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Article

Vegetation of the northern Korean Peninsula: classification, ecology and distribution

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with 1 figure, 11 tables and 1 appendix

Abstract: This preliminary survey of North Korean vegetation is based on phytocoenological data obtained during the five expeditions that took place between 1984 and 1990 (1181 relevés) by Czech and Slovak phytocoenologists. Field analyses and the classification of vegetation were carried out using the Braun-Blanquet approach and methods of hierarchical numerical classification. In the eleven synoptic tables, related to the eleven main groups of biotopes, all distinguished associations and communities are presented and compared. Individual vegetation units are syntaxonomically and nomenclaturally revised. Within the 20 classes (Asteretea tripolii, Bidentetea tripartitae, Cakiletea maritimae, Carici rupestris-Kobresietea bellardii, Glehnietea littoralis, Lemnetea, Miscanthetea sinensis, Oryzetea sativae, Phragmito-Magnocaricetea, Plantaginetea majoris, Potametea, Querco-Fagetea crenatae, Rhamno-Prunetea, Robinietea, Rosetea multiflorae, Salicetea sachalinensis, Salsoletea komarovii, Selaginello tamariscini-Potentilletea dickinsii, Stellarietea mediae, Vaccinio-Piceetea), 89 associations and communities are distinguished. Each unit is characterised by the correct name and short paragraphs on the diagnostic species, synmorphology, synecology, intra-association variability, distribution, human influence and references used. The zonality of the forest vegetation in North Korea is briefly characterised.

Keywords: Braun-Blanquet methodology, East Asia, floristic composition, plant communities, synchorology, synecology, syntaxonomy, vegetation survey

Contents

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Introduction

Knowledge on the vegetation cover of North Korea was quite sparse before the series of botanical field expeditions of Czech and Slovak geobotanists in the vegetation seasons between 1984 and 1990. Some floristic data on shrubs and trees had been published by Boratyński (1984), Staszkiewicz (1992a, b). Several works dealt with cultivated plants (Baik et al. 1986, Hammer et al. 1987, Hoang & Hammer 1988). The main objective of the expeditions was basic phytocoenological research on the floristic composition and variability of plant communities (associations), their ecology, and their distribution in the country. Also, knowledge on the vegetation cover of the entire Korean Peninsula has been relatively poor (Yim 1977a, b, 1995, Yim & Kira 1975). On the other hand, the long-term investigation into the vegetation of the southern part of the Korean Peninsula progressed further (e.g. Cho & Kim 2005, Choung & Lee 2001, Ihm et al. 2001, Jung 2000, Kim 1990, Kim & Kim 1988, Kong 1988, 2000, Kong & Watts 1993, Song 1988, 1991a, b, 1992a, b, 2001a, b, Song & An 1999, Song & Nakanishi 1985, Song et al. 1999). Phytocoenological studies published from neighbouring countries (Japan, Russia, and China) served as good comparative material for the evaluation and classification of North Korean vegetation.

In all seasons, we collected phytocoenological relevés from a wide range of various vegetation units. All relevés were processed and syntaxonomically evaluated, compared with the geographically relevant phytocoenological literature mainly from the Japanese Islands and South Korea, less often from Russia, China, and in some cases also Europe, and consequently published in successive steps during the years 1985–2010 in international botanical journals and books. The syntaxonomy of the following vegetation types has been successfully worked out, either partly or completely: (1) forests – a survey of forest vegetation units of North Korea has been published (Kolbek et al. 2003a, c) in a book dedicated to the forest vegetation of Northeast Asia (Kolbek et al. 2003b), forest zonation (Neuhäusl & Neuhäuslová 1994), and epiphytic communities in forests (Kolbek 1995); (2) the vegetation structure of tree stands and alpine grasslands near the timberline (Šrůtek & Kolbek 1994, Šrůtek & Lepš 1994, Šrůtek et al. 1994, 2003a, b, Kolbek & Jarolímek 2007); (3) the vegetation of rocks (Kolbek et al. 1997, 1998) and walls (Kolbek & Valachovič 1996); (4) the vegetation of water bodies (Kolbek & Dostálek 1996); (5) nitrophilous ponds and river banks (Jarolímek et al. 1991); (6) salt marshes (Kolbek et al. 1989); (7) rice paddies (Kolbek et al. 1996) and soya bean fields (Dostálek et al. 1990); (8) grassland vegetation (Blažková 1993, Šrůtek & Kolbek 1992); (9) anthropogenic (ruderal) vegetation (Mucina et al. 1991, Kolbek & Sádlo 1996, Sádlo & Kolbek 1997); (10) communities dominated by *Salix gracilistyla* (Jarolímek & Kolbek 2006); (11) synanthropic vegetation (Kolbek & Jarolímek 2008); and (12) the vegetation of reeds (Kolbek & Jarolímek 2010).

The taxonomy, phytocoenology, and ecology of some Korean *Rhododendron* species have been analysed (Dostálek 1995, Dostálek et al. 1988). Dostálek et al. (1989) have published a few taxa new to the flora of North Korea.

Furthermore, an illustrated survey of the distribution of woody plants has been finalised (Kolbek & Kučera 1989, 1999). These books summarise our knowledge of the coenological relationships among trees and other forest species, based on phytocoenological studies. Kolbek et al. (2001) also published a book on the distribution of 398 woody species.

The aim of this study was a synthetic phytocoenological survey of all vegetation units found in North Korea based on all accessible data.

Study area

The geographic position of North Korea is limited by 38° and 43° north latitude and 124° and 131° east longitude (Anonymous 1976). Forested mountains cover more than 70 % of the country. The highest peak, the volcano Mount Paektu (2744 m a.s.l.), is situated at the northern border with China. Lowlands are concentrated along the eastern and western seacoasts. Most of the geological bedrock is composed of Proterozoic gneiss with emerging massifs of granites. In the north-eastern part, volcanic formations are represented. In the middle of the country (widely surrounding Pyongyang), there are relatively rare calcareous bedrocks (Lee 1987, Košťák et al. 2003).

According to the map of North Korean soils published in 1983 (authors unknown, personal communication, sec. Kolbek et al. 2003a), the soils are divided into six groups: 1. brown forest soils (northern and central parts of the country), 2. red-brown forest soils (in the south and east), 3. podzolised soils (in the foothills and mountains above 150 m a.s.l.), 4. podzolised brown mountain soils (montane areas near the northern border), 5. skeletal soils (hills and lower mountains), and 6. mountain meadow soils (under alpine grasslands and mountain meadows in the north). Most soils are skeletal or very skeletal, humus-rich, nutrient-poor, acidic to moderately acidic, and freshly moist for the most part.

North Korea lies in the temperate zone with four distinct seasons and a warm and moist climate. The average annual temperature varies between 9.5 and 10.5 °C in the central region; in mountainous areas in the north, the average temperature is 3 °C. Precipitation has a wide range of 630–1630 mm per year. From the point of view of vegetation, the distribution of precipitation throughout the seasons is important. Most precipitation (about 60 %) falls within the summer monsoon from the middle of

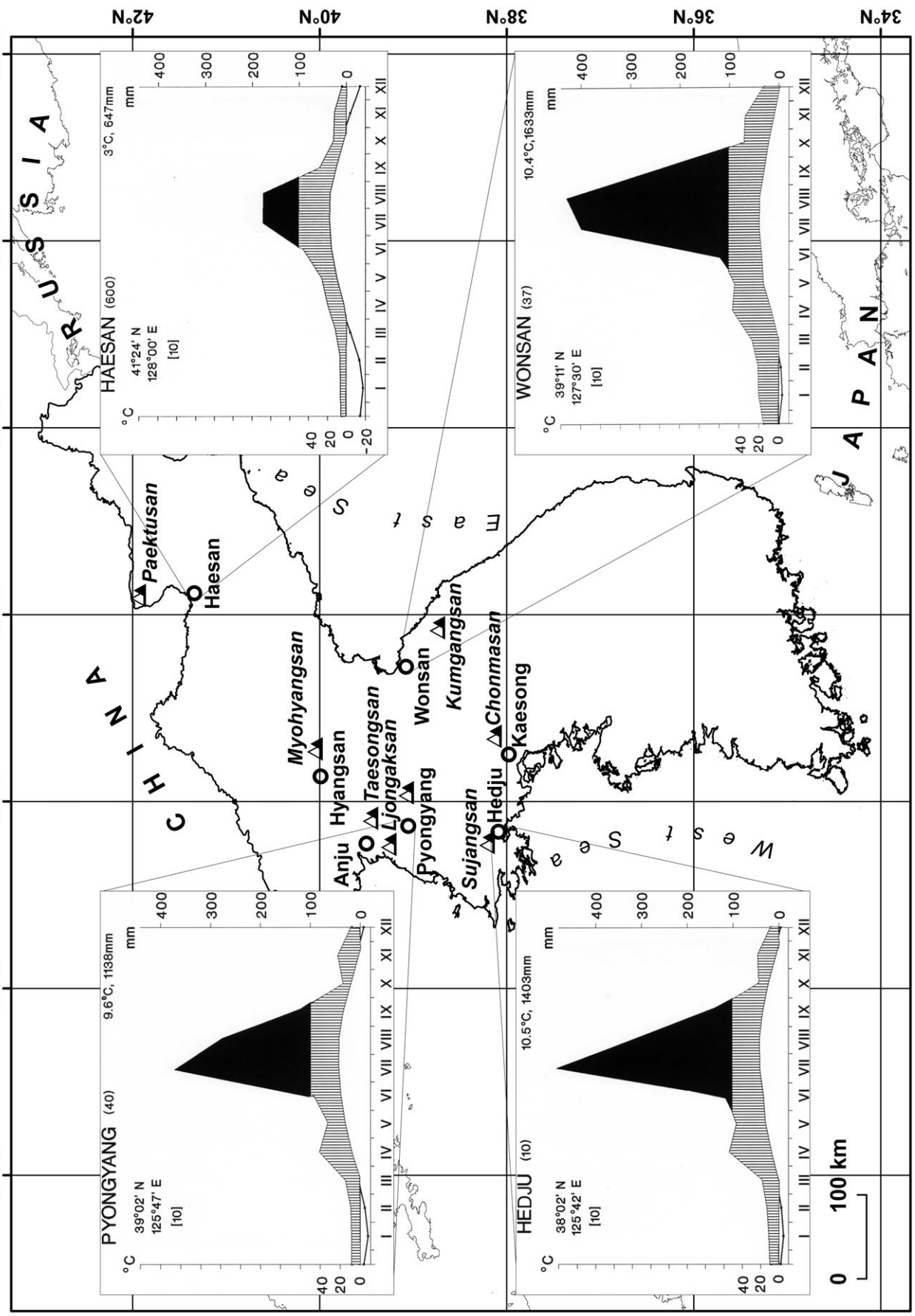

Fig. 1. The location of the study areas within the northern Korean Peninsula with four representative climate diagrams (Layout D. Senko).

June to the end of July, from time to time up to the beginning of August (Yim & Kim 1983, Box & Choi 2003) (Fig. 1).

The bioclimate and zonal vegetation in north-east Asia have been published by Hämet-Ahti et al. (1974), Nakamura et al. (2007), newly in comprehensive survey paper by Box & Fujiwara (2012). Floristically, the Korean Peninsula is divided into eight biogeographical regions (Kong & Watts 1993). Four regions encompass the territory of North Korea. Each region was characterised by selection of arboreal species. According to typical species found in these regions, we have modified the classification of Kong & Watts (1993) as follows:

I – The northern alpine region is represented by the Paektusan Mountains. Its flora is characterised by numerous coniferous and alpine evergreen broadleaved species (*Dryas tschonoskii, Juniperus sibirica*, *Larix olgensis*, *Ledum decumbens*, *L. palustre* var. *maximum*, *Phyllodoce coerulea*, *Rhododendron aureum*, *R. parvifolium*). Dark and light taiga forests prevail. The zonality of this type of vegetation has been described by Kolbek et al. (2003a).

II – The north-south subalpine region in North Korea is predominately represented by the Myohyangsan and Kumgangsan Mountains. In addition to coniferous trees and shrubs (*Abies nephrolepis*, *Juniperus sargentii*, *Pinus koraiensis*, *Thuja koraiensis*) and evergreen broad-leaved plants, in the Kumgangsan Mountains there are also woody bamboo (*Sasamorpha purpurascens* var. *borealis*), and endemic stenoecious species, such as *Forsythia ovata* or *Pentactina rupicola* (plants included to the Red Data Book of DPRK; Son 2005). Mixed and broadleaved forests dominate.

III – The central mountain region contains all the areas of the lower hills near the town of Kwail and the city of Pyongyang (e.g. the Taesongsan and Ljongaksan Mountains). The most typical representatives are the Sujangsan Mountains near Hedju and the Chonmasan Mountains near Kaesong, where the alpine species subside. This region can be regarded as the transition to South Korean vegetation. The typical woody species of the region are endemic *Juniperus rigida* and *Pinus rigida*. Broadleaved thermophilous or *Pinus densiflora* forests prevail.

IV – The lowland region has been mostly converted by cultivation into fields and orchards or has been settled. The remaining poplar and willow woodlands are scattered (*Alnus hirsuta*, *A. japonica*, *Celtis bungeana*, *Populus koreana* and related taxa, *Salix gilgiana*, *S. gracilistyla*, *S. rorida*, etc.).

Methods

The field work during the expeditions was organised in close collaboration with colleagues from the Institute of Botany of the Korean Academy of Sciences in Pyongyang, who generously helped us with transport, orientation in the country and particularly with the determination of plant species directly in the field and/or collected herbarium specimens. Unfortunately, moving around the country and the number of accessible localities was limited. In spite of this, during the expeditions, we successively visited nearly all the main vegetation regions and habitats from the north boundary with China to the southern boundary with South Korea (Fig. 1):

- The Changbaishan Mountains, with the highest peak in the country, the volcano Mt. Paektusan, are covered by alpine and subalpine small shrub vegetation around the top, light and dark taiga forests on the slopes and with crop fields on the large plateau at lower altitude.
- The Myohyangsan Mountains are covered by subalpine dwarf pine and *Betula ermanii* vegetation and a montane belt rich in various broadleaved and mixed forests, riverside herbaceous vegetation, and the vegetation of rock fissures.
- The Ljongaksan, Sujangsan and Taesongsan Mountains are covered by hilly oak, pine, or mixed forests and pine plantations.
- The Chonmasan Mountains north and north-east of Kaesong are covered by thermophilous broadleaved forests.
- The Kumgangsan Mountains are covered by thermophilous broadleaved forests with bamboo (*Sasamorpha *borealis*), the vegetation of rocks, and shrub willow riverside vegetation.
- The capital of North Korea, Pyongyang, and its surrounding and cities/villages of Naegok, Hyangsan, Nampo, Anju, Hedju, Wonsan, Kail, and Kaesong are covered by ruderal and segetal vegetation (including rice fields) and the vegetation of walls, ponds, and lawns.
- The eastern and western seacoasts are covered by salt marshes and sand dune vegetation.
- The many short stops along the way while travelling from one locality to another were characterised by the vegetation near rivers and brooks, rocks, lakes, dams, rice fields, etc.

