Introduction to case studies used in the lectures

- Plants
- Birds
- Fungi
- Phenology
- Exercise case study (another fungal case study)

Plants

Source: Chapter 6.7 of Ovaskainen, O. and Abrego, N. 2020. Joint Species Distribution Modelling – With Applications in R. *Cambridge University Press*.

Key points to illustrate: Modelling trait-environment relationships.

Description: These data were collected by Damschen et al. (2010), who revisited Whittaker's historical plant community study sites in Siskiyou Mountains of Southwest Oregon, following the original methods (Whittaker 1960). Whittaker chose the sites to represent the range of topographic variation in the area. In each site, twenty-five quadrates of size 1 m x 1 m were surveyed along a 50 m transect. The species abundances were recorded as the number of 100 quadrat corners in which each species was found.

Plants

Description (cont): The topographic moisture gradient (TMG) is the environmental variable of interest. Sites on mesic, north-facing slopes receive lower TMG values than sites on warmer, south-facing slopes. The functional trait that Miller et al. (2019) selected for their analyses is leaf tissue carbon-to-nitrogen ratio (C:N). This ratio can be considered as a surrogate of competitive ability: plants with low C:N grow faster but have lower stress tolerance than plants with high C:N. It can thus be expected that species occurring on dry and warm sites have on average higher C:N ratios, resulting in a positive relationship between TMG and C:N.

Birds

Source: Chapter 11 of Ovaskainen, O. and Abrego, N. 2020. Joint Species Distribution Modelling – With Applications in R. *Cambridge University Press*.

Key points to illustrate: Spatial modelling and spatial prediction; model selection.

Description: The data originate from bird transect surveys in Finland. The example includes occurrence data for 50 common species on 137 transect (all surveyed in a single year). The environmental data contains habitat type and climatic conditions, the trait data migratory status and body mass. Aa quantitative phylogenetic tree is provided.

Fungi

Source: Saine, S., Ovaskainen, O., Somervuo, P. and Abrego, N. 2020. Data collected by fruit-body and DNA-based survey methods yield consistent species-to-species association networks in wood-inhabiting fungal communities. *Oikos* **129**, 1833–1843.

Key points to illustrate: Different response variables in the same model.

Description: 100 logs (=fallen spruces) surveyed in a single forest site. Decay class and other environmental covariates were measured for each log. The logs were surveyed for dead-wood fungi using two methods: extracting DNA from saw-dust, and traditional fruit-body surveys. For some of the species-fruit-body abundance was also measured.

Phenology

Source: Roslin, T. *et al.** 2021. Phenological shifts of abiotic events, producers and consumers across a continent. *Nature Climate Change* **11**, 241–248.

Key points to illustrate: Temporal modelling; applying HMSC to other type of data than species occurrences/abundances.

**et al.* = Antão, L., Hällfors, M., Meyke, E., Lo, C., Tikhonov, G., Delgado, M., Gurarie, E., Abadonova, M., Abduraimov, O., Adrianova, O., Akimova, T., Akkiev, M., Ananin, A., Andreeva, E., Andriychuk, N., Antipin, M., Arzamascev, K., Babina, S., Babushkin, M., Bakin, O., Barabancova, A., Basilskaja, I., Belova, N., Belyaeva, N., Bespalova, T., Bisikalova, E., Bobretsov, A., Bobrov, V., Bobrovskyi, V., Bochkareva, E., Bogdanov, G., Bolshakov, V., Bondarchuk, S., Bukharova, E., Butunina, A., Buyvolov, Y., Buyvolova, A., Bykov, Y., Chakhireva, E., Chashchina, O., Cherenkova, N., Chistjakov, S., Chuhontseva, S., Davydov, E. A., Demchenko, V., Diadicheva, E., Dobrolyubov, A., Dostoyevskaya, L., Drovnina, S., Drozdova, Z., Dubanaev, A., Dubrovsky, Y., Elsukov, S., Epova, L., Ermakova, O., Ermakova, O. S., Ershkova, E., Esengeldenova, A., Evstigneev, O., Fedchenko, I., Fedotova, V., Filatova, T., Gashev, S., Gavrilov, A., Gaydysh, I., Golovcov, D., Goncharova, N., Gorbunova, E., Gordeeva, T., Grishchenko, V., Gromyko, L., Hohryakov, V., Hritankov, A., Ignatenko, E., Igosheva, S., Ivanova, U., Ivanova, N., Kalinkin, Y., Kaygorodova, E., Kazansky, F., Kiseleva, D., Knorre, A., Kolpashikov, L., Korobov, E., Korolyova, H., Korotkikh, N., Kosenkov, G., Kossenko, S., Kotlugalyamova, E., Kozlovsky, E., Kozsheechkin, V., Kozurak, A., Kozyr, I., Krasnopevtseva, A., Kruglikov, S., Kuberskaya, O., Kudryavtsev, A., Kulebyakina, E., Kulsha, Y., Kupriyanova, M., Kurbanbagamaev, M., Kutenkov, A., Kutenkova, N., Kuyantseva, N., Kuznetsov, A., Larin, E., Lebedev, P., Litvinov, K., Luzhkova, N., Mahmudov, A., Makovkina, L., Mamontov, V., Mayorova, S., Megalinskaja, I., Meydus, A., Minin, A., Mitrofanov, O., Motruk, M., Myslenkov, A., Nasonova, N., Nemtseva, N., Nesterova, I., Nezdoliy, T., Niroda, T., Novikova, T., Panicheva, D., Pavlov, A., Pavlova, K., Petrenko, P., Podolski, S., Polikarpova, N., Polyanskaya, T., Pospelov, I., Pospelova, E., Prokhorov, I., Prokosheva, I., Puchnina, L., Putrashyk, I., Raiskaya, J., Rozhkov, Y., Rozhkova, O., Rudenko, M., Rybnikova, I., Rykova, S., Sahnevich, M., Samoylov, A., Sanko, V., Sapelnikova, I., Sazonov, S., Selyunina, Z., Shalaeva, K., Shashkov, M., Shcherbakov, A., Shevchyk, V., Shubin, S., Shujskaja, E., Sibgatullin, R., Sikkila, N., Sitnikova, E., Sivkov, A., Skok, N., Skorokhodova, S., Smirnova, E., Sokolova, G., Sopin, V., Spasovski, Y., Stepanov, S., Stratiy, V., Strekalovskaya, V., Sukhov, A., Suleymanova, G., Sultangareeva, L., Teleganova, V., Teplov, V., Teplova, V., Tertitsa, T., Timoshkin, V., Tirski, D., Tolmachev, A., Tomilin, A., Tselishcheva, L., Turgunov, M., Tyukh, Y., Van. P., Van, V., Vasin, A., Vasina, A., Vekliuk, A., Vetchinnikova, L., Vinogradov, V., Volodchenkov, N., Voloshina, I., Xoliqov, T., Yablonovska-Grishchenko, E., Yakovlev, V., Yakovleva, M., Yantser, O., Yarema, Y., Zahvatov, A., Zakharov, V., Zelenetskiy, N., Zheltukhin, A., Zubina, T., Kurhinen, J. and Ovaskainen, O.

Exercise case study (another fungal case study)

Source: Purhonen, J., Ovaskainen, O., Halme, P., Komonen, A., Huhtinen, S., Kotiranta, H., Læssøe, T. and Abrego, N. 2020. Morphological traits predict host-tree specialization in wood-inhabiting fungal communities. *Fungal Ecology* **46**, 100863.

Key points to illustrate: How to set up an Hmsc model with environmental covariates, traits, taxonomy, and a hierarchical study design.

Description: See separate file.