

# Allegato 4a\_5

## Phenology of Plants Changing Seasons in the Flora of the SNP

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Accurate phenological observations are nowadays of great interest, because plants are sensitive to global changes. For example, it has been shown that, phenologically spring has strongly shifted towards the beginning of the year. In addition to a national phenological sample, an observational network was implemented in the SNP in 1994. In the context of the alpine flora of the SNP, a time series of 30 or more years is needed for research on climate change.

Phenological studies examine yearly cycles of the periodic appearance of growth and development of animals and plants. Plant phenology records the dates on which various phenological stages appear. In the SNP, phenological observations have been documented since 1994 in three study areas: Val Mingèr, Il Fuorn and Val Trupchun. Plants observed include alpine rose (*Rhododendron ferrugineum*), aspen (*Populus tremula*), birch (*Betula pendula*), blueberry (*Vaccinium myrtillus*), cocksfoot (*Dactylis glomerata*), coltsfoot (*Tussilago farfara*), cowberry (*Vaccinium vitis-idaea*), dandelion (*Taraxacum officinale*), edelweiss (*Leontopodium alpinum*), elder (*Sambucus racemosa*), heather (*Erica carnea*), golden hawksbeard (*Crepis aurea*), larch (*Larix decidua*), martagon lily (*Lilium martagon*), meadow saffron (*Colchicum autumnale*), rosebay willow-herb (*Epilobium angustifolium*), rowan (*Sorbus aucuparia*), spruce (*Picea abies*) and stemless gentian (*Gentiana acaulis*). Phenological stages cover the beginning of flowering, flowering period, foliation, leaf discolouring, fall of leaves, and ripeness of fruit. Some of these stages are also part of the national sample of MeteoSchweiz. Data from the SNP, which is barely influenced by humans, can be compared with data from surrounding sites, e.g. Scuol, Sent or Martina. To obtain comparable data, it is necessary that the same plants are observed at the

same sites. Microclimate strongly influences the appearance date of phenological stages. However, time series from the SNP are rather short for comparisons, or even for analysis of trends. Fig. 1 shows nine phenological stages over the period 1994 to 2010, that are recorded in the three study areas. Indicated here are the earliest, latest and mean appearance dates, which is indicated e.g. by the flowering of stemless gentian or the discolouring of larch. In this way, park visitors gain an indication of when for example the „golden autumn“ is to be expected.

Due to the relatively short observation period of 20 years to date, record values (earliest or latest dates) are expected. Mean values may also shift in either direction. Fig. 1 shows that appearance dates of phenological stages vary strongly from year to year. The means of time series of phenological stages including flowering of coltsfoot, dandelion, heather, and stemless gentian, as well as foliation of larch, spruce and aspen describe spring stages and the extent of variation (fig. 2). In the three areas, yearly duration or mean duration of vegetation period can be calculated from differences between foliation and discolouring in larch (fig. 3). This correlates with the photosynthetic period of the larch, which is considered as the general vegetation period in those areas. It is suggested that a trend towards earlier phenological appearance dates in spring and summer in the SNP could be shown with a longer time series, because the weather station at Buffalora, at the border of the SNP, shows an obvious trend to warmer temperatures. Such a time shift in phenological seasons affects also the fauna. This may influence, for example, the migratory behaviour of ungulates or the duration of hibernation of marmots (*Marmota marmota*).

It is important that these phenological observations are continued for decades. Only long time series will allow substantial proof of long-term changes in vegetation development.