Data collection and evaluation

Phytocoenological data were obtained during the expeditions to the northern part of the Korean Peninsula in 1984, 1986, 1988, 1989 and 1990. In this study, we used published phytocoenological tables (relevé tables or synoptic tables). All relevés (1180 relevés in the synoptic tables + 1 relevé in the text) were made and processed following the Braun-Blanquet approach (Braun-Blanquet 1964, Westhoff & van der Maarel 1978). In the field, a modified nine-degree scale (Barkman et al. 1964) was used, with the second category divided into 2m, 2a, and 2b. Vascular flowering taxa were determined by Anony-

mous (1972–1976, 1979), Do & Im (1976), Charkewicz (1985–1989), Kim et al. (1988) and Voroshilov (1982), and ferns by Anonymous (2005).

Before the computation, all relevés were transformed into a 0–9 ordinal scale (van der Maarel 1979). Hierarchical clustering of relevés was calculated by the program NCLAS or SYNTAX2000 (Podani 1993, 2001). Ružička's coefficient similarity and β-flexible clustering method (β = –0.25) were the most frequently used parameters. On the basis of the obtained dendrograms with regard to the field experiences, the association phytocoenological tables and synoptic tables were arranged by the program FYTOPACK (Jarolímek & Schlosser 1997).

The chemical composition of the soils was analysed using methods published by Kolbek et al. (2003a) together with the data on soil profiles.

Tables

The tables were arranged based on the floristic and habitat similarity to the eleven synoptic differential phytocoenological tables of basic vegetation types: 1. Riverside communities, 2. Aquatic communities, 3. Seaside vegetation, 4. Communities of rocky and wall habitats, 5. Alpine tundra vegetation, 6. Broad-leaved and mixed forests, 7. Coniferous forests, 8. Artificial forest and shrub communities, 9. Terrestrial ruderal vegetation, 10. Weed vegetation, and 11. Rice field vegetation. The head of every table consists of a list of involved associations/communities, the number of relevés per community, and the average number of species per relevé in each community. The core of each table consists of a list of character and differential taxa of associations/communities, alliances, orders, classes, and indifferent taxa ("others"). The included indifferent taxa occur minimally in two columns or with a frequency greater than 20 % in one column. Taxa occurring in one column with a frequency below 20 % are included only if they have dominance (3 and higher). In the list of taxa are bolded character and differential taxa. Character taxa are taxa completely or almost completely confined to one syntaxon (exclusive taxa), while selective character taxa are taxa occurring with a clear preference for one syntaxon but also with a considerably lower degree of presence in other syntaxa (sensu Westhoff & van der Maarel 1978). These species work minimally in the class level or higher. Differential taxa are taxa occurring only in or with clear preference for one syntaxon in the framework of the first higher syntaxon. Character and differential taxa, constant taxa (frequency more than 50 %), and dominant taxa (dominance from 3 to 5 in at least one relevé) are bolded in the tables. At the bottom of the table, the numbers of accessory species with a frequency lower than 20 % are indicated. The columns of the tables express the percent constancy of the species in the plant communities based on five or more relevés with the interval of coverage values in the upper index. Italic numbers in the column ("spalte") show the number of occurrences of the species in the community based on fewer than five relevés.

Text

To facilitate clear and quick orientation within the text, the characteristics of units are arranged into regularly repeated short paragraphs: 1. nomenclatural type; 2. synmorphology, a description of the vertical and horizontal structure of the community; 3. species variability within the unit and infra-association units, if present; 4. synecology, habitat information on elevation, slope, orientation, soil properties, moisture demands, etc.; 5. the distribution in North Korea, based on the authors' observations; 6. man-vegetation unit relationships, exploitation, protection, disturbances, etc.; 7. a comparison with related syntaxa in neighbouring countries; and 8. the literature sources used.

Communities documented by a small number of relevés and characterized by non stable species composition were not included into the syntaxonomical system.

Nomenclature

The nomenclature of vascular plants follows the checklist of plant species names proposed by Ri & Hoang (1984), and Flora Coreana – Appendix (Anonymous 1979), the nomenclature of mosses follows Choe (1980), and the nomenclature of lichens follows Lee (1988) and Yoshimura (1994). Exceptions are stated in Appendix 1 with author abbreviations. Taxa determined on the level of genus only are indicated by the abbreviation sp. and, in several cases, also by a number, if there are more taxa in the same genus. Infra-specific names are shorted by an asterisk (*) before the last name. Their full names are given in the Appendix 1.

The names of syntaxa follow the International Code of Phytocoenological Nomenclature (Weber et al. 2000). The syntaxa previously described by the authors of this paper contain citations of the nomenclatural type.

The following abbreviations are used in the text and tables:
A – average, **All** – alliance, **C** – comparison with syntaxa in surrounding countries, **CL** – class, **D** – distribution, **DS** – diagnostic species, **E** – emergent macrophytes, **F** – floating macrophytes, **FC** – field farm crop, **M** – moss layer, **MI** – man influence, **NT** – nomenclatural type, **OR** – order, **REF** – references, **S** – shrub layer, **SE** – synecology, **SM** – synmorphology, **T** – tree layer, **U** – submerged macrophytes, **V** – variability and/or syntaxonomy.

Results

The first preliminary survey of the North Korean vegetation to this point consists of 20 classes (Asteretea tripolii, Bidentetea tripartitae, Cakiletea maritimae, Carici rupestris-Kobresietea bellardii, Glehnietea littoralis, Lemnetea, Miscanthetea sinensis, Oryzetea sativae, Phragmito-Magnocaricetea, Plantaginetea majoris, Potametea, Querco-Fagetea crenatae, Rhamno-Prunetea, Robinietea, Rosetea multiflorae, Salicetea sachalinensis, Salsoletea komarovii, Selaginello tamariscini-Potentilletea dickinsii, Stellarietea mediae, Vaccinio-Piceetea), 22 orders, 31 alliances, 62 associations (including 71 subassociations) and 26 communities. Real number of plant communities in North Korea is certainly much higher. All vegetation units described by Czech and Slovak authors were published in separate papers (see References and text of units). Consequently, this paper contains no new described units.

In the following text, the hierarchical survey of the vegetation units is presented from the level of class to the level of subassociation or community. The lower units (variants) are mentioned within paragraph "V" (variability) in the characteristics of the related association. All units are documented by the phytocoenological relevés and all other necessary characteristics. In this article, the phytocoenological synthesis is presented in eleven synoptic tables, including brief comparative descriptions and often also newly found data and supplements which have not been published before.

Hierarchical survey of vegetation units

Salicetea sachalinensis Ohba 1973
- **Alno-Salicetalia serissaefoliae** Ohba 1973
  - **Salicion gracilistylae** Ohba 1973
    - Artemisio feddei-Salicetum gracilistylae Jarolímek & Kolbek 2006
      - spodiopogonetosum sibiricae Jarolímek & Kolbek 2006
      - artemisietosum capillaris Jarolímek & Kolbek 2006

Phragmito-Magnocaricetea Klika in Klika & Novák 1941
- **Phragmitetalia** Koch 1926
  - **Oenantho javanicae-Phalaridion arundinaceae** Miyawaki & Okuda 1972
    - Phragmitetum japonicae Minamikawa 1963
      - artemisietosum feddei Kolbek & Jarolímek 2010
      - humuletosum scandentis (Minamikawa 1963) Miyawaki 1985
      - polygonetosum thunbergii Miyawaki 1982
      - boehmerietosum spicatae Kolbek & Jarolímek 2010
      - inops Kolbek & Jarolímek 2010
  - **Phragmition** Miyawaki & Ohba 1969
    - Scirpetum iseensis Miyawaki & Ohba 1969
    - Triglochini maritimae-Phragmitetum communis Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
      - typicum Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
      - scirpetosum iseensis Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
      - asteretosum tripolii Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989

Bidentetea tripartitae R. Tüxen, Lohmeyer & Preising in R. Tüxen 1950
- **Bidentetalia tripartitae** Br.-Bl. & R. Tüxen 1943
  - **Panico-Bidention frondosae** Miyawaki & Okuda 1972
    - Polygonetum thunbergii Lohmeyer & Miyawaki 1962
      - juncetosum decipientis Jarolímek, Kolbek & Dostálek 1991
      - humuletosum japonicae Jarolímek, Kolbek & Dostálek 1991
    - Polygonetum sieboldii-hydropiperis Okuda 1978
      - cyperetosum glomerati Jarolímek, Kolbek & Dostálek 1991
      - artemisietosum asiaticae Jarolímek, Kolbek & Dostálek 1991
    - Persicarietum posumbu Jarolímek, Kolbek & Dostálek 1991
    - *Bidens bipinnata* community sensu Jarolímek et al. (1991)
    - *Bidens tripartita* community sensu Jarolímek et al. (1991)

Hemarthria sibirica community sensu Jarolímek et al. (1991)
Persicaria dissitiflora community sensu Jarolímek et al. (1991)

Communities without defined syntaxonomical status
Agrostis alba-Calamagrostis epigeios community sensu Kolbek & Jarolímek (2008)
Alisma orientale community sensu Kolbek & Jarolímek (2008)
Carex pumila-Equisetum arvense community sensu Kolbek & Jarolímek (2008)
Lobelia chinensis community sensu Kolbek & Jarolímek (2008)
Scirpus preslii community sensu Kolbek & Jarolímek (2008)
Scirpus radicans community sensu Kolbek & Jarolímek (2008)
Scirpus triqueter community sensu Kolbek & Jarolímek (2008)
Scirpus yagara community sensu Kolbek & Jarolímek (2008)
Artemisia capillaris stadium sensu Kolbek & Jarolímek (2008)
Persicaria hydropiper initial stadium sensu Kolbek & Jarolímek (2008)

Lemnetea De Bolós & Masclans 1955
Lemnetalia minoris De Bolós & Masclans 1955
Lemnion paucicostatae Miyawaki & J. Tüxen 1960
Lemno paucicostatae-Azollaetum pinnatae Kolbek & Dostálek 1996
Hydrocharitetalia Rübel 1933
Hydrocharition Rübel 1933
Lemna paucicostata-Eichhornia crassipes community sensu Kolbek & Dostálek (1996)

Potametea Klika in Klika & Novák 1941
Potametalia Koch 1926
Nymphaeion albae Oberdorfer 1957
Myriophyllo spicati-Nelumbetum nuciferae c 1996
Bidenti tripartitae-Nelumbetum nuciferae Kolbek & Dostálek 1996
Ceratophyllo demersi-Nelumbetum nuciferae Kolbek & Dostálek 1996
Monochorio plantagineae-Nelumbetum nuciferae Kolbek & Dostálek 1996
Nelumbo nucifera community sensu Kolbek & Dostálek (1996)
Potamion pectinati (Koch 1926) Görs 1977
Potamogeton octandrus-Potamogeton distinctus community sensu Kolbek & Jarolímek (2008)

Cakiletea maritimae R. Tüxen & Preising 1950
Cakiletalia maritimae R. Tüxen apud Oberdorfer (1949) 1950
Thero-Suaedion Br.-Bl. 1931
Suaedetum japonicae Miyawaki & Ohba 1969
typicum Miyawaki & Ohba 1969

Asteretea tripolii Westhoff & Beeftink apud Beeftink 1965
Zoysietalia sinicae nipponicae Miyawaki & Ohba 1969
Zoysion sinicae nipponicae Miyawaki & Ohba 1969
Artemisietum fukudo Miyawaki & Ohba 1969
typicum Miyawaki & Ohba 1969
zoysietosum sinicae Miyawaki & Ohba 1969

Salsoletea komarovii Ohba, Miyawaki & Tüxen 1973
Salsoletalia komarovii Ohba, Miyawaki & Tüxen 1973
Salsolion komarovii Ohba, Miyawaki & Tüxen 1973
Artemisio capillaris-Salsoletum komarovii Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989

Rosetea multiflorae Ohba, Miyawaki & Tüxen 1973
Rosetalia rugosae Ohba, Miyawaki & Tüxen 1973
Rosion rugosae Ohba, Miyawaki & Tüxen 1973
Salsolo komarovii-Rosetum rugosae Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989

Glehnietea littoralis Ohba, Miyawaki & Tüxen 1973
Glehnietalia littoralis Ohba, Miyawaki & Tüxen 1973
Caricion kobomugi Ohba, Miyawaki & Tüxen 1973
Elymo-Caricetum kobomugi Miyawaki 1967
Carex pumila-Lathyrus maritimus community sensu Mucina & Dostálek (1985)

Selaginello tamariscini-Potentilletea dickinsii Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek
Potentilletalia dickinsii Ohba 1973
Potentillion dickinsii Ohba 1973
Rhododendro mucronulati-Potentilletum dickinsii Kolbek, Jarolímek & Valachovič 1997
Selaginellion tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek
Artemisio keiskeanae-Chrysanthemetum coreani Kolbek, Jarolímek & Valachovič 1997
arundinelletosum hirtae Kolbek, Jarolímek & Valachovič 1997
orostachyetosum erubescentis Kolbek, Jarolímek & Valachovič 1997
asteretosum maackii Kolbek, Jarolímek & Valachovič 1997
Amitostigmato gracilis-Sedetum polytrichoidis Kolbek, Jarolímek & Valachovič 1997
spodiopogonetosum sibirici Kolbek, Jarolímek & Valachovič 1997
lepisoretosum ussuriensis Kolbek, Jarolímek & Valachovič 1997
Davallietum mariesii Kolbek, Jarolímek & Valachovič 1997
Lepisoro ussuriensis-Selaginelletum tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek
Woodsio polystichoidis-Orostachyetum erubescentis Kolbek, Jarolímek & Valachovič 1997
Sedetum sarmentoso-middendorffiani Kolbek, Jarolímek & Valachovič 1997
Commelino communis-Sedetum sarmentosi Kolbek & Valachovič 1996
Parietario micranthae-Pileaetum peploidis Kolbek, Jarolímek & Valachovič 1997
Camptosorus sibiricus-Pilea peploides community sensu Kolbek & Valachovič (1996)
Oxalis stricta-Microlepia pilosella community sensu Kolbek & Valachovič (1996)
Saxifragetalia fortunei Kolbek, Valachovič & Jarolímek 1998
Saxifragion fortunei Kolbek, Valachovič & Jarolímek 1998
Patrinio saniculaefoliae-Mukdenietum rossii Kolbek, Valachovič & Jarolímek 1998
Mukdenio rossii-Selaginelletum rossii Kolbek, Valachovič & Jarolímek 1998
typicum Kolbek, Valachovič & Jarolímek 1998
androsacetosum cortusaefoliae Kolbek, Valachovič & Jarolímek 1998
Dryopterido saxifragae-Saxifragetum fortunei Kolbek, Valachovič & Jarolímek 1998
Saxifraga fortunei-Boehmeria spicata community sensu Kolbek & Valachovič (1996)
Selaginella stauntoniana community sensu Kolbek, Valachovič & Jarolímek (1998)

