VACCIA Action 11 Assessment of impacts of climate change on biodiversity in coastal ecosystems and implementation of new policies and conservation strategies

Sub-action Habitat and climatic contributions to populations of managed forest landscapes

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<u>Outline of research methodologies, conservation stage and management of boreal forest species: milestone</u> 30th Sep 2009

We will relate spatial structure and quality of the landscape to territory occupancy and measures of fitness of resident boreal birds under changing habitat structures. The research will capitalize upon unique combination of precise individual based demographic (mark-recapture) data as well as count-based long-term time series on species abundances. In addition, presence-only and presence-absence (given reliable information on absence) species data can be applied in habitat suitability modelling (HSM, often called also species distribution modelling) to define species' habitat requirements and give spatial prediction of the most suitable (and unsuitable) habitats as a function of environmental conditions. Landscape structure (quality, quantity and spatial pattern of different habitat patches) and its change will be derived from current and series of historical aerial photographs, and verified with own detailed field observations. Habitat quality measures are derived from European land cover and land-use classification (CORINE) and the Finnish multi-source forest inventory (NFI) data. Time series on weather and climatic variables are available from Finnish Meteorological Institute, and data on North Atlantic Oscillation and Arctic Oscillation from the internet.

The species considered are (1) boreal forest parids: the willow tit (*Parus montanus,* declining in numbers), the Siberian tit (*P. cinctus*, considered as near threatened), are old forest specialists, and broad-leaved forest specialists, the great tit *(P. major)* and the blue tit *(P. caeruleus,)* which recently have expanded their range in northern Europe.

Measures of habitat quality and connectivity to territory type and permanence will be considered in modeling. In this context we apply the metapopulation theory to the set of potential territory sites (breeding territories around located nest sites) in the study landscape. Measures of landscape quality in relation to the fraction of suitable habitat occupied allow us to evaluate possible threshold conditions for the persistence of the species in fragmented forest landscapes. We will start the modelling by applying willow tit data in order to study nest site selection at tree different scales; territory core (1 ha), territory (4 ha) and landscape (34 ha). Several habitat variables, e.g. percentage of different habitat types, distance to the nearest ditch and number of decayed birch trees available for excavating the nest hole, were measured from nest sites and randomly selected empty sites.

We will also apply habitat suitability modelling (HSM) to define species' habitat requirements and give spatial prediction of the most suitable (and unsuitable) habitats as a function of environmental conditions. HSM traditionally relates the occurrence or abundance of species to environmental variables and helps in identifying characters in species distribution. However, in order to assess the relationship between environment and long term-survival, it is more appropriate to use fitness-related species data (e.g. breeding success) and thus define the species niche. Spatial predictions of HSMs can be used to recognize high suitable areas, which is of great importance since species extinctions are less likely in those areas and thus, including such information in selection of protected areas can improve the ability to ensure long-term persistence of species. Recognition of most suitable habitats is

important also from the prioritization point of view, since in any given region the total amount of land that can be protected is limited by various social and economic factors.