TR79 Butterfly communities as indicators of habitat change in Tarnava Mare

In Europe, agricultural landscapes often possess great conservation value. The European Environment Agency (Stoate *et al*. 2009) has estimated that 50% of all species in Europe have some reliance on agricultural habitats, including species considered threatened by the IUCN (2014). This is partly due to the wide spatial extent of agricultural land in Europe, but also because of the region's long history of low intensity farming practices which have allowed species-rich farmland communities to develop gradually over time (Stoate *et al*. 2009).

The conservation value of low intensity farming areas has been recognized by European agricultural policy since the 1990s. The term 'High Nature Value farmland' (HNVf) was coined at this time to define areas where predominantly agricultural landscapes overlap with either a high diversity of habitats and species, or where these landscapes support a species of particular conservation importance, or both (Lomba *et al*. 2014). Across Europe, the maintenance of High Nature Value farmland and its important biodiversity is usually dependent on the continuation of traditional farming practices (Henle *et al*. 2008). These traditional practices are, however, in sharp decline due to drivers in recent EU agricultural policy, and this is contributing to a concordant decline in farmland biodiversity. Three key trends are typically associated with the loss of traditional farming practices: intensification of agriculture, increasing scale of agricultural operations and abandonment of agriculturally marginal but High Nature Value farmland (Henle *et al*. 2008).

Environmental changes can be identified using bio-indicator species or communities. Commonly the indicators are species or assemblages which have parameters (biochemical, physiological, ethological or ecological) that describe very precisely the state of the environment, indicating their natural or anthropogenic changes. Several ecological characteristics make butterflies promising biodiversity indicators: easy to survey, intensely studied, worldwide distribution well documented, they represent a dominant fraction of biodiversity and, more important, they are sensitive to many environmental changes, natural or atrophic (Settele *et al.*, 2008). Consequently, monitoring the change in abundance and assessing the distribution of butterflies has been suggested as a potential tool for assessing large-scale biodiversity trends (Settele *et al.*, 2008).

In the Tarnava Mare Natura 2000 site we are monitoring these biodiversity trends using butterflies as indicators, in a region that is characterized by low-intensity land use practices which have created a mosaic landscape capable of sustaining high diversity and having high conservation value for both grasslands and also arable land (Loos *et al.*, 2014). Nowadays the land use practices are changing and the biodiversity from this area is threatened, mainly due to land abandonment and agricultural intensification (Akeroyd & Page, 2011).

In 2013 through to 2018 we surveyed the butterfly species richness and abundance by using standardized "Pollard walks" in different types of habitat (High Nature Value grasslands, grasslands of lesser nature value, abandoned land, scrubland and farmland). The walks are located around 7 villages in the Târnava Mare region. All standardized walks are 50 meters in length and are completed in 5 minutes. During the walks every individual butterfly within 5 meters (to either side and above) is identified and counted. The surveys take place between 10am and 4pm when butterfly species are most active. Counts do not take place in windy or rainy conditions.

The same sites and villages from 2014 to 2018 will be studied in 2019. These data will allow us to identify to what extent the changes of land abandonment and agricultural intensification may be affecting the butterfly communities. Students undertaking this project topic can use the butterfly survey data along with land cover mapping data that is also being produced to investigate whether certain butterfly species have particular habitat associations. Alternatively, a student could assess whether any species of butterfly can be used as indicators of High Nature Value grassland, using the butterfly survey data and data collected by the botany team.

Photograph: James O'Neill

Butterfly Specific References

Akeroyd J.R., Page J.N. (2006) The Saxon villages of southern Transylvania: Conserving biodiversity in a historic landscape. In: Gafta D., Akeroyd J.R., *Nature Conservation: Concepts and Practice*. Heidelberg, Germany: Springer Verlag. pp. 199–210.

Baur B., Cremene C., Groza G., Rákosy L., Schileyko A.A., *et al*. (2006) Effects of abandonment of subalpine hay meadows on plant and invertebrate diversity in Transylvania, Romania. *Biological Conservation* 132: 261–273.

Cremene C., Groza G., Rákosy L., Schileyko A.A., Baur A., *et al*.(2005) Alterations of steppe-like grasslands in Eastern Europe: a threat to regional biodiversity hotspots. *Conservation Biology* 19: 1606–1618.

Kuemmerle T., Muller D., Griffiths P., Rusu M. (2008) Land use changes in Southern Romania after the collapse of socialism. *Regional Environmental Change* 9: 1–12.

Loos J., Dorresteijn I., Hanspach J., Fust P., Rákosy L., *et al*. (2014) Low-Intensity Agricultural Landscapes in Transylvania Support High Butterfly Diversity: Implications for Conservation. *PLoS ONE*

9(7): e103256.

Loos J., Hanspach J., von Wehrden H., Moga C.I., Fischer J. (2014) Developing robust field survey protocols in landscape ecology: A case study on birds, plants and butterflies. *Biodiversity and Conservation*, DOI 10.1007/s10531-014-0786-3.

Pollard E., Yates T.J. (1993) Monitoring butterflies for ecology and conservation: the British butterfly monitoring scheme*; Institute of Terrestrial Ecology JNCC*, editor. London: Chapman & Hall. 274 p.

Settele J., Kudrna O., Harpke A., Kühn I., Van Swaay C., Verovnik R., Warren M., Wiemers M., Hanspach J., Hickler T., Kühn E., Van Halder I., Veling K., Vliegenthart A., Wynhoff I., Schweiger O. (2008) Climatic Risk Atlas of European Butterflies. *BioRisk 1 (special issue)*: 1-710.