Carici rupestris-Kobresietea bellardii Ohba 1974
Caricetalia tenuiformis Ohba 1968
Phyllodocion nipponicae Miyawaki et al. 1968
Dryado tschonoskii-Rhododendretum aurei Dostálek sen., Dostálek jr., Mucina & Hoang 1988
typicum Kolbek & Jarolímek 2007
erigeronetosum thunbergii Kolbek & Jarolímek 2007
papaveretosum radicatae Kolbek & Jarolímek 2007

Querco-Fagetea crenatae Miyawaki et al. 1968 emend. Kim (1990) 1992
Quercenea mongolicae Kim 1992
Rhododendro-Quercetalia mongolicae Kim 1992
Pino koraiensis-Quercion mongolicae Kim 1990
Lychno-Quercetum mongolicae Kim 1990
disporetosum ovalae Kim 1992
astilbetosum thunbergii Kolbek, Jarolímek & Valachovič 2003
Vaccinio-Quercetum mongolicae Kim 1990
abietosum holophyllae Kim 1990
hostetosum longipes Kim 1990

Parthenocisso tricuspidati-Fraxinetum rhynchophyllae Kolbek, Jarolímek & Valachovič 2003
Rhododendro mucronulati-Pinion densiflorae Kim & Yim 1988
Festuco ovinae-Pinetum densiflorae Song 1992
peucedanetosum terebintacei Kolbek, Jarolímek & Valachovič 2003
lilietosum partheneioni Kolbek, Jarolímek & Valachovič 2003
Lindero-Quercion mongolicae Kim 1990
Saso-Quercetum mongolicae Kim 1990
quercetosum variabilis Kim 1990
Artemisio-Quercetum mongolicae Kim 1990
juniperetosum rigidae Kim 1992
deutzietosum prunifoliae Kolbek, Jarolímek & Valachovič 2003
styracetosum obassiae Kim 1992
Syneilesio palmatae-Carpinetum laxiflorae Kolbek, Jarolímek & Valachovič 2003
Weigelo floridae-Fagarion schinifoliae Kolbek, Jarolímek & Valachovič 2003
Lilio lancifolii-Rhododendretum schlippenbachii Kolbek, Jarolímek & Valachovič 2003
Indigofera kirilowii-Securinega suffruticosa community sensu Kolbek et al. (2003a)

Vaccinio-Piceetea Br.-Bl. 1939
Abieti nephrolepidis-Piceetalia jezoensis Song 1992
Laricion olgensis Kolbek, Jarolímek & Valachovič 2003
Rhododendro aurei-Laricetum olgensis Dostálek sen., Dostálek jun., Mucina & Hoang 1988
typicum Kolbek, Jarolímek & Valachovič 2003
salicetosum arcticae Kolbek, Jarolímek & Valachovič 2003
gentianetosum algidae Kolbek, Jarolímek & Valachovič 2003
pyroletosum dahuricae Kolbek, Jarolímek & Valachovič 2003
Goodyero repentis-Piceetum jezoensis Kolbek, Jarolímek & Valachovič 2003
usneetosum longissimae Kolbek, Jarolímek & Valachovič 2003
listeretosum nipponicae Kolbek, Jarolímek & Valachovič 2003
Carici peiktusani-Abietetum nephrolepidis Kolbek, Jarolímek & Valachovič 2003
iridetosum dichotomae Kolbek, Jarolímek & Valachovič 2003
phegopteridetosum polypodioidis Kolbek, Jarolímek & Valachovič 2003
lycopodietosum complanati Kolbek, Jarolímek & Valachovič 2003
Ledo decumbentis-Laricetum olgensis Kolbek, Jarolímek & Valachovič 2003
linnaeetosum borealis Kolbek, Jarolímek & Valachovič 2003
potentilletosum cryptotaeniae Kolbek, Jarolímek & Valachovič 2003
brometosum jezoensis Kolbek, Jarolímek & Valachovič 2003
betuletosum paishanensis Kolbek, Jarolímek & Valachovič 2003
Rhododendro dahurici-Acerion barbinervi Kolbek, Jarolímek & Valachovič 2003
Dryopterido fragranti-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003 nom. corr. Kolbek & Jarolímek
ledetosum maximi Kolbek, Jarolímek & Valachovič 2003
sorbetosum amurensis Kolbek, Jarolímek & Valachovič 2003
Abieti nephrolepidis-Piceion jezoensis Song 1991
Taxo-Pinetum pumilae Song & Nakanishi 1985
Thujo koraiensis-Piceetum jezoensis Kolbek, Jarolímek & Valachovič 2003

Robinietea Jurko ex Hadač & Sofron 1980
Chelidonio-Robinietalia Jurko ex Hadač & Sofron 1980
Chelidonio-Robinion Hadač & Sofron 1980
Commelino communis-Robinietum pseudoacaciae Cho & Kim 2005
pinetosum densiflorae Cho & Kim 2005

Rhamno-Prunetea Rivas-Goday & Borja Carbonell ex R. Tx. 1962
Sambucetalia racemosae Oberdorfer ex Passarge in Scamoni 1963
Arctio-Sambucion nigrae Doing 1962
Lycium chinense community sensu Kolbek & Jarolímek (2008)

Stellarietea mediae R. Tüxen et al. in R. Tüxen 1950 ex von Rochow 1951
Commelinetalia Miyawaki 1969
Cassio nomame-Phyllanthion ussuriensis Sádlo & Kolbek 1997
Acalypho australis-Digitarietum pectiniformis Dostálek, Kolbek & Jarolímek 1990
Cosmo-Humulion japonicae Kolbek & Sádlo 1996
Beckmannio eruciformis-Potentilletum costatae Kolbek & Sádlo 1996
Daturo tatulae-Siegesbeckietum pubescentis Kolbek & Sádlo 1996
Humulo japonicae-Chenopodietum albi Kolbek & Sádlo 1996
Cephalonoploso segeti-Geranietum eriostemoni Dostálek, Kolbek & Jarolímek 1990
Aeschynomeno indicae-Kummerowietum striatae Jarolímek, Kolbek & Dostálek 1991
pycreetosum sanguinolenti Jarolímek, Kolbek & Dostálek 1991
ambrosietosum artemisiifoliae Jarolímek, Kolbek & Dostálek 1991
Platycodon grandiflorus culture
Secale cereale culture

Plantaginetea majoris R. Tüxen & Preising in R. Tüxen 1950
Plantaginetalia asiaticae Miyawaki 1964
Plantaginion asiaticae Miyawaki et al. 1971
Artemisio asiaticae-Plantaginetum asiaticae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
Bryo-Saginetum japonicae Ohba 1971
Plantagini depressae-Polygonetum avicularis Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991 emend. Sádlo & Kolbek 1997
polygonetosum avicularis (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
potentilletosum costatae (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
trifolietosum repentis (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997 comb.
inops (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997 comb.
Euphorbio maculatae-Centipedetum minimae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991 emend. Sádlo & Kolbek 1997
cyperetosum microiriae (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
plantaginetosum depressae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
typicum Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
amaranthetosum retroflexi Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
Digitario pectiniformis-Eleusinetum indicae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
digitarietosum sanguinei Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
chlorisetosum virgatae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
Setario viridis-Chlorisetum virgatae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
Plantagini asiaticae-Poetum pratensis Blažková 1993

Miscanthetea sinensis Miyawaki & Ohba 1970
Caricetalia nervatae Suganuma 1966
Zoysion japonicae Suzuki & Abe ex Suganuma 1966
Digitario ciliaris-Zoysietum japonicae Blažková 1993
cyperetosum microiriae Blažková 1993
eragrostietosum ferrugineae Blažková 1993
ixeridetosum dentatae Blažková 1993
Eragrostietum ferrugineae Yoshioka 1955

Oryzetea sativae Miyawaki 1960
Cypero-Echinochloetalia oryzoidis Bolós & Masclans 1955
Cypero-Echinochloion oryzoidis Bolós & Masclans 1955
Sagittario-Monochorietum Miyawaki 1960
limnophiletosum sessiliflorae Kolbek, Dostálek & Jarolímek 1996
najadetosum gramineae Kolbek, Dostálek & Jarolímek 1996
sagittarietosum aginashi Kolbek, Dostálek & Jarolímek 1996

Riverside communities

CL Salicetea sachalinensis Ohba 1973 (Tab. 1: A)
OR Alno-Salicetalia serissaefoliae Ohba 1973
ALL Salicion gracilistylae Ohba 1973

This alliance comprises colline and (sub-)montane alluvial willow communities occurring in Japan and Korea (Kolbek et al. 2003c). Physiognomically similar vegetation with quite different floristical composition from East Asia was ordered by Achtyamov (2001) to the class Salicetea schewerinii Achtyamov 2001. The typical feature of the alliance is the high number of accessoric species as a consequence of the strong seasonal dynamics of its habitats. Floods influence the changes in sedimentation and erosion of the soil and bring many diaspores of various species from the higher situated riverine communities. In the northern part of the Korean Peninsula, only one association was described (see below); the others, such as Coriaio-Elaeagnetum umbellatae Okuda 1978 and Salicetum gracilistylae Minamikawa 1963 till were not found there.

Artemisio feddei-Salicetum gracilistylae Jarolímek & Kolbek 2006
(Tab. 1: A)
NT Jarolímek & Kolbek (2006): Table 1, rel. 20
SM The low shrub willows determine the physiognomy and vertical structure of the community. The shrub *Salix* usually prevails; *S. gilgiana* and *S. koriyanagi* are regularly represented, and in some places *S. rorida* and *S. siuzevii* also occur. The slightly gapped stands with total cover of 80–98 % (A90) are mostly 90–160(200) cm in height. In the upper, denser shrub layer from 60 to 160 cm, besides the abovementioned willows, herbs and graminoids such as *Phragmites japonica*, *Phalaris arundinacea*, *Artemisia asiatica*, *A. capillaris*, *A. feddei*, and *Agropyron *transiens* often participate. The ground herb layer up to 60 cm consists mainly of therophytes, such as *Bidens frondosa*, *Cassia nomame*, and *Commelina communis*. In both layers, herb liane *Humulus japonica* occurs. The community is medium-rich in species (10–27, A18).
V The floristic composition of the community depends on habitat conditions and is very changeable. The species with a similar growth strategy to those growing in Central Europe, such as *Humulus lupulus* and other geographical variants of the various genera such as *Artemisia*, *Salix*, etc., together with the identical species *Phalaris arundinacea*, *Equisetum arvense*, *Bidens frondosa*, *Salix purpurea*, *Phragmites communis*, characterise similar communities in the alluviums of Northeast Asia, as well. The diversity of species composition in the association Artemisio feddei-Salicetum is also very high. In our 20 relevés, 88 species of vascular plants were found. However, the number of species with high constancy in this group is very low. In the phytocoenological table, only eight taxa belong to constancy classes V and IV; however, 65 species belong to the first class. This fact generally corresponds with the dynamic succession of the riverside communities. A reason could be in several annually repeated disturbances in the community. Within the association, two subassociations were distinguished:
1. spodiopogonetosum sibiricae Jarolímek & Kolbek 2006
2. artemisietosum capillaris Jarolímek & Kolbek 2006
SE This community usually colonises the flat riverside zone close to the water level of the river or the gravelly sandy alluvium of the river terrace, 0.5 to 1.5 m above the summer water level. It also occurs on river islets. The community prefers finer sediments in the lower stream of the river. The primitive soils are mostly sandy and gravelly sandy in the middle stream with a high share of boulders of different sizes. In the middle stream, the community is dominated by the species *Phragmites japonica* which alters the association Artemisio feddei-Salicetum gracilistylae. The habitats are probably flooded several times each year by torrential water, and the stands of the community are repeatedly damaged or destroyed. These floods influence the great variability in the species composition, especially in the herb layer. In addition to the irregular disturbance of habitats, the role of the deposition of nutrients from the surrounding (forest) communities is important. The torrential water mainly moves fine sediments. The stands alternately silt up with sediments or, on the contrary, their substratum is washed out. The dominant species *Salix gracilistyla* is well-adapted to both situations as roots grow quickly on lying down or buried limbs. They penetrate relatively deeply into the soil; in the washed bank, we found roots 1.5 m below the soil surface.
D Relevés were obtained on the riversides of the Namgang and Onjong Rivers flowing from the Kumgangsan Mountains to Samilpo Lake and to the East Sea. The distribution of these communities is insufficiently known; we visited several other mountain regions in North Korea (e.g. Changbaishan, Chonmasan, Ljongaksan, Myohyangsan, Sujangsan, Taesongsan Mountains), and the fully developed stands of the association Artemisio-Salicetum gracilistylae were found only in the Kumgangsan Mountains. We expect the occurrence of this community in other parts of the Korean Peninsula as well.
MI This is a naturally developed unit without direct human influence.
C Physiognomically similar community (Salicetum gracilistylae Minamikawa 1963) with different floristical composition is well-known in Japan. Several relevés have also been published from South Korea. The total number of relevés from Northeast Asia is very low, and the representative comparison is limited by the unequal size of the data sets from various areas. Miyawaki & Okuda (1972) described the related community Salice-

Table 1. Riverside communities.
A – Artemisio feddei-Salicetum gracilistylae; B – Phragmitetum japonicae; C – Polygonetum thunbergii; D – Polygonetum sieboldii-hydropiperis; E – Persicarietum posumbu; F – *Persicaria dissitiflora* community; G – *Bidens tripartita* community; H – H*emarthria sibirica* community; I – *Bidens bipinnata* community; J – *Persicaria hydropiper* stadium; K – *Artemisia capillaris* stadium; L – *Carex pumila-Equisetum arvense* community; M – *Agrostis alba-Calamagrostis epigeios* community; N – *Lobelia chinensis* community; O – *Scirpus triqueter* community; P – *Scirpus radicans* community; R – *Scirpus yagara* community; S – *Scirpus preslii* community; T – *Alisma orientale* community

Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T
Number of relevés	20	40	26	21	6	5	3	4	3	2	3	2	2	1	6	1	2	1	1
Average number of species	18	15	15	16	11	13	12	15	18	14	20	14	30	14	11	9	6	7	8
Artemisio feddei-Salicetum gracilistylae, Salicion gracilistylae, Salicetea sachalinensis																			
Salix gracilistyla	**100**^{a5}	**58**$^{+3}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Artemisia feddei	**75**$^{+b}$	35^{+a}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	*1*^{11}	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
*Agropyron *transiens*	**70**$^{++}$	20^{+1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*2*$^{++}$	*1*$^{++}$	*2*^{1a}	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Salix gilgiana	**65**$^{+3}$	3^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Cassia nomame	**65**^{rm}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	***3***$^{+1}$	*0*$^{..}$	*2*$^{+1}$	*0*$^{.}$	17^{rr}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Salix koriyanagi	**45**$^{+b}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Rumex acetosella	**50**$^{+a}$	8^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*2*$^{+1}$	*2*$^{+a}$	*1*^{aa}	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Phalaris arundinacea	**35**$^{+1}$	3^{11}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Oenothera lamarckiana	**30**^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*^{aa}	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Stachys japonica	**30**$^{r+}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{.}$	17^{rr}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Cuscuta japonica	**20**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Salix rorida	**15**$^{+b}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Viola yezoensis	**15**$^{r+}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Phragmitetum japonicae, Oenantho japonicae-Phalaridion arundinaceae, Phragmito-Magnocaricetea																			
Phragmites japonica	**75**$^{+a}$	**100**^{a5}	23^{+a}	10^{+1}	33^{+1}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*2*$^{++}$	*1*^{11}	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	17^{rr}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Viola verecunda	20^{++}	**35**^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*2*$^{++}$	*1*^{3}	17^{++}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Isodon excisus	0$^{..}$	**13**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Vitis amurensis	0$^{..}$	**13**^{ra}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Polygonetum thunbergii																			
Persicaria thunbergii	45^{rb}	25ra	**100**^{15}	**19**$^{+3}$	50^{+1}	**100**$^{+1}$	*0*$^{..}$	*2*$^{++}$	*0*$^{..}$	*1*^{rr}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*^{a}	**100**$^{+3}$	*1*$^{+}$	*2*$^{+1}$	*1*^{a}	*1*$^{+}$
Oenanthe decumbens	0$^{..}$	5^{r+}	**46**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{aa}	*1*$^{++}$	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*^{1}	17^{aa}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Juncus decipiens	15^{++}	0$^{..}$	**46**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{+}$	17^{11}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Isachne globosa	0$^{..}$	0$^{..}$	**27**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Beckmannia syzigachne	0$^{..}$	0$^{..}$	**19**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Polygonetum sieboldii-hydropiperis																			
Acalypha australis	0$^{..}$	0$^{..}$	4^{++}	**33**^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Solanum nigrum	0$^{..}$	0$^{..}$	0$^{..}$	**33**$^{r+}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*2*$^{+1}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Senecio vulgaris	0$^{..}$	0$^{..}$	0$^{..}$	**19**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Stellaria media	0$^{..}$	0$^{..}$	0$^{..}$	**19**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
*Potentilla *costata*	0$^{..}$	0$^{..}$	0$^{..}$	**19**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Chenopodium glaucum	0$^{..}$	0$^{..}$	0$^{..}$	**19**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Persicarietum posumbu																			
Persicaria posumbu	0$^{..}$	0$^{..}$	4^{11}	5^{aa}	**100**^{45}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Pilea mongolica	0$^{..}$	0$^{..}$	23^{+a}	**24**$^{+3}$	**100**$^{+b}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Geranium sieboldii	0$^{..}$	0$^{..}$	15^{+1}	14^{++}	**67**$^{+1}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Siegesbeckia pubescens	0$^{..}$	0$^{..}$	15^{+1}	33^{+a}	**67**$^{r+}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Chelidonium majus	5^{rr}	8^{r+}	8^{+a}	5^{++}	**50**$^{+a}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Impatiens noli-tangere	0$^{..}$	8^{rr}	4^{rr}	0$^{..}$	**50**$^{+a}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
***Persicaria dissitiflora* community**																			
Persicaria dissitiflora	0$^{..}$	0$^{..}$	8^{+b}	0$^{..}$	17^{++}	**100**^{b5}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Panicum bisulcatum	0$^{..}$	0$^{..}$	**58**$^{+a}$	48ra	0$^{..}$	**100**$^{+b}$	*2*$^{+1}$	*2*^{11}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	17^{++}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Phragmites communis	0$^{..}$	0$^{..}$	15^{+a}	0$^{..}$	0$^{..}$	**100**$^{+a}$	*1*$^{++}$	***3***$^{+a}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	17^{rr}	*1*^{1}	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Rorippa palustris	0$^{..}$	5^{r+}	31^{r+}	**52**$^{+a}$	0$^{..}$	**100**$^{+1}$	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$

Table 1. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T
Number of relevés	20	40	26	21	6	5	3	4	3	2	3	2	2	1	6	1	2	1	1
Rorippa globosa	0··	0··	0··	10^{r+}	0··	**60^{+1}**	0··	0··	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
***Bidens tripartita* commnunity**																			
Bidens tripartita	10^{++}	0··	**50^{+3}**	38ra	0··	0··	***3*^{45}**	***4*$^{+1}$**	*2*$^{+1}$	*1*^{rr}	0··	0··	0··	0·	0··	0·	*1*$^{++}$	0·	0·
***Hemarthria sibirica* community**																			
Hemarthria sibirica	0··	0··	19^{++}	5^{++}	0··	0··	0··	***4*^{a4}**	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
***Bidens bipinnata* community**																			
Bidens bipinnata	5^{++}	0··	23^{+a}	10^{1a}	33^{11}	0··	0··	0··	***3*^{44}**	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Panico-Bidention frondosae, Bidentetea tripartitae																			
Bidens frondosa	40^{rm}	18^{r+}	**35^{+4}**	**67^{+5}**	0··	**40^{++}**	0··	0··	***1*^{bb}**	*1*$^{++}$	0··	0··	0··	*1*$^{+}$	17^{++}	0·	0··	0·	*1*^{r}
Persicaria sieboldii	40^{r1}	18^{r+}	**4^{aa}**	**14^{+a}**	0··	0··	0··	0··	0··	*2*^{rr}	0··	0··	*1*$^{++}$	*1*$^{+}$	33^{++}	*1*$^{+}$	0··	0·	0·
Persicaria hydropiper	5^{++}	15^{r+}	**77^{+4}**	**90^{+4}**	0··	**80^{+3}**	0··	***2*^{11}**	0··	*2*$^{++}$	0··	0··	0··	0·	0··	0·	0··	0·	0·
Echinochloa crusgalli	0··	0··	**62^{+4}**	**71^{+3}**	0··	**40^{++}**	***3*^{ab}**	***4*^{13}**	***2*$^{+a}$**	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Persicaria lapathifolia	0··	0··	**58^{+b}**	**67^{+4}**	**50^{+1}**	**100^{+4}**	0··	***3*$^{++}$**	***1*^{11}**	*1*$^{++}$	*1*^{rr}	*1*^{rr}	0··	0·	0··	0·	0··	0·	0·
Digitaria sanguinalis	0··	0··	**42^{+a}**	**62^{+a}**	0··	**40^{+1}**	***1*^{11}**	***1*$^{++}$**	0··	0··	0··	*1*^{11}	0··	0·	0··	0·	0··	0·	0·
Kyllinga brevifolia	0··	0··	**42^{+1}**	**5^{++}**	0··	**20^{aa}**	0··	***1*^{11}**	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Cyperus microiria	0··	0··	**27^{+1}**	**24^{+1}**	0··	0··	0··	***1*$^{++}$**	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Persicaria cochinchinensis	0··	0··	**19^{r+}**	**33^{+a}**	0··	0··	***1*$^{++}$**	***1*$^{++}$**	***2*$^{+1}$**	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Cardamine scutata	0··	0··	**15^{+1}**	**14^{+1}**	0··	0··	***1*^{aa}**	0··	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Xanthium strumarium	0··	0··	**15^{r1}**	**43ra**	0··	**60^{r1}**	0··	***4*$^{+a}$**	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
Rumex maritimus	0··	0··	**8^{++}**	**24^{+1}**	0··	0··	0··	***1*$^{++}$**	0··	0··	0··	0··	0··	0·	0··	0·	0··	0·	0·
***Artemisia capillaris* stadium**																			
Artemisia capillaris	50^{r1}	13^{r+}	19^{r+}	0··	0··	0··	0··	0··	0··	*1*^{rr}	***3*^{1a}**	0··	0··	0·	0··	0·	0··	0·	0·
***Carex pumila-Equisetum arvense* community**																			
Carex pumila	10^{++}	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	***2*^{33}**	0··	0·	0··	0·	0··	0·	0·
***Agrostis alba-Calamagrostis epigeios* community**																			
Agrostis alba	0··	0··	0··	0··	0··	0··	0··	0··	0··	*1*$^{++}$	0··	0··	**2^{aa}**	0·	17^{++}	0·	*1*^{aa}	*1*^{1}	0·
Calamagrostis epigeios	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	**2^{aa}**	*1*^{a}	0··	0·	0··	0·	0·
***Lobelia chinensis* community**																			
Lobelia chinensis	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	***1*^{3}**	17^{11}	0·	0··	0·	0·
***Scirpus triqueter* community**																			
Scirpus triqueter	0··	0··	8^{+1}	0··	0··	**60^{+1}**	0··	0··	0··	0··	0··	0··	0··	0·	**100^{15}**	*1*^{1}	*1*$^{++}$	0·	0·
Potamogeton distinctus	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	**67ra**	0·	*1*$^{++}$	*1*$^{+}$	*1*$^{+}$
Lythrum anceps	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	*1*$^{++}$	0·	**50^{+1}**	*1*^{r}	0··	0·	0·
Alisma canaliculatum	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	**50^{r+}**	0·	0··	*1*$^{+}$	*1*^{r}
Typha angustata	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	**33^{a3}**	0·	0··	0·	0·
Bidens cernua	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	**33^{++}**	0·	0··	0·	0·
Lycopus maackianus	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	**33^{r+}**	0·	0··	0·	0·
***Scirpus radicans* community**																			
Scirpus radicans	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	0··	***1*^{3}**	0··	0·	0·
***Scirpus yagara* community**																			
Scirpus yagara	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	0··	0·	**2^{45}**	0·	0·
***Scirpus preslii* community**																			
Scirpus preslii	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0··	0·	0··	0·	*1*^{11}	***1*^{3}**	*1*^{1}
***Alisma orientale* community**																			
Alisma orientale	5^{rr}	0··	12^{+1}	0··	0··	20^{++}	0··	0··	0··	0··	0··	0··	0··	0·	33ra	0·	0··	0·	***1*^{3}**

Table 1. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	R	S	T
Number of relevés	20	40	26	21	6	5	3	4	3	2	3	2	2	1	6	1	2	1	1
Other species																			
Artemisia asiatica	**95**$^{+a}$	**60**^{r3}	27^{r1}	38^{+1}	50^{r+}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{..}$	*1*$^{++}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Commelina communis	**75**$^{+1}$	38^{r1}	0$^{..}$	43^{+a}	**67**$^{+a}$	0$^{..}$	*1*$^{++}$	*2*$^{+1}$	*2*$^{+1}$	*0*$^{..}$	*2*$^{+1}$	*2*$^{+a}$	*1*$^{++}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Equisetum arvense	50^{+1}	20^{r1}	38^{+a}	14^{+1}	0$^{..}$	40^{11}	*0*$^{..}$	*1*^{11}	*2*^{aa}	*1*$^{++}$	*2*$^{r+}$	*2*^{1a}	*2*$^{+1}$	*0*$^{.}$	17^{++}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Humulus japonica	40^{+1}	35^{r1}	**35**$^{+3}$	**57**$^{+a}$	33^{+a}	**60**$^{+1}$	*0*$^{..}$	*0*$^{..}$	***3***$^{+b}$	*1*^{rr}	*1*^{rr}	*2*^{r1}	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Poa pratensis	40^{++}	10^{++}	0$^{..}$	10^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*^{rr}	*0*$^{..}$	*1*^{aa}	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Spodiopogon sibiricus	35^{+1}	15^{r3}	0$^{..}$	5^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Lysimachia davurica	25^{r+}	5^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*$^{++}$	*0*$^{.}$	17^{aa}	*1*^{r}	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Agrostis stolonifera	20^{++}	10^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Stephanandra incisa	15^{r1}	28^{+a}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Arthraxon hispidus	15^{++}	43ra	**62**$^{+b}$	10^{++}	0$^{..}$	20^{aa}	*0*$^{..}$	***4***$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Erigeron canadensis	10^{++}	20^{r+}	12^{r+}	14^{++}	33^{rr}	0$^{..}$	*2*$^{r+}$	*0*$^{..}$	*2*$^{++}$	*1*$^{++}$	*1*^{11}	*2*$^{+a}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Persicaria mitis	0$^{..}$	15^{r+}	**31**$^{+3}$	14^{11}	17^{11}	20^{++}	*2*$^{+a}$	*0*$^{..}$	*0*$^{..}$	*1*^{rr}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Impatiens textori	0$^{..}$	15^{r+}	8^{++}	5^{++}	33^{+1}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Ambrosia artemisifolia	0$^{..}$	5^{rr}	0$^{..}$	5^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*1*^{11}	*1*$^{++}$	*1*^{rr}	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Elscholzia patrini	0$^{..}$	3^{++}	19^{+1}	14^{+1}	33^{r1}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Chenopodium album	0$^{..}$	3^{rr}	12^{++}	**57**$^{+a}$	33^{++}	0$^{..}$	*0*$^{..}$	*0*$^{..}$	***3***$^{+1}$	*0*$^{..}$	*0*$^{..}$	*1*^{rr}	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Sium suave	0$^{..}$	3^{rr}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	33^{+1}	*1*$^{+}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Setaria pycnocoma	0$^{..}$	0$^{..}$	27^{+1}	14^{11}	0$^{..}$	0$^{..}$	*1*$^{++}$	***3***$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Juncus krameri	0$^{..}$	0$^{..}$	23^{+1}	0$^{..}$	0$^{..}$	20^{++}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Leersia oryzoides	0$^{..}$	0$^{..}$	19^{+a}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*2*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	33^{++}	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Cyperus glomeratus	0$^{..}$	0$^{..}$	12^{++}	29ra	0$^{..}$	0$^{..}$	***3***$^{+a}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Microstegium vimineum	0$^{..}$	0$^{..}$	12^{++}	**29**$^{+4}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Centipeda minima	0$^{..}$	0$^{..}$	8^{+1}	5^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Setaria glauca	0$^{..}$	0$^{..}$	0$^{..}$	43^{+a}	17^{++}	**60**$^{+1}$	*0*$^{..}$	***3***^{11}	*1*$^{++}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
*Digitaria *pectiniformis*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{11}	***3***$^{+1}$	*2*^{1b}	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	0$^{..}$	*0*$^{.}$	*0*$^{..}$	*0*$^{.}$	*0*$^{.}$
Aneilema japonica	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{..}$	*0*$^{.}$	33^{+1}	*0*$^{.}$	*1*$^{++}$	*1*$^{+}$	*1*^{1}
Number of accessoric spec.	50	158	35	38	11	3	11	3	16	9	28	9	29	6	16	1	3	1	1

tum integrae subass. *Miscanthus sinensis* dominated by *Salix integra* and subdominated by *Salix gracilistyla*.
REF Minamikawa (1963), Miyawaki (1982–1988), Song & Song (1996), Song (2001a), Kolbek et al. (2003c)

CL Phragmito-Magnocaricetea Klika in Klika & Novák 1941 (Tab. 1: B)
OR Phragmitetalia Koch 1926
ALL Oenantho javanicae-Phalaridion arundinaceae Miyawaki & Okuda 1972
Mountain river bank communities in East Asia.

