Patch dynamics in sand grasslands: connecting primary and secondary succession

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Short term (5–10–20 years) consequences of climate, and land use changes often appear at fine spatial scales. To understand plant community dynamics at these finer scales, patterns of sand vegetation were monitored at six localities representing various habitat types in the Kiskunság. Repeated vegetation maps within 40 × 100 m areas with a 5 × 5 m resolution were made between 1998 and 2007. Results from two localities, depicting primary and secondary (oldfield) successional processes, are presented here. Both stands were ca. 25 years old at the beginning of the study. Vegetation patch types mapped were mainly dominance types defined after extensive coenological surveys and on the basis of the age-states (life-stages) of dominant grasses (Figure 1).

A high diversity of patches and considerable temporal change of vegetation patchworks were revealed in both dynamics (Figure 2).

It is typical in these habitats that early successional patch types are still present after 25 years of vegetation development. Succession seems to be highly stochastic at the site level (e.g. at the scale of abandoned fields). However, it can be understood easily and described clearly at the patch scale by the transformations between the small number of patch types (16 coenological states, Figure 3).

We found considerable overlap between primary and secondary succession. The same patch types appear in both dynamics but with different probabilities and through different local successional pathways. The main drivers of transformations are the ageing and competitive dynamics of dominant grasses, the accumulation of plant litter, the animal (and human) disturbances, and the recurring drought effects. Transitional probabilities fluctuate over time, underlining the importance of long-term studies (Figure 4). The graphs describing the potential transformations between vegetation patches can serve as a conceptual basis for planning conservation and restoration managements in the future.
Figure 2. Repeated mapping of vegetation patch dynamics near Fülöpháza. 40 × 100 m areas mapped with 5 × 5 m resolution. a) primary succession, b) secondary succession.
Figure 3. Graphs of state-transformations representing vegetation patch dynamics between 1998 and 2007 near Fülopáza. Only transitions with transitional probability > 0.1 are shown (most frequent transitions are marked by blue colour). a) primary succession, b) secondary succession.

Figure 4. Temporal variability of transitional probabilities. Three examples are shown. F -> FS* (species poor Festuca patch -> Festuca-Stipa species rich patch), FS*-> S (Festuca-Stipa species rich patch -> species poor Stipa patch), FS*-> Ann (Festuca-Stipa species rich patch -> species poor patch characterized by cryptogams and annuals).
References


The first stage of primary succession starting on the moving sand.