, through soil erosion; reduction in soil organic matter and related loss in soil structure from over

use and over-grazing; salination of irrigated soils; alternate uses of farmland for biofuel production, and consequent expansion of arid and desert areas[5].

iii. Massive population increases in tropical and sub-tropical countries are accompanied by corresponding increases in water needed for those peoples' domestic requirements. Most of the additional rural families own livestock; they too need more water. Population growth has also led to the clearing, cultivation and grazing of ever more marginal lands. More and more people in both rural and urban areas have created huge new demands for fuelwood for cooking, heating and animal fodder. Vast areas of 'bush forest' in drier and semi-arid lands around the world are being cleared to meet these needs. This, together with the destruction of rain forests for timber, has influenced rainfall in wide areas. In semi-arid and arid areas of north eastern African countries, for example, rainfall and groundwater levels have been falling steadily over the past 40 years with associated reduction in crop and livestock production, successive famines, progressive desertification and increasing migration to towns.

iv. A recent study led by Yale University[6] examined the 'Synchronized peak-rate years of global resources use'. The crop and livestock products examined, and their annual increase studied over the past 50 years, were:

Cassava	Cotton	Dairy
Eggs	Fish caught	Fish farmed
Maize	Meat	Meat indigenous
Meat poultry	Milk	Oil palm
Rice	Soya Beans	Sugar Cane
Wheat	Wood	

Also examined were: Cropland area, Irrigated land area and Fertiliser Use
All increased to the point of a peak-rate year (14 of them between 1985 and 2010) but their rate of production increase has declined since that peak.
The peak-rate year for population growth passed in 1989[7], but the falling rate of increase of crop and livestock products is greater than that of global population so the gap between the global population's needs for essential foods and levels of production of those foods continues to widen.

v. Of particular global significance are projections for cereal production. Cereal grains are humankind's major food, contributing more than two-thirds of the world production of edible dry matter and half of the world's protein. Globally, without major technological intervention, the annual rate of growth in yields of the major cereal crops is likely to slow, as it has from 3.2% per year in 1960 to 1.5% percent in 2000[8]. To meet demand, the World Bank estimates that cereal production will need to increase by 50% (from 2.1 to 3 billion tonnes), and meat by 85% (to reach 470 million tonnes) between 2000 and 2030[9]. Over one third of the world's cereal

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5 For a summary of the current climate change situation and its effect on Britain's food supply, see Sir Crispin Tickell's paper for the Oxford Food Conference: 'Climate Change: the Hazards and Opportunities for Agriculture'. www.Crispintickell.com

6 Seppelt, R., A. M. Manceur, J. Liu, E. P. Fenichel, and S. Klotz. 2014. Synchronized Peak-rate Years of Global Resources Use. *Ecology and Society* **19**(4): 50. http://dx.doi.org/10.5751/ES-07039-190450

7 (Lutz K. C. 2010)

8 FAO. How to feed the world in 2050.

9 World Bank. World Development Report 2008: Agriculture for Development.

production is being used as animal feed[10]. This has serious implications for meat price rises as priority demand for cereals for the growing human population increases.

A high percentage of the incremental food produced in the world over the past 30 years has been as a direct result of using oil-based fertilisers. Between 1990 and 1997 the average price of fertilisers and soil improvers rose by 124% - rendering them unaffordable to many millions of poor farmers and so reducing their yields of cereals and other crops. Fertiliser prices have continued to rise since 1997.

vi. Much of the surplus food around the world is produced on the highly fertile soils of river deltas; many of those areas are also densely populated. Those areas are the first casualties to sea level rises - first by the sea backing up the big rivers which have formed the deltas, leading to fresh water flooding; subsequently by actual flooding by the sea. These processes have already begun - with growing implications for rendering those soils unusable and inhabitants landless.

vii. A deliberate new policy in China is to follow past experience of western European countries which concentrated new investment on industrial development and bought food from abroad.

viii. 50% of the world's people lived in urban areas in 2010 - and so bought a high proportion of their food. The urban dwellers are expected to rise to 70% by 2040. This equates to an additional number of people having to buy their food of more than double the current population of Europe. (The Cambridge University study referred to above foresees the urban population reaching 85% by 2085.)