Phragmitetum japonicae Minamikawa 1963
(Tab. 1: B)
SM *Phragmites japonica* markedly dominates the stands of this community. Trees and shrubs occur only sporadically. *Artemisia feddei*, *A. asiatica*, *Arthraxon hispidus*, *Commelina communis*, and *Persicaria thunbergii* play the role of the subdominating or constant species. The average number of species in a relevé varies in the different subassociations from 3 to 39 (A15). The cover of the herb layer achieves 40–95 % (A78); the shrub layer was developed in only three relevés with cover of 25–45 % (A33) and a height 30–200 cm (A77).
V In the studied region, the association Phragmitetum japonicae is characterised by several features, which increases its heterogeneity and the species composition variability and complicates its classification: (a) repeated disturbances of the stands and habitats (riversides), (b) the speedy succession of the stands vs. blocked succession, (c) penetration of the accessoric species finding favourable life conditions for their ecession, (d) a relatively low number of species in stands results in the exchange of several species and markedly influences the position of the community in the classification space, and (e) a phytogeographically heterogeneous area of distribution.
The association is divided into five subassociations:
1. artemisietosum feddei Kolbek & Jarolímek 2010
2. humuletosum scandentis (Minamikawa 1963) Miyawaki 1985
3. polygonetosum thunbergii Miyawaki 1982
4. boehmerietosum spicatae Kolbek & Jarolímek 2010
5. inops Kolbek & Jarolímek 2010

SE The stands of the community were found at altitudes from 50–280 m. Besides the natural influence by phytogeographically-related taxa, they are also affected by the watercourse disturbance interval and the terrain position. In narrow channels and in the upper streams of mountain brooks, the stands are usually modest and grow in a slender belt along the stream. Limited space is available for the development of herb and reed growth on a gravel substratum. The main reason is the aggressive watercourse after the spring snow melt and during the monsoon season. Only a small number of species is successful in the ecession, and some species are casual invaders from the surrounding stands. The gravel alluvium contains a small amount of sandy soil with a minimum of nutrients and humus, which are egested. The reeds in these conditions attain only a low height (25–70 cm). Quite a different situation is found at the middle to lower streams of brooks and rivers. The speed of the watercourse decreases and sedimentation processes prevail above washing away. The valleys are usually wider and the reed stands occupy larger plots. The floods disturb them with lower intensity and over longer time spans. In this way, the conditions for stabilisation of the reed polycorms and successful ecesis of other species are much better than in the upper stream. The height of the reed stands is higher and exceeds two meters.
D This community is found in North Korea in the Kumgangsan Mountains (Kolbek & Jarolímek 2010).
MI In the lower part of streams, human management limits the development of the reed stands. Suitable areas are transformed into field plantations, or rarely into meadows. Consequently, the reed stands available for phytosociological study are rare.
C The association Phragmitetum japonicae was described by Minamikawa (1963) on the riverside of the Yahagi River, Middle Honshu, Japan. Within the association, five subassociations were distinguished: Phragmitetum japonicae salicetosum, anaphaletosum margaritaceae, kummerowietosum, miscanthetosum, and humuletosum. Only the first three are supplemented by synthetic phytosociological tables. Understanding the connections among the vegetation units is difficult because of tables do not have clear explanations and relation to the individually described units. The association was documented by phytosociological relevés from Kyushu, Shikoku, Chugoku, Kinki, Chubu, Tohoku, and Hokkaido (Miyawaki 1981–1985, 1987, 1988) and by a synoptic table of 47 relevés from the district of Kanto. This association was divided into four subassociations (and within them to ten variants): subass. *Polygonum thunbergii* (2 var.), subass. typicum (4 var.), subass. *Artemisia princeps*, and subass. *Humulus scandens* (4 var.). From South Korea, only one relevé was published with the association name, namely from the riverside of the Nakdong River, Hanchon area (Song & Song 1996). The same relevé was published by Song (2001a) again. Miyawaki & Okuda (1972) described it in the surrounding of Tokyo as Phragmitetum japonicae, very similar to the Korean stands.
REF Minamikawa (1979), Song (1992b)

CL Bidentetea tripartitae R. Tüxen, Lohmeyer & Preising in R. Tüxen 1950 (Tab. 1: C–J)
OR Bidentetalia tripartitae Br.-Bl. & R. Tüxen 1943
ALL Panico-Bidention frondosae Miyawaki & Okuda 1972
The annual nitrophilous pond and river bank communities.

Polygonetum thunbergii Lohmeyer & Miyawaki 1962
(Tab. 1: C)
SM The most abundant community of the alliance Panico-Bidention frondosae is typical of both natural and man-influenced alluvia of the streams and rivers. The stands are perfectly developed from September to October, when the most frequent dominant species, *Persicaria thunbergii*, flowers. At that time, stands reach a height of 50–100 cm, except those dominated by *Bidens frondosa*, which reach 100–150 cm. The stands are mostly compact; the density of the herb layer is not infrequently 100 % (75–100 %, A91). Besides the abovementioned dominants, stands are mainly formed by the species *Persicaria hydropiper*, *P. lapathifolia*, *Panicum bisulcatum*, and *Echinochloa crusgalli*. The stands are poor to medium-rich in species (8–29, A17).
V The association is differentiated from the other communities of the alliance by the common occurrence of the species *Juncus decipiens*, *J. krameri*, *Isachne globosa*, and *Beckmannia syzigachne*. In North Korea, two subassociations with two variants were distinguished:
1. juncetosum decipientis Jarolímek, Kolbek & Dostálek 1991
   A. var. *Bidens frondosa* sensu Jarolímek et al. (1991)
   B. var. *Leersia oryzoides* sensu Jarolímek et al. (1991)
2. humuletosum japonicae Jarolímek, Kolbek & Dostálek 1991
SE The alluvia are often gravelly, rarely sandy, mostly covered by a variously thick layer of mire. Light and sunny habitats are periodically flooded and occasionally destroyed by running water. Stands are in the close relation to the water surface throughout their development throughout the course of the year. They were found at an altitude from 10–300 m.
D This is a widely dispersed community, e.g. in the surroundings of Kail (Suputschongang River, Opong Lake), Kaesong (brooklet near the King Wault), Anju (Tschontschongang River), Hedju (alluvia of brooklets in Sujangsan Mountains), and Myohyangsan Mountains (alluvia of streams).

MI This spontaneous short-term community is in some places influenced by the agricultural activities at the alluvia of bigger rivers after a decrease in the water level.
C Syntaxonomically, Japanese authors describe the association rather widely. The same association name has been used for considerably heterogeneous phytosociological material from various Japanese islands (cf. Miyawaki 1981–1987). In these works, the association is integrated primarily by the high dominancy of *Persicaria thunbergii*. From this point of view, the subassociation Persicarietum thunbergii humuletosum japonicae is more similar to the Japanese material. The association was described on the basis of three relevés from Japan (Lohmeyer & Miyawaki 1962). Simoda & Suzuki (1979) published from Japan the similar community *Phragmites communis-Polygonum thunbergii*.
REF Miyawaki & Okuda (1972), Miyawaki et al. (1973), Jarolímek et al. (1991), Song (1992b, 2001a), Song & Song (1996), Choung & Lee (2001)

Polygonetum sieboldii-hydropiperis Okuda 1978
(Tab. 1: D)
SM Stands of this association reach a height of 50–160 cm, depending on the prevailing species. Relevés consist of 6–27 (A16) species. The most frequent are *Persicaria hydropiper*, *P. lapathifolia*, *Echinochloa crusgalli*, *Bidens frondosa*, *Digitaria sanguinalis*, *Humulus japonica*, and *Rorippa palustris*. If we look at the synoptic table of phytosociological relevés from North Korea, the syntaxonomical differentiation of the association is relatively weak. Differential species occur only with low values of abundance, dominance and constancy. The association is differentiated from other communities of the alliance Panico-Bidention frondosae, mainly by the species *Acalypha australis* and *Solanum nigrum*.
V Floristically and physiognomically, this is a rather variable plant community. Within the association, two subassociations and three variants are distinguished:
1. cyperetosum glomerati Jarolímek, Kolbek & Dostálek 1991
2. artemisietosum asiaticae Jarolímek, Kolbek & Dostálek 1991
   A. var. *Microstegium vimineum* sensu Jarolímek et al. (1991)
   B. var. *Persicaria cochinchinensis* sensu Jarolímek et al. (1991)
   C. var. *Pilea mongolica* sensu Jarolímek et al. (1991)

SE The stands of the association are frequent on the banks of rivers, brooks, lakes, dams, and on slightly elevated terraces built by gravelly alluvia covered by a variously thick layer of a clay substratum at an altitude of 20–230 m. They are mostly in close contact with the water surface.
D This is a frequently observed community near the towns Anju (Yongpchun Lake), Pyongyang (Taedonggang River), Hyangsan, Kaesong and in the Myohyangsan Mountains.
MI In some places, this spontaneous natural community is influenced by agricultural activities at the alluvia of bigger rivers after a decrease in the water level.
C The character species *Persicaria sieboldii* and *P. nepalensis* were brought from several Japanese islands (Miyawaki 1983, 1985, 1987). They are indicated as the differential species of the subassociation Polygonetum sieboldii-hydropiperis polygonetosum nepalense only from phytosociological material from Shikoku Island (Miyawaki 1982). *Cardamine flexuosa* subsp. *regeliana* is considered a character species as well. The similar community Panico-Polygonetum hydropiperitis was described by Miyawaki & Okuda (1972) from Tokyo.
REF Jarolímek et al. (1991), Song & Song (1996), Choung & Lee (2001), Song (2001a)

Persicarietum posumbu Jarolímek, Kolbek & Dostálek 1991
(Tab. 1: E)
NT Jarolímek et al. (1991): Table 3, relevé 48
SM The stands of this community are characterised by the high dominance of the species *Persicaria posumbu*. They reach a height of 50–70 cm and cover 85–95 % (A90) in the period of their phenological optimum (September). The stands are formed by 8–17 (A11) species. The most frequent are *Persicaria lapathifolia*, *P. thunbergii*, *Commelina communis*, *Siegesbeckia pubescens*, *Geranium sieboldii*, *Pilea mongolica*, *Chelidonium majus*, and *Impatiens nolitangere*. Besides the dominant species, the last three clearly define the habitat conditions which are suitable for the development of the community and at the same time they clearly differentiate it from the other communities of the alliance Panico-Bidention frondosae.
V This is a homogenous community with small infra-association variability.
SE The stands occur in shaded and moist habitats on slightly elevated terraces, where the gravel basis is overlaid by fine-grain clay to sand-and-clay substratum at an altitude of 170–225 m.
D The community was investigated at many places along the streams in the Myohyangsan Mountains.
MI This is a natural community without regular human influence.
C This association is similar to the Persicario-Microstegietum viminei Ohba 1973 from the class Artemisietea principis Miyawaki & Okuda 1972 known from Japan and South Korea.

Persicaria dissitiflora community sensu Jarolímek et al. (1991)
(Tab. 1: F)
SM The typical stands are dense (90–100 %, A96), 50–70 cm in height. They are optimally developed in Sep-

tember, when the dominant and other species of the genus *Persicaria* are in full bloom. As a result of marked dominance, the stands are relatively species-poor (11–17, A13). High constancy is reached by *Persicaria thunbergii*, *P. lapathifolia*, *Panicum bisulcatum*, *Rorippa palustris*, and *Phragmites communis*.
V All relevés of the community are very similar.
SE The stands of the community occur in open and sunny habitats on the sand-and-mire alluvia at low altitude (10 m). They are periodically flooded.
D Around the town of Anju on the alluvium of the Tschontschongang River, large stands of a plant community dominated by *Persicaria dissitiflora* were found.
MI This is a natural community without direct human impact.
C The *Persicaria dissitiflora* community is well-differentiated from the other communities of the alliance Panico-Bidention frondosae by *Scirpus triqueter*. This community is most similar in species composition to Persicarietum sieboldii-hydropiperis.

Bidens tripartita community sensu Jarolímek et al. (1991)
(Tab. 1: G)
SM The stands are characterised by the high dominance of the species *Bidens tripartita*, resulting in a low number of species in the relevés (9–13, A12) and their relatively high dissimilarity. The height of stands depends on the nutrient content of the substratum, varying from 90–200 cm. They are optimally developed towards the end of September.
V In comparison with the other communities of the alliance, this community is relatively heterogeneous.
SE The stands occur on sunny to slightly shaded banks of streams and basins on nutrition-rich mire substrata within the reach of water.
D This community was found in Pyongyang and Kail.
MI This spontaneous community is irregularly affected by man.
C The community physiognomically resembles the European association Polygono-Bidentetum tripartitae (from the alliance Bidention tripatitae). Besides the dominant, they have some common species, e.g. *Echinochloa crusgalli* and *Persicaria mitis*. However, the majority of species unequivocally classify the Korean *Bidens tripartita* community to the vicarious East Asian alliance Panico-Bidention frondosae.

Hemarthria sibirica community sensu Jarolímek et al. (1991)
(Tab. 1: H)
SM The species of the family *Poaceae* play a very important role in the community. *Hemarthria sibirica* dominates in the community and other grasses occur with high constancy, i.e. *Echinochloa crusgalli*, *Arthraxon hispidus*, *Setaria lutescens*, *S. gigantea*, *Digitaria *pectiniformis*, etc. It results in a different physiognomy of these stands from the majority of the other communities of the alliance Panico-Bidention frondosae. The stands reach a height of 70–90 cm. In each relevé, there are 12–18 (A15) species.
V The small distribution area of the community probably affects its high degree of homogeneity.
SE The community was found in sunny habitats on a mire-and-sandy alluvium. The stands are close to the water. They are occasionally flooded.
D The community was studied on the banks of Lake Opong near the town of Kail.
MI This is a natural community without a direct human influence.
C With respect to the species composition, the community is the most similar to the *Bidens tripartita* community, partially to Persicarietum sieboldii-hydropiperis. From a syntaxonomical point of view, the community is classified by numerous species into the alliance Panico-Bidention frondosae and class Bidentetea tripartitae.

Bidens bipinnata community sensu Jarolímek et al. (1991)
(Tab. 1: I)
SM The dense stands of the community reach a height of 90–120 cm. They are best developed in September. At that time, they are dominated by the minute yellow flowering *Bidens bipinnata*, which produces a large number of easily shed four-apex seeds. Its demands on the soil moisture are less than those of *Bidens tripartita*. *Humulus japonica* and *Commelina communis* occur in the community with lower values of dominance. Some species of the class Stellarietea mediae are frequent: *Chenopodium album*, *Erigeron canadensis*, *Amaranthus retroflexus*, etc. The stands are not species-rich (10–24, A18).
V The evaluated relevés were relatively heterogeneous.
SE The community is found in moist and shaded habitats, mostly out of reach of water at a low altitude, about 30 m.
D The community was registered in the surroundings of Pyongyang.
MI The stands of the community were noted mainly on human-influenced habitats.
C The *Bidens bipinnata* community belongs to the driest wing of the alliance Panico-Bidention frondosae.

Communities without defined syntaxonomical status:

Several of following communities were found only at a limited number of localities (1–3). These data mostly do not permit a comment in paragraphs **V** and **C**. Their synecology (**SE**) and man influence (**MI**) are described in a single paragraph.

Alluvium grasslands

These are pioneer communities at the gravel and sand river alluvia along uncontrolled rivers. They are mostly influenced by the dynamics of flow and flow volume. They change during vegetation seasons.

