

STATEMENT OF REQUIREMENT

GREENHOUSE GAS BUDGET FOR THE RURAL DEFENCE ESTATE AND MOD NATURAL CAPITAL ASSET REGISTER AND ACCOUNTS PROFESSIONAL SERVICE SUPPORT FOR MOD

PURPOSE

1. **The Task:** To develop the MOD Rural Estate Greenhouse Gas Budget Natural Capital Asset Register and Accounts to inform corporate strategy, corporate reporting and operational decisions.
2. **Background:** MOD is one of the largest landowners in the UK. As responsible environmental stewards, we must understand the baseline of natural capital assets and ecosystem services on the defence estate, the opportunities for natural capital investment, and the opportunity cost of constraints such as military training and land management activities. Defining a greenhouse gas budget for the estate and identifying policy options is a key priority in the MOD Climate Change and Sustainability Review and the MOD and DIO Sustainability Strategies. The natural capital account and carbon budget will support MOD's delivery of the Government's Net Zero 2050 legislation and the 25 Year Environmental Plan.

Goal:

- Objective 1: To agree a GHG operating and accounting protocol appropriate for the MOD Estate.
- Objective 2: To provide a spatially-explicit inventory of the soil- and vegetation-based carbon stocks of the MOD Estate.
- Objective 3: To estimate the net annual soil- and vegetation-based carbon flows, and associated GHG emissions, of dominant land types on the MOD Estate.
- Objective 4: To identify and quantify opportunities to increase soil- and vegetation-based carbon sequestration and decrease GHG emissions for the dominant land types.
- Objective 5: To provide recommendations for Phase 2 including the development of a Natural Capital Asset Register and MOD Natural Capital accounts, a monitoring programme, and extension of work to the overseas defence estate.

STAKEHOLDERS

3. **Customer / End-User.** Lt Gen Richard Nugee
4. **Key Stakeholders.** The below personnel will be involved in the delivery of this project.

Name	Role	Responsibility
Helen Sheridan	FMC Infra Pol SustMOD	Project Manager
WO2 Richard Byrne	FMC Cap Infra CCS1	Project Manager
Stuart Otway	DIO Technical Services	Environmental Technical Lead
Ant Raney	DIO DA&I	Data Lead
DIO Ecologists	DIO Technical Services	Monitoring Arrangements

CONSTRAINTS

5. **Location.** The project, scheduled for completion in six months, comprises five work-packages, each aligned to an objective:

Package 1. To agree a GHG operating and accounting protocol appropriate for the Based MOD Estate. The GHG and carbon accounting operating protocols used by the MOD need to align to their security considerations and best practice. On meetings with the MOD, The Contractor will propose an operating protocol that addresses MOD security considerations. The selected operating protocol may require some the Contractor staff to receive security clearance and this may take time.

Initial meetings will be held to ensure that the GHG and carbon accountancy protocol used in this project align with future MOD's plans to develop an asset register. The data architecture used and the outputs should reflect UK standards, where possible, including for example those developed for the UK Greenhouse Gas Inventory, Office of National Statistics, the Committee on Climate Change and the Natural Capital Committee, and Defra's ENCA Guidance. Any GIS outputs will be in an ArcGIS format. A discussion/workshop will be undertaken to explore how outputs and tools can be imported into or accessed from MOD information systems. This will result in an initial inception report by Month 2.

Package 2. To provide a soil and vegetation based carbon inventory of the MOD estate. Any long-term accounting of the effect of land management on GHG emissions will benefit from a baseline inventory of the carbon stock on the MOD Estate. This will comprise at least two components: carbon in soil, and carbon as vegetation. It is assumed that the carbon stored in buildings and man-made infrastructure is outside the scope of this project. For the baseline inventory, we will provide spatially-explicit estimates of carbon stocks based on soil types and land cover.

The MOD has indicated that a GIS dataset will be provided under licence within the MOD freehold and leasehold land parcel boundaries.

The MOD does not hold a land cover dataset for the full UK defence estate and hence this will be derived from a 3rd party sources. The Contractor is currently determining the cost for purchasing a 3rd party land cover dataset (e.g. Centre for Ecology and Hydrology's (CEH) highest resolution land cover maps or OS master mapping) so that MOD can retain access for a time-specified period, but this cost is not yet confirmed. Hence the current project cost remains exclusive of this component.

Soil carbon: a baseline estimate, together with an estimate of uncertainty, will be established for the amount of soil carbon (to a specified depth or soil weight) stored on the MOD estate. The Contractor University, with the support of James Hutton Institute, has developed a soil carbon concentration map for England, Scotland and Wales at a resolution of 100 m x 100 m, for a range of soil depths to 50 cm. Assumptions will be specified to derive a bulk density for each site, so values of soil carbon can be expressed for a specific depth as well as a specific dry weight of soil. Estimates of soil carbon storage in Northern Ireland will be made using the most appropriate alternative datasets.

Vegetation carbon: a spatial estimate of the carbon storage in vegetation (above- and below-ground) will be determined using existing land cover datasets and look-up tables specifying representative levels of carbon (and the associated variance). An example of such an approach is provided by Cantarello et al. (2011). If resources allow, datasets such as satellite images and LIDAR may be used to improve the estimates of land cover and reduce their uncertainty for selected case study areas.

This work-package will result in Geographical Information System (GIS) outputs showing the estimated mean values of soil carbon and vegetation carbon for the MOD estate in the UK in units of tonnes of carbon per hectare by Month 6.