All of the above contribute to increasing the global demand for food without corresponding increases in supply. All combine to have profound implications for rapid, worldwide food price rises, particularly for foods on which Britain so heavily depends.

Annex 2

Action Necessary to Increase Food Production in Britain

A. LAND

The area of high quality agricultural land in Britain is finite. The government's call for doubling output from the same area in the next 25 years, bearing in mind the growing constraints to this objective referred to above, make the need to conserve and protect this land paramount.

The current Local Planning exercise to produce a framework for planning at county and local levels country-wide until 2031 is now complete in draft form for most counties. The very large number of new houses and related physical services being proposed are roughly estimated to require in excess of a quarter of a million acres of land - most of it being productive agricultural land. Plans for this irreversible destruction of farmland appear to have been drawn up in total disregard (or ignorance) of the national and international food

[10] UN, Food and Agricultural Organisation: 'How to feed the world in 2050' Rome, 2009

emergency bearing down upon us. (It is not irrelevant to note that, as an encouragement to build more houses, Councils receive £1,000 for every new house built in their areas and more than this amount subsequently from taxes etc. on those homes.)

A contributing factor to our loss of agricultural is the valuation process in which its value is calculated on the estimated annual productivity set against the estimated return from whatever form of construction is proposed. The land's value would be seen to be far higher if the cumulative value to the nation were based on it's annual crop and livestock production potential over many years. If this basis for land valuation were adopted it would take account of substantial increases in crop prices in the foreseeable future, and the increases in value arising from a continuing reduction in available agricultural land as more and more is lost to construction and to renewable energy production - both from solar and bioenergy.

If we cannot change the prevailing attitude towards our agricultural land amongst planners, policy makers and politicians particularly, we will have no choice but to try to satisfy our food needs with ever more expensive food from abroad.

- and rationalising projections for new housing in light of food production and water needs (see Section 4. below and Annex 3.);
- The average age of farmers in Britain is over 60. Almost 60% are expected to retire in the next 15 years. Experienced farmers are not readily available; they require an appropriate educational background plus a number of years of practical farming and farm management experience;
- preserve our biodiversity to maintain sustainable conditions for plant and animal growth;
- limit population increase in Britain - including drastic review of the benefit system to eradicate the incentives it currently provides which encourage single

On the positive side:

i. Spectacular advances are foreseen involving soil-free hydroponics, 24 hour controlled lighting and full water recovery and re-use (in a process now called 'vertical farming' because it can be carried out, with little additional floor space, on the walls of tall buildings). These techniques can provide many types of fruit and vegetable crops for the rapidly growing populations of cities worldwide. Examples already exist on all continents and this new science is advancing rapidly.[11] For example: A new 'vertical farm' in Scranton, Pennsylvania will grow 14 consecutive lettuce crops per year, as well as spinach, kale, tomatoes, peppers, basil and strawberries. (The technique is not suitable for growing food crops requiring large areas of land - cereals, sugar and root crops in particular - and tree crops.)

ii. A second 'green revolution' is needed but the cross-breeding techniques used 60 -70 years ago, by their nature, require many years of crop generations to produce, test and prove the new varieties needed. The growing food crisis the world now faces requires the use of the most modern breeding techniques involving gene transfer of characters of higher yield, disease and drought resistance, nitrogen fixation and others for specific climates and soil types. Proven technology for this already exists. However, this is no instant solution; any plant with new characteristics has to be field tested and stocks of seed built up - matters of

[11] New Scientist, 14 January, 2014, 'Fruit and veg fresh from the skyscraper'.

years not months! The urgency and priority for funding this work has yet to be widely recognised. Creating this understanding and recognition needs to be one objective of the communication programme described below - as too will be the information/education needed to address current, mostly ignorant opposition in Britain to plant breeding involving gene transfer.

