SFI Public Service Fellowship 2023

1. **Name of Governmental Department or Agency**
Inland Fisheries Ireland
2. Title of the Project
IFI1 Develop GIS tools to support Inland Fisheries Ireland's national fish and climate change risk modelling and other research programmes
3. Description of the Project
IFI established the Climate Change Mitigation Research Programme (CCMRP) in 2019 to build an evidence-based research programme to assess the impact of climate change on Ireland's fish species and their habitats, with the aim to inform policy and build capacity for fisheries conservation and protection measures. The main objective of the research programme is to establish and manage a long-term environmental, fish and habitat monitoring programme and use the most advanced mapping tools and spatial modelling available to analyse the data. We will then be able to identify waterbodies most at risk from climate change throughout Ireland and find ways of reducing its impact. By examining climate change and its impact on Irish fisheries and their habitats, we can make predictions for the future and develop methods to "mitigate" or reduce its potential impact. An essential part of the project is to develop an environmental GIS layer to support the national risk modelling of water temperature, flow dynamics and changes in fish habitat and habitat modelling related to climate change. Currently calculation of many relevant landscape metrics at the scale required is onerous and is being done manually and on a catchment level rather than on the national scale. New innovative methods are required to improve the calculation processes for these metrics at a national level and update them automatically when new data becomes available.
4. Project Scope
Develop GIS tools to support national fish and climate change risk modelling. Examples of potential tasks are below. The final list of tasks will be developed in collaboration with the project team and the successful candidate. 1. A tool is required to calculate upstream area from any site along a stream segment, the project would build on the existing EPA Hydro tool and expand from fixed sites to random sites. 2. A tool is required to calculate riparian tree cover – IFI would like to investigate the efficacy of applying machine learning to satellite images to calculate canopy/tree cover along river banks at the national scale. This workpackage is broken into three sub-tasks: 2(a) review state-of-the-art in applications of machine learning techniques to satellite and remote sensing imagery for land coverand riparian tree cover classification. 2(b) apply appropriate machine learning techniques to estimate riparian tree cover on selected catchments and evaluate efficacy by ground-truthing against empirical data.

2(c) apply best-performing machine learning technique to satellite imagery to calculate riparian tree cover on a national level and explore possibility to detect change in tree cover over time.

3. The third task is to develop an environmental layer, combining the outputs from these tools and other available data layers (from a fisheries perspective) to form the basis of any modelling of spatial network modelling for various IFI R&D projects (e.g. fish distribution or habitat modelling, climate change risk modelling, barrier mitigation, etc.)

5. Skills/Expertise Required

In order of preference

- Geo-spatial analysis
- Mathematical, statistical modelling and scientific programming skills - computational science
- Machine learning
- Spatial modelling
- Geomorphology
- Ecology

6. Expected Outputs of Project

Outputs will inform IFI and other agencies how to maximise potential environmental gain through climate resilience measures and inform policy. Outputs will also support other IFI Research and development projects.

Examples of specific outputs are:

- A tool to calculate upstream area from any site along a stream segment – this tool would be used by IFI across multiple programmes (e.g. Climate Mitigation Research Programme, Water Framework Directive, National Barrier Programme, National Eel Programme, etc.) and other agencies.
- A tool to calculate riparian/tree cover from the latest satellite data/images and build in intelligent and regular updates from new satellite data that becomes available.
- Environmental GIS layer, combining the outputs from these tools and other available landscape layers to form the basis of any national modelling or spatial network modelling for the project(s).
- Opportunity to contribute to peer reviewed scientific publications.

All tools and data deriving from the project will be made available to stakeholders via the IFI data portal. The outputs will be presented at different fora, e.g. the annual freshwater sciences .

7. Working Arrangements

The candidate will be assigned a desk and appropriate ICT facilities in FI HQ AT Citywest Business Campus, Dublin 24 (or other appropriate IFI office). The candidate will work as part of the CCMRP team but will also liaise with other teams across IFI R&D. The project will be desk-based, but there may be an opportunity to participate in fieldwork from time to time. IFI are an equal opportunities employer and offer hybrid working arrangements.

8. Expected Timeline

12 months full time

9. **Contact Details**
Cathal Gallagher