Habitat requirements of the Semicollared Flycatcher *Ficedula semitorquata* in Armenia

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Introduction
According to the last assessment, the forests make less than 8% of the area of Armenia, significantly decreased during mass logging in 1990s (Stern 2015). Use of forests in Armenia is implemented by the State Non Commercial Organization "Hayantar" (Armenian Forest), and does not suppose approaches, which are based on the constant assessment of relations between volume and method of logging from one side and with the conditions of forest ecosystems and its particular representatives from another. It leads to the inevitable degradation of the forest ecosystem, decrease of its productivity, and speeding up of a decrease of populations of rare and endangered plant and animal species.

The studies of the relationship between conditions of forest ecosystem and animal communities have been started in 2010 (Aghababyan et al. 2010); as result of the investigations a list of species, which strongly depend on the anthropogenic pressure on the habitat, was identified. One of those species is the Semicollared Flycatcher – less-studied Passerine bird that was classified as Near Threatened by IUCN, and as Data Deficient in the Red Book of Animals of Armenia (Adamyan and Klem 1999, BirdLife International 2012, Cramp and Perrins 1993, Aghasyan & Kalashyan 2010). It shows moderately rapid population decline, which most probably is a result of breeding habitat destruction (BirdLife International 2004, BirdLife International 2012). The species inhabits various types of mature forest and is obligate hollow-nester; therefore conversion of forest habitat strongly influences the species (BirdLife International 2012). Although it is habitat specialist, however the information about its habitat requirements is scarce (Georgiev and Iankov 2009). Meanwhile understanding of the habitat requirements and their relations to commonly collected forest data can help in the following aspects of species conservation: (1) estimation of its population throughout the breeding range; (2) modelling and planning of the industrial activities (such as forest logging, constructions of roads and hydro-electric power plants, etc.); (3) habitat restoration. Therefore the main goal of the study was to clarify habitat requirements of the species and how are they related to supplementing data sources (e.g. satellite imagery and forest classification parameters) in Armenia.

Study Site and Methods
The plots have been selected in the forests of Dilijan National Park, Noyemberyan, Sevkar, Vanadzor, and Stepanavan forestry. We have been putting the plots at least 500 m apart in order to avoid duplication of records. The plot distribution has been covering three different types of the forest area: old-growth forest, forest with historical (but not current) logging, and forest with active logging.
The counts have been implemented at the central spot of each plot. The counts have been carried out in the early morning (within two hours of dawn) from 7th of May to 14th of June.

During each count we have been recording all the singing mails of Semicollared Flycatchers by listening for their songs for 5 minutes at each spot. After finishing each count we were using playback for 5 minutes to estimate the presence of all five species of woodpeckers in the area (Great, Medium and Lesser Spotted, Black and Green). In addition we have also been recording some other forest species: Red-breasted Flycatcher, Green Warbler, Eurasian Nuthatch, and Song Thrush, as they also could be important indicators.

After finishing bird count we have been implementing measuring the forest characteristics of each plot: tree species, their number, height and width, number of hollow trees, number of dead standing trees, number of dead fallen trees, shrub layer characteristics (species, coverage, height), grassiness of the forest floor (rough percentage), area of small bogs or ponds (if any), number of stumps left after felling, tracks of livestock grazing in the forest.

Also we have obtained data from Hayantar SNCO regarding a history of forest logging: how long the area has been logged, when the site was last logged; history of pesticide use: when were pesticides last applied, why, and what were the active ingredients, as well as data about forest classification types: canopy coverage, completeness, class of forest.

To analyze the collected data the Generalized Linear Modelling (GLM with Poisson error and logarithmic link) was used, with the aim of quantifying the relationships between the habitat characteristics (independent variables) and the numbers of Semicollared Flycatchers (dependent variable) per plot (Anderson et al. 2007). For the statistical analysis we have been using SPSS 16.0 and R. The habitat characteristics identified as important were compared with the features of satellite imagery. To do this, 10x10m Rapid Eye satellite imagery were obtained from Forest Monitoring Center, which has purchased the latest images for the forests of Armenia. The Rapid Eye satellite images were processed into GIS shape files using eCognition Developer 9.0; the 10x10m pixels were aggregated to calculate pixels average value for 100x100m plot. Then the correlation analysis was used to link the characteristics of the satellite image to the habitat characteristics found to be important for Semicollared Flycatchers. For estimation of species population in North-eastern Armenia and preliminary evaluation of other potential suitable areas in the country we have used spatial modelling based on satellite imagery. Spatial analysis will be done using ArcGIS 10.1.

Results

We found a significant correlation between density of Semicollared Flycatchers and tree width ($P<0.01$), number of dead standing and dead fallen trees ($P<0.05$); some influence was played by coverage of shrub layer. Also a negative correlation was found with the factors of human disturbance, particularly – number of fresh stumps ($P<0.01$). The number of bogs or ponds in vicinity of counting areas was too law to have any influence on the number of species. In tree composition it appears that beech tree (*Fagus orientalis*) plays insignificant role in the life of the species, as the species was found in both areas – with presence of the beech trees and their absence; however occurrence of Semicollared Flycatchers was dropping in the areas occupied by beech trees only. There was no correlation found with the density of Great Spotted Woodpecker, most probably because the species is too adaptable, widespread, and occupies wide variety of forests, and with Little Spotted and Black Woodpeckers due to their extremely low density, as well as with Green Woodpecker, probably due to its uneven distribution. However, some correlation was found with the density of Middle Spotted Woodpecker.