ANNEX 3

WATER RESOURCES

1. RELEVANCE TO LAND USE

The Balance of water resources for any river or groundwater catchment has a direct influence, albeit to varying degrees, on the nature of land-use. But the reverse case can apply when physical changes to a catchment, caused by, for example, urbanisation, land drainage, de-forestation or road construction, bring about corresponding changes in river run-off or evaporation losses. Aspects of river flooding also need to be incorporated in any routine assessment. Hence, a hydrological 'budget' can be compiled for any specific area to serve as a reference for water availability for that area. In its simplest form, this could be expressed as:-

GAINS	LOSSES	BALANCE
RAINFALL	EVAPOTRANSPIRATION ABSTRACTION	RIVER FLOW + CHANGE IN STORAGE

From this we can derive estimates of the proportion of the resource committed to abstraction for all purposes (e.g. public supply, industry, agriculture), and this gives us a basic indication of "sustainability". The Environment Agency (EA) in November 2012 published the results of a national survey on similar lines and have assessed most of the Kent area as "seriously stressed". Examples of the process were also included in the CPRE strategy documents published in 2006 (Kent) and 2007 (S.E. England). The water resource assessment, for whatever period, would form an input to the land-use discussion alongside the environmental, social and economic components; and provide a basis for assessing water availability for any form of development which increases demand for water.

2. THE PROCESS

1.1 In practice, a water resource assessment can be seen as comprising two separate routine determinations:

a. The "natural" Water Resource Balance, and

b. Water Company Supply/Demand Balances.

i. The Water Resource Balance is a catchment based process that can be up-dated annually using EA, Water Company and Met Office data; and usually summarised as monthly and annual estimates.

ii. The Water Supply /Demand Balances are calculated by each of the companies for theirrespective supply areas and the smaller constituent water resource zones. Supply capacity is expressed in terms of both average and peak drought output and the corresponding demands are estimated for annual average and dry year critical periods.

iii. The output from each Water Company Supply/Demand Balance forms the basis for their short term (5 year) and long term (25 year) Water Resource Management Plans (WRMPs.) These provide the context for assessing the impact of such factors as climate change, population growth, housing development and a range of environmental sustainability commitments.

1.2 A typical programme of plan options would include:-

Leakage control
Water efficiency measures
New boreholes
Additional reservoir capacity
Effluent re-use (indirect)
De-salination of brackish waters
Internal transfers
Inter-company transfers

3. SUPPLY AND DEMAND IN KENT 25 YEARS ON

3.1 Agricultural usage amounts to approx. 1% of the total demand, the greater part (80%) being committed to public supply; and for most catchments (whether river or groundwater), there will be a net deficit in the resource balance which will generally preclude further development for irrigation other than on the basis of "imported" raw water transfers or winter storage. The water companies also face major challenges in the formulations of their Water Resource Management Plans (WRMP) and three factors in particular have a direct bearing on any long term strategy for what is essentially a diminishing asset. These are:-

- Population growth
- Environmental sustainability
- Climate change

3.2 Population growth is one of the more problematic and uncertain terms in the demand calculation. Growth in the South East has been forecast at 14% over the next 25 years. For Kent, with a current population (including Medway) of approximately 2M, this would amount to an increase by 2040 of nearly 300,000 new water users: representing an additional demand of 39 Ml/d. (assuming an average per capita demand in the next 25 years of 130 l/h/d). This additional 39Ml/d. has to be found during the planning period.