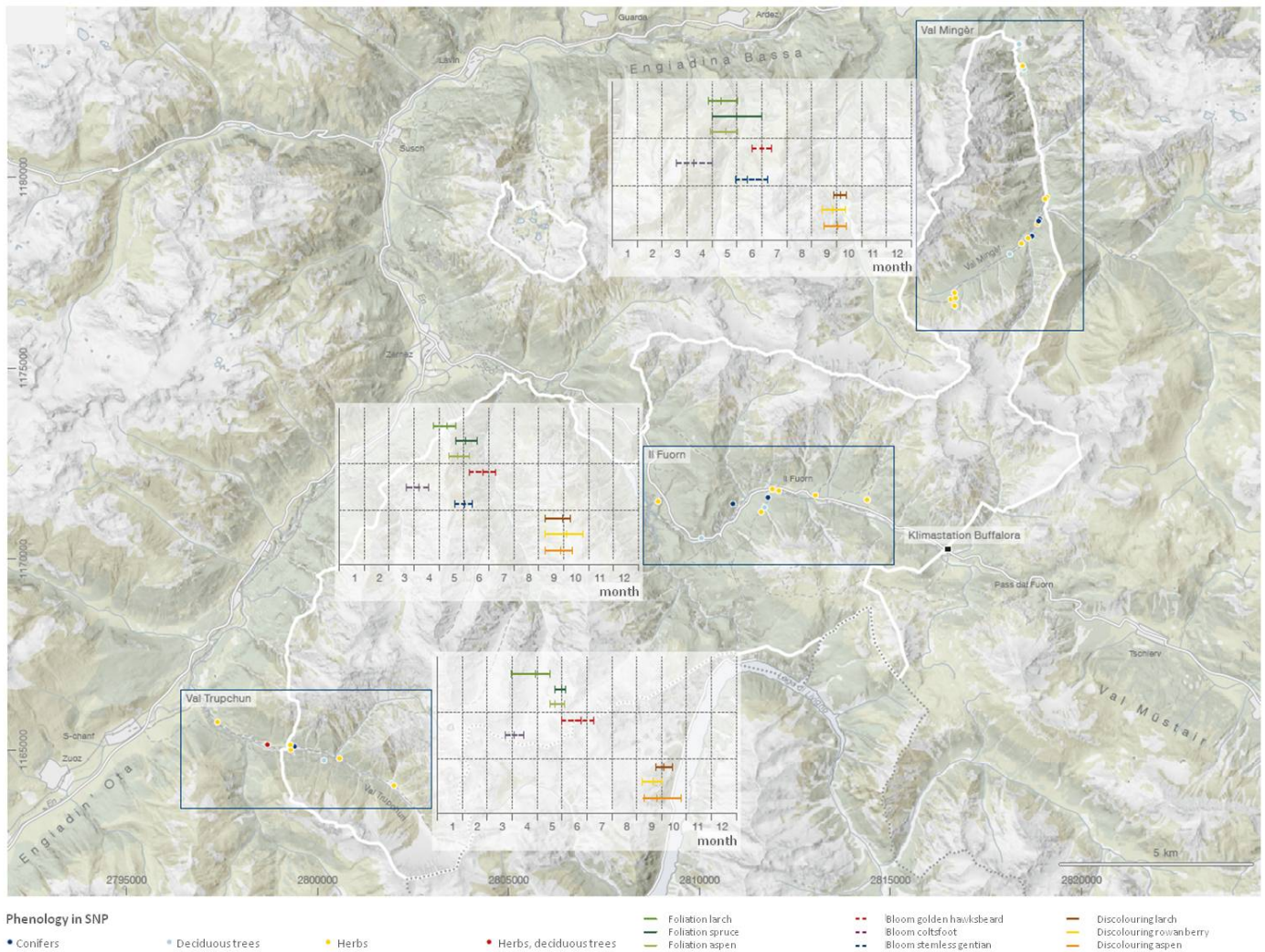


Fig. 1. Phenology in SNP

Conifers

Deciduous trees

Herbage

Foliation larch

Foliation spruce

Foliation aspen

Bloom golden hawksbeard

Bloom coltsfoot

Bloom stemless gentian

Discolouring larch