No correlation was found between the density of Flycatcher and spectral characters of the satellite images; however the latest can be used for assessment of the logging load on the forest. Based on the analysis, which also includes all the records of the species in the country its distribution was estimated as restricted by Northern, North-eastern, and South-eastern forests (see fig 1), while its population is preliminary estimated from 950 to 1150 breeding pairs in Armenia.

Figure 1 Distribution of Semicollared Flycatcher in Armenia

Additional result of the project is data on distribution and abundance on five species of Woodpeckers, Red-breasted Flycatcher, Green Warbler, Eurasian Nuthatch, and Song Thrush.

Application of the results

Results of the project are being used for estimation of populations of Semicollared and Red-breasted Flycatchers, Green Warbler, Eurasian Nuthatch, Song Thrush, Great Spotted, Middle Spotted, Little Spotted, Green and Black Woodpeckers; the data will be used for first National Atlas "The State of Breeding Birds of Armenia" (planned for 2019), for further assessment of those species for the next edition of Red Book of Animals of the Republic of Armenia (planned for 2020), and in the process of assessment of Emerald Sites protected under Bern Convention.
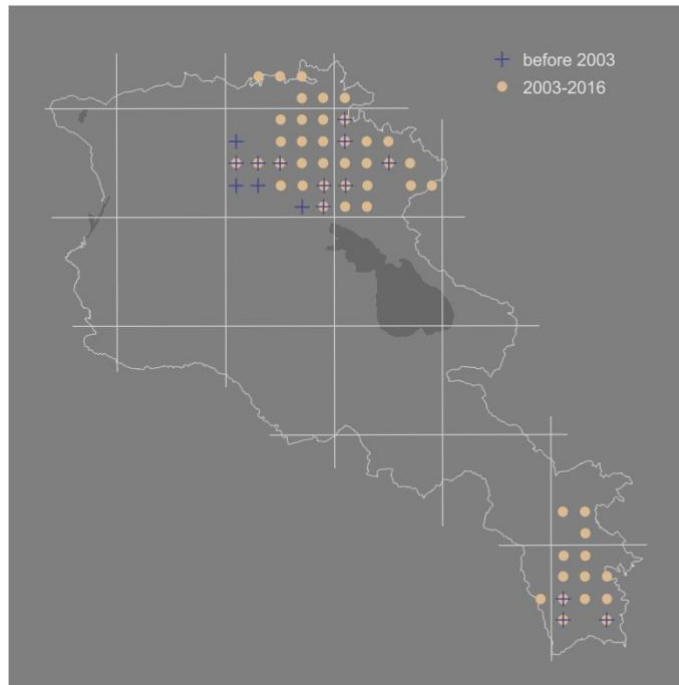
The results are being used for development of set of easy indicators of forest ecosystems, which can be used by forestry enterprises with low capacity of specialists.

We have conducted two workshops with the staff of Sevkar, Ijevan, Noyemberyan, Vanadzor, and Stepanavan forestry enterprises, as well as with Dilijan National Park for explaining the necessity of using bio-indicators in the process of forest management. In addition the project idea was presented at the other two workshops:

1. conducted by German Organization for International Cooperation (GIZ) and related to the monitoring of biological diversity

2. conducted by United Nations Development Program (UNDP) and related to the monitoring of forest ecosystems

REPORT FROM A BOU-FUNDED PROJECT

Aghababyan, K. 2018. Habitat requirements of the Semicollared Flycatcher *Ficedula semitorquata* in Armenia .

A BOU-funded project report. BOU, Peterborough, UK. Karen Aghababyan was awarded £1,980 by the BOU in 2015.

The project results have been published in:

Aghababyan K., Ter-Voskanyan H., Khachatryan A., Gevorgyan V., Khanamirian G. 2010. The state of Semicollared Flycatcher (*Ficedula semitorquata* Homeyer, 1885) in Armenia. Proceedings of International Conference "Biological diversity and conservation problems of the fauna - 3" (September 25-29, 2017, Yerevan, Armenia). – Yerevan: LLC "TASK", 2017; pp 7-11.

The next publication "Habitat requirements of Semicollared Flycatcher in Armenia" are in the process of formalization.

Next steps

The current project received a continuation being included into a larger UNDP-GEF UNDP-GEF Project "Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-eastern Armenia" Project "Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-eastern Armenia", aimed at development of the forest indicators. Thus the further research and policy related works will be funded by the mentioned UNDP GEF project.

The next species which requires special attention in Armenia that we plan to focus our attention is White-headed Duck (*Oxyura leucocephala*), which breeds in carp farms of Ararat Plain and is being threatened by intensification of the fish farming.

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