3.3 Environmental Sustainability remains the largest single element of future demand growth within the medium – long term but it also rates as the most difficult to forecast with any measure of certainty. The European Water Framework Directive requires member nations to take measures to achieve "good status" in the environmental quality of both surface and groundwater regimes; and this could entail substantial reductions in the annual and daily quantities abstracted for public supply from certain specified rivers and aquifers. There is a target date of 2026/27 for full implementation but we have no firm estimates of the likely total reduction required. One water company has adopted a "worst case" figure corresponding to more than 50% of their average and peak abstraction rates; and this would have to be replaced from other (mainly external) sources of supply. The water balance review published by CPRE in the 2006 report "A Water Resource Strategy for Kent" included an estimate of average daily deployable output, as a total for all constituent companies, of 766 Ml/d. If we take the EWFD objective as applying to the authorised maximum daily quantities, the worst case sustainability reduction target for Kent would be 50% x 766 = 383 Ml/d.

3.4 A forecast of the impact of climate change demand was outlined in the 2007 CPRE report "A Water Resource Strategy for South East England". Tentative forecasts were attempted, based on the Hadley Centre UK Climate Impacts Programme (UKCIPO2) Report, "Climate Change Scenarios in the UK April 2002." These clearly require up-dating but, for purposes of a preliminary indication of the implications for demand growth, we could work on the basis of the Hadley forecast of a 1◦C increase in annual mean temperature, with a corresponding 5% net decrease in mean annual rainfall. This, as reported in the Environment Agency 2004 review, translates into a 20 year increase for the South East of approximately 3%; and it would seem appropriate to carry the same estimate forward as the increment for the 20 year period 2015 to 2035. The 2006 CPRE estimate (outlined in Fig 13) anticipated an overall climate change demand growth rate for the 20 year period to 2026 of 3% which, for an initial demand level of 725 Ml/d gave a climate change increment by 2026 of 74 Ml/d. If, to simplify the process, we assume continuation of the climate change impact at the same rate, this would add a further 40 Ml/d for the period 2026 to 2040, giving an out-turn demand of 839 Ml/d; an increment relative to the 2014 level (755) of 84 Ml/d.

3.5. In summary; by 2040, the 3 factors could amount to a combined demand increment of 506 Ml/d which, added to the 2006 dry year critical period demand gives an out-turn demand of 725 + 506 = 1231 Ml/d; a potential deficit for 2040 of 1231 – 765 = 466 Ml/d, (assuming of course that no action is taken to increase the total deployable drought output beyond the 2006 figure of 765 Ml/d)

3.6 Even assuming a 100% over-estimate of the demand increment, Kent would still face a net deficit of more than 200 Ml/d to be made-good during the next 25 years; representing a level of capital investment at least 3 x that of any supply-side scheme undertaken in the last 40 years. This is the measure of the competition facing any agricultural case for increased abstraction under peak season conditions. There is an inevitable co-incidence of peaks for PWS, irrigation and sustainability requirements, and this is without any special measures needed to address existing local stresses on resources (Ref EA Nov 2012) or to improve water company levels of service under design-drought conditions. At such times similar supply/demand shortfalls are likely to apply throughout the South East and the deficit cannot be resolved by improved local transfer agreements or any of the options identified in the short-medium term programmes embodied in the current WRMP. The solution must self-

evidently be strategic and inter-regional, and possibly involving a Major NW – SE transfer initiative. (This takes no account of any additional demand arising from the influence of global shifts in the management and conservation of water for agriculture.)

4. THE ELEPHANT AT THE WATER HOLE

4.1 It has been reported (Ref. FT 15.7.2014 .) that global water use has increased 4–fold in the last 60 years from approx. 1,000 to 4,000 Km^3/yr and forecast to increase to more than 5,000 Km^2/yr by 2025. Water scarcity should perhaps now be regarded as a more urgent issue than climate change, and reflected as such in the range of ("shadow") potable supply prices –anything from 50p/m^3 to £3/m^3. The condition is exacerbated by the fact that more than 40% of the world's fresh water (both surface and groundwater) is held by just 5 countries: Brazil, Russia, US, China and Canada. Leading multi-national (including Nestle', Ford, Coca Cola, Rio Tinto, EDF, BG Group, Shell, BHP and Google) are now reported (Ref FT. 1/7/14) as having to adapt to rising water costs world-wide and are committing record levels of investment (estimated at $84 Bn since 2011) to water management and conservation measures, having identified water availability as a substantive business risk factor. The Chairman of Nestle' has been quoted as saying "we will run out of water before we run out of oil".