Persicaria hydropiper initial stadium sensu Kolbek & Jarolímek (2008)
(Tab. 1: J)
SM The initial stadium occurs on gravel and sand dune river alluvium. The cover of the herb layer is very low and does not achieve 5 %. The stands are formed by 10–16 species (A13). No species dominates. The moos layer is absent.
D Relevés were obtained on the banks of the Hyangsantschon River in the Myohyangsan Mountains.
REF Choung & Lee (2001)

Artemisia capillaris stadium sensu Kolbek & Jarolímek (2008)
(Tab. 1: K)
SM The cover of herb layer attains 5–30 % (A22) with 12–27 (A17) species in each relevé. The moss layer is absent or only weakly developed.
V In the more developed stands on the riverbanks, the number of species is significantly higher. Shrubs and plants indicating higher succession stability occur in the stadium, e.g. *Sorbaria stellipila*, *Rhus javanica*, *Boehmeria spicata*, *Clematis serratifolia*, and *Pulsatilla koreana*.
D The stands of the stadium were found on the banks of the Hyangsantschon River in the Myohyangsan Mountains and on the banks of the Namgang River between the sandy dunes near the village Samilpori, Kumgangsan Mountains.

Carex pumila-Equisetum arvense community sensu Kolbek & Jarolímek (2008)
(Tab. 1: L)
SM This community has more stable structure and is identifiable in the fields; due to these properties, it is more frequently described in the literature. In the next succession, willow shrubs replace this community. The cover of herb layer varies between 50 and 60 % (A55). On average, 14 species occur in each relevé. Nevertheless, *Carex pumila,* together with several species, such as *Commelina communis*, *Humulus japonica*, *Lepidium apetalum*, *Rumex acetosella*, and *Equisetum arvense*, persist in stands for several years – see Artemisio-Salicetum gracilistylae artemisietosum capillaris (Jarolímek & Kolbek 2006: tab. 1, rel. 6 and 12).
V The stands along the riverbanks at sand alluvia are different by the absence of seacoast species.
SE The community occupies deeper and more stable sands less frequently affected by water flow. The slope can be a maximum of 15–20°; northern exposure prevails.
D This community is found on the sandy dunes near the village of Samilpori on the banks of the river Namgang and between the villages of Samilpori and Onjongri in the Kumgangsan Mountains.
C From the northern part of the Korean Peninsula, the community with *Carex pumila* was mentioned by Mucina & Dostálek (1985) on sea sand dunes near Wonsan (see seaside vegetation) with typical seacoast species. Only *Carex pumila* is a common species.

Agrostis alba-Calamagrostis epigeios community sensu Kolbek & Jarolímek (2008)
(Tab. 1: M)
SM The well-developed herb layer attains cover of 90–95 %. The number of species varies in each relevé from 26–35 (A31). This community belongs to the most developed grassland communities on sand riverbanks.
D The community is found on sandy dunes between the villages of Samilpori and Onjongri in the Kumgangsan Mountains.
C The structure of the community is very similar to the European meadow communities with a moister regime. We also found several common species, such as *Sanguisorba officinalis*, *Stellaria alsine*, and *Taraxacum officinalis* agg, but in the northern Korean Peninsula, the species composition also contained tall pteridophytes (*Onoclea sensibilis*), grasses (*Miscanthus sinensis*), and shrubs (*Rosa multiflora*, *Securinega suffruticosa*). These species indicate the absence of mowing.

Lobelia chinensis community sensu Kolbek & Jarolímek (2008)
(Tab. 1: N)
SM The moister type of grass-herbaceous riverbank community is characterised by the dominant species *Lobelia chinensis* and several taxa, such as *Juncus decipiens*, *Oenanthe decumbens*, *Stellaria alsine*, and *Bidens frondosa*. The cover of the herb layer attains 90 % in each relevé, and around 14 species are present.
SE The community grows on fresh and not-drying soils.
D It occurs on the banks of the Namgang River near the village of Samilpori in the Kumgangsan Mountains.
C *Lobelia chinensis* also occurs in the community with *Scirpus triqueter*. Miyawaki & Okuda (1972) described this in the surroundings of Tokyo in a similar association, Lobelio-Ixeridetum japonicae.

Communities of periodically flooded depressions

In the depressions of dunes, the location of vegetation depends on the level of underground water. In some places, the water level increases above the soil surface and forms inundated depressions with the depth of the water from several centimetres to several decimetres. In the course of the vegetation period, the depth of water oscillates; the deepest water is usually found during the summer monsoon. A direct human influence has not been shown.

Scirpus triqueter community sensu Kolbek & Jarolímek (2008)
(Tab. 1: O)
SM The dominant species, *Scirpus triqueter*, is of wide ecological valence. Codominants are *Persicaria thunbergii* and *Potamogeton distinctus*, in some stands with permanent water level also *Typha angustata*. The cover of the herb layer varies between 40–85 % (A65). The number of species in a typical stand is 5–10, but in the more developed stands reaches 28 (A11). In species-rich stands, taxa with higher demands on the stability of ecological factors also occur, e.g. *Alopecurus amurensis*, *Juncus alatus*, *J. decipiens*, *Lobelia chinensis*, *Oenanthe decumbens*, *Ranunculus chinensis*.
V Variability mostly depends on the occurrence of the species *Zizania latifolia*, *Typha angustata*, *Alisma orientale*, *A. canaliculatum*, and *Leersia oryzoides*.
SE This community occurs on the sandy banks of rivers.
D This community was found scarcely along the Namgang River and on depressions in the sand dunes between the villages of Samilpori and Onjongri, both in the Kumgangsan Mountains.
MI This is a spontaneously arisen community without a direct human influence.
C *Scirpus triqueter* also occurs in rice fields in the association Sagittario-Monochorietum Miyawaki 1960 in North Korea (Kolbek et al. 1996) and in the salt marsh vegetation at the seacoast of West Sea in the associations Triglochini maritimae-Phragmitetum communis Kolbek et al. 1989 and Artemisietum fukudo Miyawaki & Ohba 1969 (Kolbek et al. 1989). This species is rarely found in the associations Polygonetum thunbergii Lohmeyer & Miyawaki 1962 and *Persicaria dissitiflora* community (Jarolímek et al. 1991). Miyawaki (1984: 212) published *Scirpus triqueter* from the riverbank of the Takeda River (Insel Kinki) as the dominant of a species-poor community containing only four species. Miyawaki & Okuda (1972) described it in the surroundings of Tokyo as "*Scirpus triqueter*-Gesellschaft", but with a different species composition.
REF Miyawaki (1960)

Scirpus radicans community sensu Kolbek & Jarolímek (2008)
(Tab. 1: P)
SM In some relevés, *Scirpus radicans* dominates. The composition of the other species is nearly identical with the previous community. The cover of the herb layer attains 50 % and the number of species around nine.
D This community was found on sandy dunes between the villages of Samilpori and Onjongri in the Kumgangsan Mountains.

Scirpus yagara community sensu Kolbek & Jarolímek (2008)
(Tab. 1: R)
SM In some relevés, *Scirpus* prevails. The species composition is nearly identical with the following community. Both communities frequently form transition stands with the occurrence of the species *Scirpus preslii* and *S. tabernaemontani*. The cover varies between 70–90 % (A80) and the number of species is very low (A4); in transition stands, it is higher (9).
SE This community is found on sand dunes alongside rivers.
D Relevés were sampled between the villages of Samilpori and Onjongri and in the surroundings of the village of Onjongri, near the Onjongtschon River in the Kumgangsan Mountains.
C Community with *Scirpus yagara* (syn. *S. fluviatilis*) has different species composition from the ass. Scirpo fluviatilis-Zizanietum latifoliae Miyawaki & Okuda 1972 (e.g. Miyawaki 1987) from class Phragmito-Magnocaricetea and can not be identified with this unit.

Scirpus preslii community sensu Kolbek & Jarolímek (2008)
(Tab. 1: S)
SM In some stands, the species *Scirpus preslii* and representatives of the genus *Eleocharis* significantly dominate. The cover of the herb layer attains 80 % and the number of species is around seven.
SE The community forms transition stands to the *Scirpus yagara* community and the *Alisma orientale* community, depending on water depth.
D It was registered on the bank of the Onjongtschon River near the village of Onjongri in the Kumgangsan Mountains.
C In North Korea, *Scirpus preslii* also occurs in the association Sagitario-Monochorietum Miyawaki 1960 in rice fields. It is a differential species of the subassociation S.-M. sagittarietosum aginashi Kolbek et al. 1996.

Alisma orientale community sensu Kolbek & Jarolímek (2008)
(Tab. 1: T)
SM The community of hydrophytic species includes *Alisma orientalis* or *A. canaliculatum* altere in domi-

nance. The cover of the herb layer is low (35 %) and the average number of species is eight.
SE The vegetation occurs in wet shallow depressions along river banks.
D It is scarcely found near the Onjongtschon River near the village of Onjongri in the Kumgangsan Mountains.
C This stand is similar to those found in analogous habitats in Central Europe, which are overgrown by an *Alisma plantago-aquatica* community.
REF Miyawaki (1960)

Aquatic communities

CL Lemnetea De Bolós & Masclans 1955 (Tab. 2: A–B)
OR Lemnetalia minoris De Bolós & Masclans 1955
ALL Lemnion paucicostatae Miyawaki & J. Tüxen 1960
These are the communities of floating and submerged water plants. The relevés were taken mainly in the surroundings of the towns of Pyongyang, Anju, and Wonsan at altitudes from 10–50 m.

Lemno paucicostatae-Azollaetum pinnatae Kolbek & Dostálek 1996
(Tab. 2: A)
NT Kolbek & Dostálek (1996): Table 1, relevé 1
SM This aquatic floating plant community is dominated by *Azolla imbricata* (syn. *A. pinnata*). The community achieves cover of 80–100 % (A93) and is very poor in species (1–4, A3). The cover of the submerged layer is minimal at 0–2 % (A1). The height of stands above the water is ca. 1 cm.
V *Azolla imbricata* also occurs with high cover in Ceratophyllo demersi-Nelumbetum nuciferae.
SE It was observed in eutrophic waters with a pH value of 6.1 and muddy sediment. The depth of the water was 70 cm.
D This community was found both in 1988 and 1990, only in Pyongyang, in a number of water basins in the southwestern part of the city.
MI The occurrence of dominant plants and community stability is influenced by water birds and can change from year to year.
C In the Japanese town of Kawasaki, this species-poor association was identified as Lemno paucicostatae-Salvinietum natantis in which *Lemna paucicostata*, *Spirodela polyrhiza*, and *Salvinia natans* were the dominant species. Similar units were found on the islands of Kanto, Kinki, Chubu, Chugoku, Tohoku, and Shikoku. On Cheju Island (South Korea) two relevés of the community *Lemna paucicostata-Spirodela polyrhiza* were recorded. No similar communities were found in North Korea; however, the individual species of this community occur sparsely in the country.
REF Miyawaki et al. (1981), Miyawaki (1982–1987), Song (1991b, 2001a), Song & Song (1996), Kim & Nam (1998)
Related syntaxa (which may be found in North Korea):
Azollaetum japonicae Miyawaki et al. 1983
Lemno paucicostatae-Salvinietum natantis Miyawaki & J. Tüxen 1960
Spirodeletum oligorhizae Okuda 1978
Lemna gibba community sensu Miyawaki (1983)
Lemna paucicostata-Azolla imbricata community sensu Miyawaki (1982, 1983)
Lemna paucicostata-Spirodela polyrrhiza community sensu Miyawaki (1981–1985), Song (1991b)
Wolffia arrhiza-Lemna paucicostata community sensu Miyawaki (1984)

OR Hydrocharitetalia Rübel 1933
ALL Hydrocharition Rübel 1933
The plant communities of sedimentation water basins and ponds.

Lemna paucicostata-Eichhornia crassipes community sensu Kolbek & Dostálek (1996)
(Tab. 2: B)
SM This species-poor community (1–5, A3 species per relevé) is dominated by *Eichhornia crassipes*. The plants grow up to 1 m (!) above the water surface. The height of stands above the water ranges from 3–100 cm. The cover of floating vegetation varies from 85–100 % (A96); the cover of submerged vegetation barely reaches 1 %.
V Due to shade from the high cover of *Eichhornia crassipes*, the species *Lemna paucicostata* is missing in some places.
SE This community was found in basins with strongly eutrophised water at pH 6.0. A favourable temperature during the vegetation period and plenty of nutrients enable its expansive growth and the high production of biomass. The depth of the water was 60–65 cm.
D The community was studied in several ponds in Pyongyang city.
MI The community needs extensive management. *Eichhornia crassipes* is used as feed for pigs. A few individuals are replanted every year in the spring in the basins, since the local climatic conditions do not allow this species to survive the winter in the open air.
C This community dominated by *Eichhornia crassipes*, which includes species occurring in similar stands in North Korea, e.g. *Ceratophyllum demersum*, *Lemna paucicostata*, *Spirodela polyrhiza*, and *Hydrilla verticillata* were reported on Kyushu Island (Japan).
Related syntaxa (which may be found in North Korea):
Eichhornia crassipes community sensu Miyawaki (1981)

CL Potametea Klika in Klika & Novák 1941 (Tab. 2: C–H)
OR Potametalia Koch 1926

Table 2. Aquatic communities.
A – Lemno paucicostatae-Azollaetum pinnatae; B – *Lemna paucicostata-Eichhornia crassipes* community; C – Myriophyllo spicati-Nelumbetum nuciferae; D – Bidenti tripartitae-Nelumbetum nuciferae; E – Ceratophyllo demersi-Nelumbetum nuciferae; F – Monochorio plantagineae-Nelumbetum nuciferae; G – *Nelumbo nucifera* community; H – *Potamogeton octandrus-Potamogeton distinctus* community