Schmitt T., Rakosy L., (2007) Changes of traditional agrarian landscapes and theirconservation implications: a case study of butterflies in Romania. *Diversity and Distributions* 13: 855–86.

Van Swaay, C.A.M., Van Strien, A.J., (2005) Using butterfly monitoring data to develop a European grassland butterfly indicator. In: Kühn, E., Feldmann, R., Thomas, J.A., Settele, J. (eds.) Studies on the Ecology and Conservation of Butterflies in Europe. Vol. 1, General Concepts and Case studies. *Pensoft, Sofia-Moscow*.2.

General Tarnava Mare Reading

Delbaere, B., Mikos, V., &Pulleman, M. (2014). European Policy Review: Functional agrobiodiversity supporting sustainable agriculture. *Journal for Nature Conservation*, *22*(3), 193–194. doi:10.1016/j.jnc.2014.01.003

Dorresteijn, I., T. Hartel, J. Hanspach, H. Von Wehrden, and J. Fischer. 2013. The conservation value of traditional rural landscapes: The case of woodpeckers in Transylvania, Romania. PLoS ONE 8(6):e65236.doi:10.1371/journal.pone.0065236

Haas, G., Welterich,F., Kopke, U. (2001). Comparing intensive extensified and organic grassland farming in southern Germany by process life cycle assessment. Agriculture Ecosystems &Environment 83, 43-53.

Henle, K., Alard, D., Clitherow, J., Cobb, P., Firbank, L., Kull, T., … Young, J. (2008a). Identifying and managing the conflicts between agriculture and biodiversity conservation in Europe–A review. *Special Section: Problems and Prospects of Grassland Agroecosystems in Western China*, *124*(1–2), 60–71. doi:10.1016/j.agee.2007.09.005

Jerrentrup, J. S., Wrage-Mönnig, N., Röver, K.-U., &Isselstein, J. (2014). Grazing intensity affects insect diversity via sward structure and heterogeneity in a long-term experiment. *Journal of Applied Ecology*, *49*(0), n/a–n/a. doi:10.1111/1365-2664.12244

Kirkham, F. W., Tallowin, J. R. B., Dunn, R. M., Bhogal, A., Chambers, B. J., &Bardgett, R. D. (2014). Ecologically sustainable fertility management for the maintenance of species-rich hay meadows: a 12-year fertilizer and lime experiment. *Journal of Applied Ecology*, *51*(1), 152–161. doi:10.1111/1365-2664.12169

Klimek, S., Lohss, G., & Gabriel, D. (2014).Modelling the spatial distribution of species-rich farmland to identify priority areas for conservation actions.*Biological Conservation*, *174*, 65–74. doi:10.1016/j.biocon.2014.03.019

Kuemmerle, T., Hostert, P., Radeloff, V., Linden, S., Perzanowski, K., &Kruhlov, I. (2008). Cross-border Comparison of Post-socialist Farmland Abandonment in the Carpathians. *Ecosystems*, *11*(4), 614–628. doi:10.1007/s10021-008-9146-z

Lambin, E. F., Turner, B. L., Geist, H. J., Agbola, S. B., Angelsen, A., Folke, C., … Veldkamp, T. A. (2001). The causes of land-use and land-cover change : moving beyond the myths. *Global Environmental Change,11*, 261–269.

Lomba, A., Guerra, C., Alonso, J., Honrado, J. P., Jongman, R., & McCracken, D. (2014). Mapping and monitoring High Nature Value farmlands: Challenges in European landscapes. *Journal of Environmental Management*, *143C*, 140–150. doi:10.1016/j.jenvman.2014.04.029

Matechou, E., Dennis, E. B., Freeman, S. N., & Brereton, T. (2014).Monitoring abundance and phenology in (multivoltine) butterfly species: a novel mixture model.*Journal of Applied Ecology*, *51*(3), 766–775. doi:10.1111/1365-2664.12208

McKenzie, A. J., Emery, S. B., Franks, J. R., &Whittingham, M. J. (2013). Landscape-scale conservation: collaborative agri-environment schemes could benefit both biodiversity and ecosystem services, but will farmers be willing to participate? *Journal of Applied Ecology*, n/a–n/a. doi:10.1111/1365-2664.12122

Milenov, P., Vassilev, V., Vassileva, A., Radkov, R., Samoungi, V., Dimitrov, Z., &Vichev, N. (2014). Monitoring of the risk of farmland abandonment as an efficient tool to assess the environmental and socio-economic impact of the Common Agriculture Policy.*International Journal of Applied Earth Observation and Geoinformation*, *32*, 218–227. doi:10.1016/j.jag.2014.03.013

Robinson, N., Kadlec, T., Bowers, M. D., &Guralnick, R. P. (2014). Integrating species traits and habitat characteristics into models of butterfly diversity in a fragmented ecosystem.*Ecological Modelling*, *281*, 15–25. doi:10.1016/j.ecolmodel.2014.01.022

Stefanescu, C., Peñuelas, J., &Filella, I. (2005). Butterflies highlight the conservation value of hay meadows highly threatened by land-use changes in a protected Mediterranean area. *Biological Conservation*, *126*(2), 234–246. doi:10.1016/j.biocon.2005.05.010

Stringer, L. C., &Paavola, J. (2013). Participation in environmental conservation and protected area management in Romania: A review of three case studies. *Environmental Conservation*, *40*(2), 138–146. doi:10.1017/S0376892913000039

Thomas, J. a. (2005). Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society of London.Series B, Biological Sciences*, *360*(1454), 339–57. doi:10.1098/rstb.2004.1585