4.2 Agriculture accounts for 70% of all global water use with 22% industry and 8% domestic: almost the reverse of the UK/W. European picture. There has also been a disproportionate exploitation of groundwater and 2 bn people now rely on this source for drinking and irrigation. As a consequence, many aquifers are being over-pumped and water table levels are declining "rapidly" (NW India being the worst case). The situation is exacerbated by the continuing high level of population growth (8bn by 2030); much of this in middle income groups with the correspondingly high demand for processed meat products. Steep increases are also forecast for power generation and overall the energy sector is expected to double its water requirement within the next 25 years.

4.3 The magnitude of the demand element puts the solution more in the hands of government than any single water undertaking; and examples can be sited from Israel and Singapore. But commerce has also taken a lead with a group of large multi-nationals joining with the International Finance Corporation to form the "2030 Water Resources Group", with the objective of highlighting the scale of the water scarcity problem and identifying cost effective solutions. One report by the group concludes that, failing effective action, the demand for freshwater is likely to outstrip global supply by approx. 40% by 2030.

The cost of desalination increases with the level of salinity of the water. Thus desalination of brackish water is a lot simpler and lower cost than desalinating sea water. Without spectacular advances in low cost and low energy techniques for desalination of sea water, current desalination technology offers only a very modest solution for the growing, global demand for very large quantities of fresh water.

5. IMPLICATIONS FOR KENT

It is conceivable that the solutions to the supply deficit for many of the producer countries will call for high levels of investment in water resource development schemes

which must in turn be recovered from the sale of produce in the most profitable markets, regardless of geography. And this will almost certainly inflate the international price of many of the items currently imported by the UK. In this event the question arises as to the extent to which farmers in Kent would be encouraged to increase their acreage of high value agricultural and horticultural produce, much of which could in turn require more intensive irrigation. And for such areas, this could put agricultural interests in direct competition with other uses for the already depleted water resource.

It should follow therefore that no national strategy for the development and management of our water resources can go forward other than in a global and national context. And whatever form it takes must have sufficient scope and resilience to make appropriate provision for increased emphasis on local produce, and reduced dependence on what may well prove to be increasingly erratic and expensive imported alternatives.

6. CURRENT IRRIGATION DEMAND IN KENT

The CPRE Kent Water Resources Strategy of 2006 included a figure for the total authorised direct abstraction for spray irrigation as averaging 10,000 Ml/ann. Based on 2004/5 returns, this was taken as representing an increase of approximately 50% over the previous 30 years. But the same period also saw significant growth in the use of trickle irrigation which did not require a licence. Estimates at the time indicated an uptake for this category of around 1500 Ml/ann. Returns by EA for 2005 – 2012 show total authorised abstraction for spray irrigation averaging 10,100 M/ann which suggests that any increase in irrigation use has been taken up as trickle.

South Eastern Water has also provided a summary for 2005 – 2072 of water supplied to agricultural (including livestock) and horticultural users. This covers their entire supply area including zones 4 + 5 in E. Sussex and averages out at 14.0 Ml/d; ranging from 13.0 to 15.1 Ml/d with no significant trend. The question arises as to whether there are any parts of Kent where restrictions on authorised abstraction are already acting as a constraint on the use of irrigation for the cultivation of high value crops.

GDW.
August, 2014

ANNEX 4

PLANNING: County Council Attention to Agriculture and Water

The Kent County Council (KCC) website offers a comprehensive title index of over 200 topics which the website covers, but agriculture, farming, woodlands, forestry, the rural sector, villages, and water are not included. All non-urban land is collectively termed

'greenspace' in the website - with the implied assumption that all ‘greenspace’ is equally eligible to be built on.

The East Sussex County Council (SCC) website does have an entry for Farming but this only considers 'Animal Health and Welfare'.