Discolouring rowan berry

Discolouring aspen

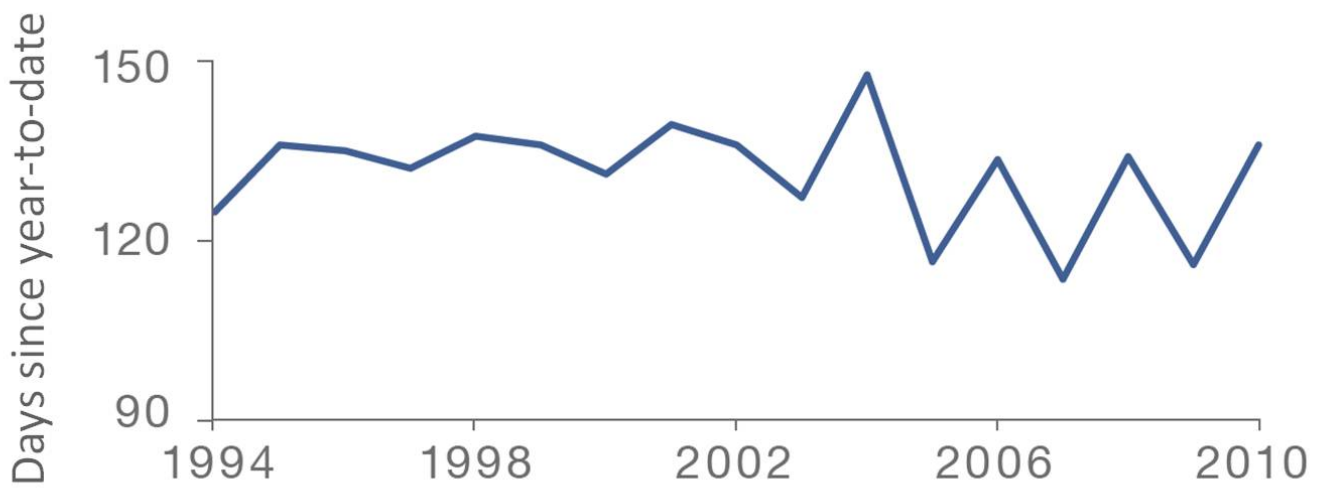


Fig. 2. Mean of spring stages in SNP  
Days since New Year

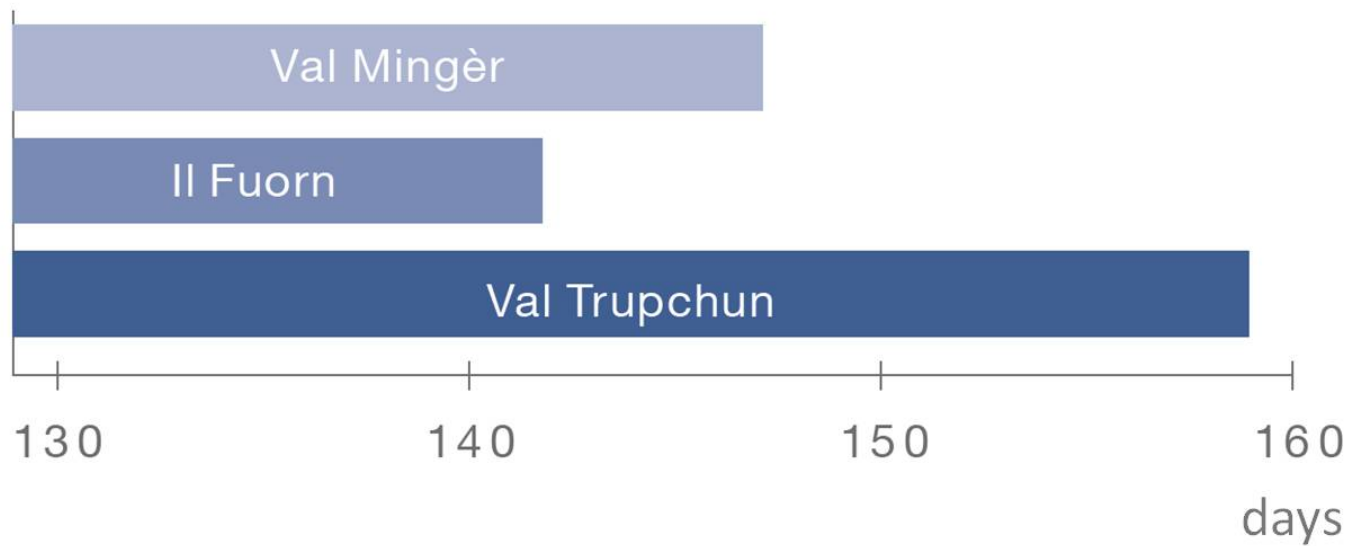


Fig. 3. Duration of vegetation period in days