Community	A	B	C	D	E	F	G	H
Number of relevés	4	4	6	6	7	7	2	1
Average number of species	2	3	6	6	6	3	4	7
Lemno paucicostatae-Azollaetum pinnatae								
F *Azolla imbricata*	***4***^{55}	*0*$^{..}$	0$^{..}$	0$^{..}$	**100**^{15}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
***Lemna paucicostata-Eichhornia crassipes* community**								
F *Eichhornia crassipes*	*0*$^{..}$	***4***^{45}	0$^{..}$	0$^{..}$	29^{++}	0$^{..}$	*1*^{33}	*0*$^{.}$
Lemnion paucicostatae, Hydrocharition, Lemnetea								
F *Lemna paucicostata*	***3***$^{r+}$	***3***$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*2*$^{+3}$	*1*$^{+}$
U *Hydrilla verticillata*	*0*$^{..}$	*1*$^{++}$	0$^{..}$	0$^{..}$	14^{11}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Myriophyllo spicati-Nelumbetum nuciferae								
U *Myriophyllum spicatum*	*0*$^{..}$	*0*$^{..}$	**100**^{a5}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Trapa pseudoincisa*	*0*$^{..}$	*0*$^{..}$	**67**^{1a}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Potamogeton natans*	*0*$^{..}$	*0*$^{..}$	**33**$^{++}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Bidenti tripartitae-Nelumbetum nuciferae								
F *Bidens tripartita*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**100**$^{+4}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Echinochloa crusgalli*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**100**$^{+3}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Cyperus glomeratus*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**50**$^{++}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Salix matsudana*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**33**^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Ludwigia prostrata*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**33**$^{++}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Ceratophyllo demersi-Nelumbetum nuciferae								
U *Ceratophyllum demersum*	*2*$^{++}$	*1*$^{++}$	**67**$^{+3}$	0$^{..}$	**100**^{55}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Ceratophyllum demersum*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	**100**$^{+5}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Monochorio plantagineae-Nelumbetum nuciferae								
F *Monochoria *plantaginea*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**71**^{1a}	*0*$^{..}$	*0*$^{.}$
F *Potamogeton distinctus*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**43**^{14}	*0*$^{..}$	*1*^{a}
***Potamogeton octandrus-Potamogeton distinctus* community**								
F *Potamogeton octandrus*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*1*^{a}
E *Alisma orientale*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*1*^{1}
Nymphaeion albae, Potamion pectinati, Potametea								
U *Potamogeton crispus*	*1*$^{++}$	*0*$^{..}$	**33**$^{++}$	0$^{..}$	**14**$^{++}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Nelumbo nucifera*	*0*$^{..}$	*0*$^{..}$	**100**^{a4}	**17**^{33}	**86**^{13}	**14**^{aa}	*1*^{33}	*0*$^{.}$
F *Potamogeton pusillus*	*0*$^{..}$	*0*$^{..}$	**17**^{11}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
E *Nelumbo nucifera*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	**100**^{15}	**86**^{a5}	**86**^{a5}	*2*^{a5}	*0*$^{.}$
Other species								
F *Spirodela polyrhiza*	*0*$^{..}$	*2*$^{++}$	33^{++}	17^{aa}	**57**$^{+1}$	**71**^{15}	*1*$^{++}$	*0*$^{.}$
F *Phragmites communis*	*0*$^{..}$	*0*$^{..}$	33^{aa}	33^{+a}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
U *Utricularia* sp.	*0*$^{..}$	*0*$^{..}$	33^{+1}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
F *Alisma orientale*	*0*$^{..}$	*0*$^{..}$	17^{++}	0$^{..}$	0$^{..}$	14^{++}	*0*$^{..}$	*0*$^{.}$
F *Persicaria cochinchinensis*	*0*$^{..}$	*0*$^{..}$	0$^{..}$	33^{++}	0$^{..}$	14^{++}	*0*$^{..}$	*0*$^{.}$
Number of accessoric species	0	0	1	7	0	1	0	4

ALL Nymphaeion albae Oberdorfer 1957
The fresh-water communities of rooted and submerged plants with floating or erect leaves.

Myriophyllo spicati-Nelumbetum nuciferae Kolbek & Dostálek 1996
(Tab. 2: C)
NT Kolbek & Dostálek (1996): Table 2, relevé 11
SM In this community, *Myriophyllum spicatum* and *Nelumbo nucifera* dominate. *Nelumbo nucifera* represents the majority of floating plants. As a co-dominant, *Trapa pseudoincisa* occurs. In the submerged layer, the species *Myriophyllum spicatum* dominates. The community is medium-rich in species (2–9, A6 species per relevé). The height of stands varies between 30–50 cm (A37); the cover of floating plants is 40–75 % (A56) and cover of submerged plants achieves 20–90 % (A68).
V The cover of *Nelumbo nucifera* underlies the main visual variability of stands.
SE It occurs in relatively clean water with a depth of 70–100 cm, probably poor in nutrients, with sandy sediment.
D It was found only in the surroundings of the town of Wonsan in basins situated in the vicinity of the East Sea.
MI The seeds of *Nelumbo nucifera* are collected and serve as human food.
C Very similar stands were described in the town of Kamakura (Japan) designated as the *Potamogeton crispus* community. They consist of the species *Potamogeton crispus*, *Nelumbo nucifera*, *Trapa japonica*, and *Ceratophyllum demersum*. The community *Nymphaea tetragona-Trapa japonica* was described in the town of Itami; the Nymphoido indicae-Trapetum japonicae and *Trapa japonica* communities from Japan are also related. Another analogous unit, *Potamogeton oxyphyllum-Myriophyllum spicatum*, was described on Kyushu Island (Japan).
REF Miyawaki et al. (1973), Miyawaki (1981, 1985–1987)
Related syntaxa (which may be found in North Korea):
Nymphoido indicae-Trapetum japonicae Miyawaki et al. 1977
Nymphaea tetragona-Trapa japonica community sensu Miyawaki & Fujiwara (1974)
Trapa japonica community sensu Miyawaki (1984)

Bidenti tripartitae-Nelumbetum nuciferae Kolbek & Dostálek 1996
(Tab. 2: D)
NT Kolbek & Dostálek (1996): Table 3, relevé 11
SM These stands are the richest in species (4–11, A8) among all the studied aquatic communities. The height of stands varies between 150–300 cm (A220), the cover of floating plants is 20–95 % (A39) and the cover of emergent plants reaches 5–90 % (A69).
V In some stands with shallow water, *Phragmites communis* occurs.
SE The community was studied in sedimentation basins used as sewage clarifying ponds with low water levels (depth 10–30 cm, A18) and a thick mud layer. Depending on the character of the locality and the supply of diaspores, some species may prevail in stands.
D It was found in Pyongyang in a basin with older vegetation in an advanced succession stage. Some stands are transitional stages to the riverside communities of the alliance Panico-Bidention frondosae.
MI The community aids in the control of water pollution.
C Similar communities in Japan were described by Miyawaki et al. (1973).

Ceratophyllo demersi-Nelumbetum nuciferae Kolbek & Dostálek 1996
(Tab. 2: E)
NT Kolbek & Dostálek (1996): Table 2, relevé 7
SM The physiognomy of the stands of this community above the water surface is determined by the dominant species *Nelumbo nucifera*. The water surface is covered by *Azolla imbricata*, *Ceratophyllum demersum* and the floating leaves of *Nelumbo nucifera*. The water column from the sediment to the surface is densely overgrown with *Ceratophyllum demersum*. These thick stands hinder the movement of fish. The total cover of dense stands is normally 100 %; the cover of emergent plants is quite variable (0–100 %, A44), while the cover of floating plants is more balanced (80–100 %, A94) as is the cover of submerged plants (90–100 %, A95). The stands are medium-rich in species, and consist of five to seven (A6) species, because the dense growth of the dominant species hinders the development or penetration of other species. The height of stands varies from 50–130 cm (A94).
V The floristic composition of the community is relatively homogeneous.
SE This community was found in the shallow eutrophic basins (depth of 60 cm) with muddy sediment; the pH values of the water fluctuated around 6.1. The water temperature was rather high; when measured on September 7, 1986, it was 25 °C.
D It was observed in 1984, 1986, and 1990 in the southwestern part of Pyongyang.
MI Seeds of *Nelumbo nucifera* are regularly collected for food.
C An analogous unit, *Ceratophyllum demersum-Najas marina*, was described on Kyushu Island, Japan.
REF Miyawaki et al. (1973), Miyawaki (1981)

Monochorio plantagineae-Nelumbetum nuciferae Kolbek & Dostálek 1996
(Tab. 2: F)
NT Kolbek & Dostálek (1996): Table 3, relevé 5
SM In this extremely species-poor community (3–5, A4 species per relevé) the name giving species dominates. The stands with a height of 30–150 cm (A104) have cover

of the emergent layer around 0–90 % (A48) and the floating layer at 20–95 % (A54). Besides the dominant species, *Potamogeton distinctus* and *Sagittaria trifolia* also occur with lower constancy.
V The cover of the dominant species determines the main visual variability of stands.
SE This community represents an earlier succession stage of the vegetation in shallow clarifying ponds with water depth of 10–20 cm and pH around 6.3.
D The stands were found in the city of Anju.
MI The ponds aid in the control of water pollution.
C Similar communities are known in South Korea and Japan. *Monochoria *plantaginea* also occurs in rice fields on the Korean Peninsula and in Japan.
REF Miyawaki (1960), Song (1991b)

Nelumbo nucifera community sensu Kolbek & Dostálek (1996)
(Tab. 2: G)
SM This community includes several stands dominated by *Nelumbo nucifera* with a characteristic physiognomy but with no characteristic species. These stands achieve a height of 40–150 cm. The cover of the emergent layer varies from 20–90 % and the floating layer from 1–95 %. The number of species varies from two to five.
V The initial stands are mostly species-poor, whereas in some stands one or two dominants of aquatic plants prevail (*Lemna paucicostata*, cultivated *Eichhornia crassipes*, etc.).
SE The depth of the water is quite variable because the dominant species is very adaptable.
D The stands occur in the capital, Pyongyang, and in the city of Anju.
MI The ponds aid in the control of water pollution and in the cultivation of *Eichhornia crassipes* for pig food. *Nelumbo nucifera* is purposely propagated and exploited as a source of edible seeds.
C More or less similar communities are commonly known in southeastern and southern Asia with a variable accompanying species composition.

ALL Potamion pectinati (Koch 1926) Görs 1977
The communities of mainly water floating plants.

Potamogeton octandrus-Potamogeton distinctus community sensu Kolbek & Jarolímek (2008)
(Tab. 2: H)
Note: Kolbek & Jarolímek (2008) published on the community *Potamogeton vaseyi-Potamogeton distinctus* from the sand banks of the Namgang River in the Kumgangsan Mountains. The species *Potamogeton vaseyi* was determined according to the keys available in that time in North Korea. The same determination was confirmed using different determination keys from the southern Korean Peninsula. Later, Wiegleb & Kaplan (1998) described the distribution of *Potamogeton vaseyi* J.W. Robbins in A. Gray in eastern North America. They noted that *P. vaseyi* is very similar to *P. octandrus* Poiret in Lamarck, which is widely distributed in southern and eastern Asia. This error is visible in published East Asian Floras, because *P. octandrus* is mostly missing. According to numerous new determination handbooks (e.g. Lee T.-B. 1999, 2003, Oh & Pak 2001, Lee Y.-N. 2006, Park 2007), *P. vaseyi* is no longer mentioned or confirmed in Korea, whereas *P. octandrus* is widely distributed. In the Table 2, column H is therefore corrected as a *Potamogeton octandrus-Potamogeton distinctus* community.
SM The stand was covered by representatives of the genus *Potamogeton*, which are able to accept oscillating water levels (*Potamogeton octandrus* and *P. distinctus*). The cover of the herb layer is 40 % and the number of species is seven. The height of flowering *Potamogeton* species above the water level is 1–5(10) cm.
V The single relevé was insufficient for the evaluation of variability.
SE This community grows in the depressions between sand dunes with sufficiently deep water. The depth of water varies from several centimetres to several decimetres. The depth of the water oscillates in the course of the vegetation period, with the deepest water usually found during the summer monsoon.
D The sand banks of the Namgang River in the Kumgangsan Mountains; stands of the community are in contact with meadow-like vegetation.
MI This community probably represents irregularly mowed vegetation.
C Similar communities will likely be found in surrounding areas.
Related syntaxa (which may be found in North Korea):
Hydrilla verticillata community sensu Miyawaki & Fujiwara (1974), Miyawaki et al. (1981)
Hydrilla verticillata-Myriophyllum verticillatum community sensu Miyawaki (1982)
Najas marina-Ceratophyllum demersum community sensu Miyawaki (1981)
Potamogeon crispus community sensu Miyawaki et al. (1973)
Potamogeton oxyphyllus community sensu Miyawaki (1984)
Potamogeton oxyphyllus-Myriophyllum spicatum community sensu Miyawaki (1981)

Seaside vegetation

CL Cakiletea maritimae R. Tüxen & Preising 1950
(Tab. 3: A)
OR Cakiletalia maritimae R. Tüxen apud Oberdorfer (1949) 1950
ALL Thero-Suaedion Br.-Bl. 1931
The salt marsh vegetation of the seacoast.

Table 3. Seaside vegetation.
A – Suaedetum japonicae; B – Scirpetum iseensis; C – Triglochini maritimae-Phragmitetum communis; D – Artemisietum fukudo; E – Artemisio capillaris-Salsoletum komarovii; F – Salsolo komarovii-Rosetum rugosae; G – Elymo-Caricetum kobomugi; H – *Carex pumila-Lathyrus maritimus* community

Community	A	B	C	D	E	F	G	H
Number of relevés	23	11	28	45	7	9	4	2
Average number of species	1	2	4	6	9	12	6	8
Suaedetum japonicae, Thero-Suaedion, Cakiletea maritimae								
Suaeda japonica	**100**^{a5}	**64**^{ra}	**68**$^{+3}$	44^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Scirpetum iseensis, Phragmition, Phragmito-Magnocaricetea								
Scirpus iseensis	0$^{..}$	**100**^{34}	**46**$^{+3}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Triglochini maritimae-Phragmitetum communis, Phragmition, Phragmito-Magnocaricetea								
Phragmites communis	0$^{..}$	9^{++}	**100**$^{+3}$	**71**^{r3}	0$^{..}$	11^{11}	*0*$^{..}$	*0*$^{..}$
Triglochin maritimum	0$^{..}$	0$^{..}$	**75**$^{+4}$	**18**$^{+3}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Spergularia marina	0$^{..}$	0$^{..}$	**21**$^{+3}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Eleocharis acicularis agg.	0$^{..}$	0$^{..}$	**7**^{1a}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Artemisietum fukudo, Zoysion sinicae nipponicae, Asteretea tripolii								
Artemisia fukudo	0$^{..}$	0$^{..}$	0$^{..}$	**91**^{r4}	14^{rr}	11^{++}	*0*$^{..}$	*0*$^{..}$
Zoysia sinica	0$^{..}$	0$^{..}$	11^{+1}	**89**$^{+5}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Aster tripolium	0$^{..}$	0$^{..}$	18^{+a}	**64**^{r4}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Limonium tetragonum	0$^{..}$	0$^{..}$	0$^{..}$	**60**$^{+4}$	14^{++}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Salicornia europaea	0$^{..}$	0$^{..}$	0$^{..}$	**47**^{ra}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Atriplex gmelinii	0$^{..}$	0$^{..}$	0$^{..}$	**29**^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Artemisio capillaris-Salsoletum komarovii, Salsolion komarovii, Salsoletea komarovii								
Elymus mollis	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**^{15}	**89**$^{+a}$	*1*^{11}	*0*$^{..}$
Artemisia capillaris	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**$^{+4}$	**100**$^{+3}$	*1*^{rr}	*0*$^{..}$
Salsola komarovii	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**$^{+a}$	**56**$^{+1}$	*3*$^{+1}$	*2*$^{+3}$
Corispermum stauntonii	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**$^{+a}$	**56**$^{+1}$	*0*$^{..}$	*0*$^{..}$
Salsolo komarovii-Rosetum rugosae, Rosion rugosae, Rosetea multiflorae								
Rosa rugosa	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**^{a5}	*0*$^{..}$	*0*$^{..}$
Artemisia japonica	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**33**$^{+a}$	*0*$^{..}$	*0*$^{..}$
Orobanche coerulescens	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**22**$^{++}$	*0*$^{..}$	*0*$^{..}$
Lactuca indica	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**22**$^{r+}$	*0*$^{..}$	*0*$^{..}$
Elymo-Caricetum kobomugi, Caricion kobomugi, Glehnietea littoralis								
Carex kobomugi	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*4*^{35}	*0*$^{..}$
Glehnia littoralis	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*4*$^{+1}$	*2*$^{+1}$
Ixeris repens	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	29^{+1}	11^{++}	*3*$^{+1}$	*2*$^{+b}$
***Carex pumila-Lathyrus maritimus* community**								
Carex pumila	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*2*^{13}
Ischaemum anthephoroides	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*2*$^{++}$
Asparagus schoberioides	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*2*$^{++}$
Other species								
Suaeda heteroptera	9^{1a}	36^{++}	50^{+a}	**40**$^{+4}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Suaeda glauca	9^{++}	0$^{..}$	0$^{..}$	9^{+1}	14^{++}	11^{++}	*0*$^{..}$	*0*$^{..}$
Carex scabrifolia	4^{11}	0$^{..}$	**36**$^{+3}$	13^{+a}	0$^{..}$	11^{aa}	*0*$^{..}$	*0*$^{..}$
Juncus gracillimus	0$^{..}$	0$^{..}$	4^{aa}	11^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Scirpus triqueter	0$^{..}$	0$^{..}$	4^{++}	11^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Melilotus suaveolens	0$^{..}$	0$^{..}$	0$^{..}$	**9**$^{+3}$	0$^{..}$	11^{++}	*0*$^{..}$	*0*$^{..}$
Diplachne fusca	0$^{..}$	0$^{..}$	0$^{..}$	7^{+m}	14^{++}	11^{aa}	*0*$^{..}$	*0*$^{..}$
Calystegia soldanella	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**100**$^{+a}$	**89**$^{+a}$	*4*$^{+3}$	*2*^{ab}
Asparagus oligoclonus	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**57**$^{+1}$	**89**$^{+1}$	*0*$^{..}$	*0*$^{..}$
Oenothera biennis	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**57**$^{+1}$	**89**$^{+a}$	*0*$^{..}$	*0*$^{..}$

Table 3. cont.