The Surrey County Council Website gives greater attention to it's 'Rural Sector' it begins with the curious statement: 'Although farming and forestry account for only a small proportion of the County's total gross domestic product, their impact on the maintenance of the landscape is significant'. A 'Consultation on the Issues Facing Surrey' was held in 2008 from which followed a ‘Surrey Rural Strategy 2010-2015’. However, in this document, future provision of the necessary food, land and water are not shown to be issues in Surrey.

The Norfolk CC’s website includes a section on ‘County Farms’ which describes NCC’s County Farms Estates covering 16,200 acres of farmland let to 145 tenants across the county. There is no mention of other farmers in the county and the only reference to water is to ‘Waterways’ administered by NCC. The Oxfordshire CC website, like East Sussex, only mentions farm animals giving guidance on their identification, movement etc., their welfare on the farm and disposal of dead carcasses. Otherwise farming activities do not appear to warrant a mention in the county. Water receives more attention than in the other county websites. A Thames Water company plan to build a new reservoir to meet demand for water over the next 25 years was rejected by the relevant Secretary of State on the grounds that an adequate case for the reservoir had not been made.

Many County Councils have helped to set up Rural Boards (names vary) for rural sector development. Their chief function has been to attract investment into the rural sector and their assistance includes such things as community halls and shops, rural housing, transport, access to services, post offices and even broadband installation and upgrading.[10] It is not the role of the Boards to handle issues of farming, woodlands, forestry, water, or preservation of biodiversity.

Thus the County and District Councils seem largely unaware of the looming food crisis for Britain, the related growing water issues in the drier counties, and the relevance of these to local planning thinking and decisions. Reformed standards for housing are called for. Extensive housing programmes based on architects' pretty pictures of multitudes of detached houses in wide, shady suburbs must be made a thing of the past. New, dense housing models become essential, built only on the lowest grades of rural land after all brownfield sites have been built on. Likewise, quality agricultural land cannot be filled with solar panels. These will need to be sited on roofs of warehouses and other large buildings, on south-facing embankments and cuttings of railways and major roads, on wetlands, and so on. New garden cities are being advocated in some quarters based on examples such as Milton Keynes - which must be the most wasteful example of the use of productive farmland in Britain.

ANNEX 5

A NATIONAL COMMUNICATION INITIATIVE

Objectives

1. To address the widespread lack of awareness and knowledge amongst most of the UK population so that they understand and accept that:

- we are entering a changing food production situation both globally and nationally. This is not temporary phenomenon;
- we cannot continue to live on imported food while that food becomes progressively less available and more expensive internationally;
- we must double food production in Britain;
- more crop and animal production requires more water; we need to conserve our water - particularly in drier areas of the country;
- we have to preserve agricultural land countrywide; we cannot continue to destroy agricultural land by building upon it;
- the preservation of our natural ecosystems and biodiversity is essential for achieving major increases in Britain's plant and animal production;
- the need to reduce current levels of wastage of food;
- food costs are already rising in Britain but the serious food price increases which are fast approaching have barely yet begun;
- the continuing population increase in Britain has profound implications for our future food situation, and
- planning of new physical infrastructure in Britain cannot continue in disregard of the growing land and water constraints.

2. To establish a point of responsibility and funding within government with the mandate, skills and operational mechanisms for:

- leadership in planning a national communication initiative, drawing upon and coordinating involvement of the various agencies involved in communication for information transfer and learning, and the different forms of communication media and sources of specialist skills in the country (see Annex 4.), and
- research, development and piloting of the different forms of media for creating the greater awareness, interest, learning and knowledge leading to changes in understanding, perceptions and behaviour required by the above objectives. (These should include: broadcast and printed media; advertising and marketing; digital media and private sector 'high tech' involvement in coordinated multi-media programmes to reach specific audiences; innovative websites; social media apps; e-mail marketing campaigns.)