Package 3. To estimate the net annual vegetation- and soil-based carbon flows and other direct GHG emissions from land management activities (e.g. livestock, manure and machinery) of the dominant land types on the MOD Estate.

Carbon stocks are not static. In establishing a carbon plan for the MOD it is important to establish a counterfactual of the “Business as Usual” carbon flows for the dominant land types, for example cultivated arable areas and peatland areas may currently be losing carbon (Bellamy et al 2005; Holman 2009). Research led by the Contractor has calculated that carbon losses in England and Wales incur economic costs of about £558 million per annum (Graves et al., 2015). Working with the MOD, and building on the results of Work Package 2, we will identify the dominant land types (e.g. upland peat, upland forest, lowland grassland) where we may anticipate changes in soil and vegetation carbon, or significant annual GHG emissions.

We will determine the current changes in soil and vegetation carbon for land use systems for the dominant land types, building on existing the Contractor (Bellamy et al., 2005) and other research. Soil carbon can be lost through soil erosion and surface runoff exacerbated by vehicle movement, oxidation (e.g. areas of peat drainage or intensive cultivation) and shrinkage (Holman 2009). Possible causes of vegetation C change on the MOD estate include: i) land use changes e.g. grass to arable and vice versa, ii) the harvest or growth of biomass in woodland, and iii) changes in the areal extent of trees and hedges outside of woodland. It is estimated that 20% of the UK’s tree cover is outside of “woodlands”. The analysis of vegetation change would be strengthened if the MOD can provide spatial data on historic woodland planting on their estate.

Other significant sources of annual GHG emissions on the MOD Estate could include livestock, manure, fertiliser application, and machinery. A protocol will be established and used to estimate the magnitude of these sources using, for example, gridded livestock or fertilizer use data.

This work-package will be written up in a report by Month 6.

Package 4. To identify and quantify opportunities for the MOD Estate to increase soil- and vegetation-based carbon stocks and decrease GHG emissions for selected land types.

The purpose of developing a carbon inventory is to encourage and reward changes in land management that contribute towards achieving net zero greenhouse gas emissions. This Work Package will review, for dominant MOD land types, the anticipated effect on carbon stocks and sequestration that can be made through changes in soil or land management up to 2050. This section will also briefly review the options to decrease GHG emissions associated with land management operations.

Constraints on land use and management change

An online workshop between the Contractor and MOD will be undertaken to capture some of the key constraints (including for example operational use, health and safety, natural and historic environment features, unexploded ordnance, public access, long-term tenancies and development and disposal programmes) that need to be taken into account in developing management options.

Evaluation of land management operations to decrease GHG emissions

We will review practices such as: reverting arable to forest land which can reduce GHG emissions due to lower fuel requirements arising from fewer land operations (Garcia de Jalon et al., 2018), reduced livestock numbers, and reduced fertiliser use.

Evaluation of measures to increase C/reduce soil C losses on MOD land
Land management measures to increase soil carbon include land use change (e.g. arable to pasture); reduced tillage intensity; cover and companion cropping; field buffer strips; rewetting peatlands/wetland creation, and application of organic amendments .

The evidence linking these practices with better carbon storage and sequestration, in the context of the main MOD land use types, will be critiqued and quantified.
Inventory and evaluation of methods to increase vegetation-based carbon sequestration
Management measures to increase vegetation carbon include woodland creation, agroforestry (Kay et al., 2019) and hedgerows (Axe et al., 2017).
Other considerations

A final section will consider other aspects of land management that may be important in determining the desirability and feasibility of the options.

This work-package will be written up in a report by Month 6.

Package 5. To develop recommendations for phase 2 and subsequent projects for the MOD

Work-package 2 will provide a spatially explicit map of carbon stocks on the MOD Estate for a specified baseline date. Work-package 3 will quantify the annual baseline change for dominant MOD land use types, and work-package 4 will quantify potential options to increase carbon levels.

6. Timing. Urgent - Must be delivered in FY20/21 due to availability of funding and to support the findings of the MOD Climate Change and Sustainability Review.

ASSUMPTIONS

7. The following assumptions have been made:
 - a. The Contractor will have the capacity to delivery in the required period.
 - b. The Contractor has suitably qualified staff to delivery the work packages

Functional Requirements

8. The Contractor is to delivery the work packages in the timescales and to an acceptable level of quality for DIO Technical Services Requirements. The detail of the work packages is outlined in para 5 above.

Performance Requirements

9. The Contractor is responsible for the delivery of the work packages. Monitoring and assurance arrangements will be conducted by DIO ecology specialists advising CC&S/FMC infra of any concerns.

Security Requirements

10. The Contractor is to have the correct security classification of its staff for viewing supplied data and delivering the work packages and for the physical handling and transfer of data.

Cultural Requirements

11. N/A

Legal Requirements

12. N/A

Risks

13. Without the understanding of MOD's greenhouse gas and natural capital baseline there is a major risk that future investment to meet the Government's 25 Year Environment Plan and Net zero legislation will be poorly made. The knowledge gained from Phase 1 in particular will enable MOD to develop its strategic thinking on achieving Net Zero, develop policy options, and understand where best to invest in the estate to lessen its emissions and to what extent and where it can use the estate to off-set against irreducible emissions.

14. The work requires completion before the end of the Financial Year in order to feed into the recommendations of the MOD Climate Change and Sustainability Review and the Sustainable MOD Strategy. Any potential risk to the delivery will be, once identified, assessed and acted upon accordingly in consultation with stakeholders.