Once established, this point of responsibility and expertise for mobilising and integrating capability in all forms of communication (see below) can be used for reaching and influencing people of Britain on other matters of national importance - such as climate change, changes in the global economic order, threats of social disorder, and others. A key requirement of the 'Communication Authority' (or whatever name is chosen) is that it should remain free from party political interference. This body would be additional to, but work in close cooperation with, the Government Services and Information Office.

The Nature of a National Communication Initiative

A National Initiative requires a comprehensive approach using all forms of communication, and combinations of media, to reach and influence people of all ages and all walks of life. Forms of communication include print, broadcast, internet based media including social media, film, drama and face-to-face communication (e.g. teachers, instructors, field workers and others.) The scale and complexity of achieving the objectives outlined in this paper call for a coordinated programme over an extended period and requires a low key approach, i.e. not misguided, blaring headlines which do little to increase the knowledge or understanding on which changes of perceptions and behaviour are based.

Britain has a substantial body of experience and expertise in the communication field. The BBC is well known internationally for its educational programming. The Open University is widely respected for its distance teaching - both for use in educational establishments and for adult education. Many non-governmental organisations in Britain have assisted, mainly in poorer countries, in important advances in the use of communication media for promoting better health, population control, increasing agricultural production, forest conservation, wildlife preservation, water and sanitation initiatives and many others. Leaders such as the BBC Media Action are currently receiving £90 million from UK aid to transform lives through media around the world. Creative communication agencies run integrated multi-million pound initiatives which impact audience thinking and perceptions from products we buy, opinions we buy into, perceptions of political integrity, the impact of celebrities in our daily lives and so on. Some organisations have been involved in state-of-the-art work in the uses of interactive, digital technologies in communication and learning. The uses of social media in the 'Arab Spring', the riots in London and other cities in England in 2011, and in recent elections in various countries, all demonstrate the enormous future potential of this media for reaching and influencing very large numbers of people.

Worthy of special note is the remarkable experience in many countries in the uses of radio and television drama to reach and change perceptions of people of many different cultures and levels of education and income. Much of this was based originally on the pioneering successes of 'The Archers' radio drama programme in this country. A study in the 1980s found that a majority of farmers in Britain reported receiving more useful farming information from The Archers than from any other single source. Many examples have demonstrated the role that celebrities can play by their involvement in raising interest in, and adding credibility to, the content and objectives of specific communication programmes.

All this experience and expertise can be drawn upon in planning, designing and introducing new approaches for changing perceptions and behaviour of both rural and urban people in Britain. However, currently needed is a central body with the authority and funding to work across, and draw upon the full range of communication expertise and experience outlined above.

The advances, now needed urgently in Britain, are also needed in many other countries. A successful initiative in Britain would have immediate application in those countries - particularly in countries where the effects of climate change and continuing rapid population growth and food, land or water shortages are most severe. Success of the initiative proposed here would create new export opportunities for Britain.

Current Constraints Impeding the Introduction of a National Communication Initiative

1. The government in Britain and those of most other western countries are structured in the traditional technical, scientific 'sectors' - transportation, energy, water, agriculture, forestry, telecommunication etc., together with ministries of education, health, and the various social services, each staffed with their relevant technical specialists. Although all are involved to varying degrees in communication activities related to their functions, these efforts are modest and discipline specific. It is not the role, nor within the budgets and skills, of any one of those ministries to handle a cross-agency national communication initiative, including private sector expertise and funding. Similarly, while the raison d'être of broadcasting authorities and the printed media is communication, it is not their role either to manage a cross-agency initiative.

2. Economics, now so centrally involved in government planning processes, is itself an obstacle. The abstract world of economics deals with what economists can measure, count and value. This is straightforward when dealing with the costs and products of the technical/physical 'sectors'. Means have also been devised for assigning economic values to education, health and the social services. Hence, these have an economic 'identity' and feature in economic models. In contrast, the communication processes to inform and achieve learning and behavioural change (particularly among adults and out-of-school youth) have, so far, eluded economists' efforts to measure and value their impacts. Consequently, communication activities of the kind outlined here have no place in the economic world. They have no place in the planning processes, staffing and financial allocations deriving from economic thinking and planning.

These characteristics are all part of the prevailing conventions within which we currently think, reason and operate. If we are to address the threats and challenges of our rapidly changing world, we now need to move beyond the confines of current orthodoxy - and the inability of the prevailing thinking and approaches to deal adequately with the 'human dimension' of change and development.

The fact that we must move beyond the confines of prevailing conventions and institutional structures means that a major new initiative can only emerge with the greatest difficulty from within existing policies, thinking and remits of any one of the technical 'sectors' of government. Hence, by definition, the impetus now needed for the advances in understanding and new policy directions has to come from outside current governmental structures and the approaches that follow from them, and outside the confines of current economic thinking.

ANNEX 6

An Outline of Necessary Steps for a Programme of Action; a Role for CPRE

Kent, 'the Garden of England', is the county with the largest and fastest growing population; it has the the fastest loss of agricultural land, it is the driest county with the greatest competition for available water resources. Hence it is logical that Kent should be the county in which to initiate a county level programme of action to address the looming threats. There is also an urgent need to establish a model in one county which others can adopt and adapt to their own conditions.

CPRE, with it's national structure giving access to policy-making levels of government at central and county levels; it's reputation for professional integrity and its a-political nature, make it well placed to promote the advances in thinking and action referred to which are now both possible and urgently needed. CPRE's role can only be catalytic and advocacy. It will need to generate support and leadership from intellectuals, business leaders, non-governmental organisations active in the rural sector, representatives of relevant government ministries, the creative communication industry, and other influential individuals to articulate fully (a) the practical nature of what is now needed, and (b) the necessary focal point in government necessary to achieve this.

Implementation will involve action at national and county levels. Both can begin concurrently. Initial work at national level is likely to be more complex. However, support among broadcasters can move quickly, building on existing interests and experience; similarly, work in the social media field can involve the high-tech companies and draw upon their experience and commercial interests. Progress at county level will add weight to the case for a national programme of action.

CPRE, Kent can keep other CPRE county branches informed of progress of the programme initiated in Kent so that they can replicate similar initiatives in their counties according to the individual priorities and conditions of those counties.

Objectives of a programme in Kent

Raise widespread awareness in Kent of the growing conflict between the needs to: (a) increase food production, and conserve the farmland needed to do so; (b) protect woodlands and other habitats necessary for preserving biodiversity, and (c) plan land-demanding new housing and related services and for the infrastructure required for economic development - all within the all within the confines of available water reserves and non-agricultural land. Related to this objective will be the need to restrict inward migration into Kent according to the limitations that these confines will impose.

CPRE's role will be to raise awareness and understanding of the growing threats outlined in this paper among leaders in the county so that they can, together, articulate and represent their respective organisations in an agreed programme of action.

Action required

1. Identify prominent individuals, related organisations and intellectuals in the county and obtain their interest in, and support for, and support and agreed programme of action. Organisations to include, for example, farming related interests - National Farmers' Union (NFU), farm input suppliers, marketing agencies, farm financing bodies, agricultural research institutions; water authorities, farm water equipment suppliers; non-governmental

organisations and charities involved in the rural sector; forestry authorities; county level representatives of government ministries with rural sector responsibilities, etc.

Of special importance are: a.) the involvement of universities and other academic institutions. The main burden of finding and implementing solutions to the approaching threats and they need to understand fully the nature of the changes which are approaching and be prominent in raising interest and understanding in both their home and future work environments. b.) Representatives of county and district councils need to be involved from the outset. The Councils are currently a significant part of the problem. They and the Rural Board need to become a prominent part of the solution.

2. Once a programme of action has been agreed and action initiated, the press and broadcast media can be involved to perform their role in raising awareness of the food, land and water issues in Kent, to report on progress in tackling these as action proceeds, and describe action that everyone can take to avert the crisis.