Community	A	B	C	D	E	F	G	H
Number of relevés	23	11	28	45	7	9	4	2
Allium anisopodium	0··	0··	0··	0··	43^{+m}	44^{+1}	*0*··	*0*··
Lespedeza daurica	0··	0··	0··	0··	29^{+a}	44^{+1}	*0*··	*0*··
Medicago sativa	0··	0··	0··	0··	29^{aa}	22^{+1}	*0*··	*0*··
Cynanchum sibiricum	0··	0··	0··	0··	29^{11}	**67**$^{r+}$	*0*··	*0*··
Vicia japonica	0··	0··	0··	0··	29^{++}	11^{11}	*0*··	*0*··
Chenopodium album	0··	0··	0··	0··	14^{aa}	22^{++}	*0*··	*0*··
Erigeron canadensis	0··	0··	0··	0··	14^{11}	22^{r+}	*0*··	*0*··
Rubia cordifolia agg.	0··	0··	0··	0··	14^{++}	33^{+a}	*0*··	*0*··
Gypsophila oldhamiana	0··	0··	0··	0··	14^{++}	33^{++}	*0*··	*0*··
Lathyrus maritimus	0··	0··	0··	0··	0··	33^{+a}	***3***^{ma}	*2*^{a3}
Linaria japonica	0··	0··	0··	0··	0··	0··	*1*$^{++}$	*0*··
Oenothera lamarckiana	0··	0··	0··	0··	0··	0··	*1*^{rr}	*0*··
Scutellaria strigillosa	0··	0··	0··	0··	0··	0··	*0*··	*1*$^{++}$
Number of accessoric species	0	0	0	4	0	4	0	0

Suaedetum japonicae Miyawaki & Ohba 1969
(Tab. 3: A)
SM This community includes mostly monocoenoses of the species *Suaeda japonica*. Only one to three species occur in stands with various cover (10–80 %, A46). The height of stands varies between 20 and 45 cm (A30). The structure of stands is very heterogeneous. The same cover may result from a conspicuously different number of individuals. In the vegetation transect, the greatest density of individuals per m² (1400) was found about 120 m from the seaside at low tide.
V In the north of the Korean Peninsula, only stands of the subassociation typicum Miyawaki & Ohba 1969 were found.
SE Stands are periodically flooded by tide water. In the soil rhizosphere, the salinity fluctuates between 1.23–4.53 % and pH varies from 7.4 to 8.3. The soils are fine-grained, without skeletons, clayish loam to loamy clay with an admixture of sand, dark grey in colour, often with salt efflorescence on the surface. In shallow depressions, alluvial sands occur in a thin layer up to 5 cm. Marked rusty spots were visible in the profile. The proportion of sand increased from a depth of 50 cm downward.
D This community is common along the western shore of the West Sea, e.g. near Nampo, Hedju, and Kail.
MI No direct human impact was identified.
C The association was described on the island of Kyushu, Japan (Miyawaki & Ohba 1969). Min et al. (1989) gave some soil characteristics of stands with *Suaeda japonica*.
REF Nobuhara (1979), Kolbek et al. (1989)

CL Phragmito-Magnocaricetea Klika in Klika & Novák 1941 (Tab. 3: B–C)
OR Phragmitetalia Koch 1926
ALL Phragmition Miyawaki & Ohba 1969
The communities of the seacost with reeds (*Phragmites communis*).

Scirpetum iseensis Miyawaki & Ohba 1969
(Tab. 3: B)
SM The relevés from North Korea comprised one to three species, with the dominant *Scirpus iseensis*, accompanied mostly by *Suaeda japonica* and occasionally by *S. heteroptera*. The cover of stands varies between 30–90 % and the height ranges from 25–80 cm (A59).
V With regard to the extremely low number of species in all known relevés (two relevés of the original diagnosis and 11 in our species-poor relevés), the variability is also very low.
SE The soil is marshy, granular, dark grey, clay, without skeletons. It is permanently moist. The habitats of the stands are located in shallow depressions with stagnating water during the ebb tide, or along little streams which supply the soil with water during the ebb tide as well.
D This community is common on the western shore of the West Sea, e.g. near Hedju.
MI No direct human impact was identified.
C The association was described on the island of Honshu, Japan (Miyawaki & Ohba 1969).
REF Kolbek et al. (1989)

Triglochini maritimae-Phragmitetum communis Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
(Tab. 3: C)
NT Kolbek et al. (1989): Table 4, relevé 19
SM The stands are dominated by *Phragmites communis* and *Triglochin maritimum* with subdominants *Suaeda japonica*, *Scirpus iseensis*, *Carex scabrifolia*, or *Aster tripolium*. The number of species is three to seven (A4), with cover of 40–80 % (A57). The height of stands varies in the range of 25–150 cm (A51).

V Within the association, three subassociations including two variants were distinguished:
1. typicum Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
2. scirpetosum iseensis Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
A. var. typicum sensu Kolbek et al. (1989)
B. var. *Carex scabrifolia* sensu Kolbek et al. (1989)
3. asteretosum tripolii Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
SE The stands colonise the most remote sites of the tidal zone. The habitat altitude is about 1 m above the low tide level. The acidity of the soil is remarkably low (pH 4.1–5.5). The salinity fluctuates in the range of 0.38–0.82 %. The rhizosphere of the stands is rich in organic matter (the shoot remains of *Phragmites communis* and *Triglochin maritimum* produce acidic humus after decay). The soil is rusty brown (from 0 to about 23 cm), with a mosaic-like pattern, locally clayish, frequently covered with alluvial sand in several layers.
D This community is ubiquitous over the whole North Korean coast, e.g. the surroundings of Nampo and Hedju.
MI No direct human impact was identified; sometimes selectively grazed.
C The association is not known in any other areas.
REF Miyawaki & Ohba (1969)

CL Asteretea tripolii Westhoff & Beeftink apud Beeftink 1965 (Tab. 3: D)
OR Zoysietalia sinicae nipponicae Miyawaki & Ohba 1969
ALL Zoysion sinicae nipponicae Miyawaki & Ohba 1969
Communities of the higher seaside beyond the influence of the tide.

Artemisietum fukudo Miyawaki & Ohba 1969
(Tab. 3: D)
SM This is a usually open to nearly closed two-layered herb community. The stands, with a cover of 45–95 % (A77) and height from 40–130 cm (A63), are formed by four to nine species (A6).
V The floristic composition of stands from the western coast of North Korea was similar to the original description of the units in Japan. The association is divided into two subassociations, inclusive of two variants:
1. typicum Miyawaki & Ohba 1969
2. zoysietosum sinicae Miyawaki & Ohba 1969
A. var. typicum sensu Kolbek et al. (1989)
B. var. *Limonium tetragonum* sensu Kolbek et al. (1989)
SE The habitats are covered by the continuous turf layer from the litter of dominants. The salinity of the soil is ten to twenty times lower (0.23–0.32 %) than in Suaedetum japonicae. The soil acidity is just above neutral. The soil is dark grey in colour. From 0 to 13 cm, it is loamy with granular structure, moist, without skeletons on the surface, covered with a thin layer of alluvial clay (about 2 cm deep); from 13 cm downwards, the soil consists of granular, light brown loamy sand, with rusty spots.
D This community is scattered to frequent along the western shore of the West Sea, e.g. near Nampo, Hedju, and Kail.
MI Occasional livestock grazing has been observed.
C The association has been described on the Japanese islands of Honshu, Shikoku, and Kyushu based on 29 relevés (Miyawaki & Ohba 1969). Min et al. (1989) gave some soil characteristics of stands with *Artemisia fukudo*.

CL Salsoletea komarovii Ohba, Miyawaki & Tüxen 1973 (Tab 3: E)
OR Salsoletalia komarovii Ohba, Miyawaki & Tüxen 1973
ALL Salsolion komarovii Ohba, Miyawaki & Tüxen 1973
Communities of herbs on the upper parts of seaside sand dunes beyond the influence of the tide.

Artemisio capillaris-Salsoletum komarovii Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
(Tab 3: E)
NT Kolbek et al. (1989): Table 6, relevé 5
SM Relatively species-poor community with 6–11 species in each relevé (A9). *Elymus mollis* and *Artemisia capillaris* compete in coverage. The cover of stands attains 50–90 % (A76) and their height varies in the range 80–100 cm (A89).
V This is a relatively homogeneous community.
SE The habitat has a typical ecotone character with the transition parameters of soil humidity, salinity and the movement of sand between the seacoast habitats and stabilised sand dunes. It occurs on sandy substrates poorer in nutrients than the other communities. For that reason, the number of species depends on the presence and proportion of more nutrient and clay-rich substrates.
D The community was observed only in the surroundings of Kail.
MI No direct human impact was identified; sometimes selectively grazed.
C This association is currently only known on the Korean Peninsula. In Japan, the same dominants form communities with similar physiognomy, but quite different floristic composition (Lohmeyer & Miyawaki 1962). Thus, these communities cannot be compared.
REF Nakanishi (1982), Ohba et al. (1973)

CL Rosetea multiflorae Ohba, Miyawaki & Tüxen 1973 (Tab. 3: F)
OR Rosetalia rugosae Ohba, Miyawaki & Tüxen 1973
ALL Rosion rugosae Ohba, Miyawaki & Tüxen 1973
The shrub and grass communities on the stabilised sand dunes of the seacost.

Salsolo komarovii-Rosetum rugosae Kolbek, Dostálek, Jarolímek, Ostrý & Li 1989
(Tab. 3: F)
NT Kolbek et al. (1989): Table 7, relevé 7
SM The shrub vegetation dominated by *Rosa rugosa* represents the most advanced non-forest community on stabilised sand dunes. Stands are open to closed (50–100 %, A85), with a low number of species 4–14 (A11). The height of stands varies in the range of 70–130 cm (A92).
V The North Korean phytocoenological material is relatively homogeneous.
SE The habitats are situated at the seacoast, ca. 2–5 m above sea level. They are slightly inclined (0–20°). The soil salinity is very low (0.03–0.04 %) and pH varies in the range of 5.3–6.1. The uppermost soil layer (0 to 10 cm) is made up of loamy sand or sand, well aerated, of a dark grey colour, richly rooted, and containing dry plant matter. From 10 to 40 cm, the soil is light grey, sandy and granular, medium rooted.
D The community is frequently found along the East Sea coast in North Korea.
MI Stands of this community locally form a transition to remarkably human influenced, species-richer shrub communities.
C Similar units were described on the Japanese coast.
REF Ohba et al. (1973), Nakanishi (1982), Kim & Nam (1996)

CL Glehnietea littoralis Ohba, Miyawaki & Tüxen 1973 (Tab. 3: G–H)
OR Glehnietalia littoralis Ohba, Miyawaki & Tüxen 1973
ALL Caricion kobomugi Ohba, Miyawaki & Tüxen 1973
The herbaceous communities of the seacoast sand dunes.

Elymo-Caricetum kobomugi Miyawaki 1967
(Tab. 3: G)
SM The average height of the stands ranges from 30–40 cm (A33); only *Elymus mollis* attains 1 m. The number of species is low (5–8, A7), and *Carex kobomugi* plays the role of the dominant species. The stands are open with cover of 60–80 % (A74).
V The relevés from North Korea were classified as subassociation typicum Ohba et al. 1973 inclusive of two variants:
A. var. typicum sensu Ohba et al. (1973)
B. var. *Lathyrus maritimus* sensu Ohba et al. (1973)
SE The stands are found on partly stabilised coastal sand dunes in contact with *Rosa rugosa* shrubs at slight slopes of 5–10°.
D The community is known in the locality southeast of the city of Wonsan on the beach of Sijunho near Tonhchon; it probably also occurs in the sand at the seacoast of the East Sea.
MI Localities at beaches can be influenced by trampling.
C The similar stands were found on the island of Hokkaido and are known also on Honshu, Japan (Tatewaki & Ro 1960). They were studied by Du Rietz methods and described as *Ixeris repens* association. A similar community was found in South Korea (Jung 2000).
REF Mucina & Dostálek (1985)

Carex pumila-Lathyrus maritimus community sensu Mucina & Dostálek (1985)
(Tab. 3: H)
Note: The community was originally described as *Carex pumila* (Mucina & Dostálek 1985) and it differs from the riverside community *Carex pumila-Equisetum arvense*.
SM Stands dominated by *Carex pumila* and species of the Caricion kobomugi alliance resemble the previous plant community, while *Carex kobomugi* is absent. The number of species in relevé is nine and the cover varies between 60–75 %; the height of stands fluctuates around 20 cm.
V The community can be considered as an initial or degradation stage of the previous unit. Two facies are given in North Korea:
A. fac. *Chenopodium acuminatum* sensu Mucina & Dostálek (1985)
B. fac. *Lathyrus maritimus* sensu Mucina & Dostálek (1985)
SE This plant community is found on the sand dunes of beaches.
D This community is known from a locality south of the city of Wonsan; probably on the sand of the coast of the East Sea.
MI Loose stands are highly disturbed by man, including trampling.
C Similar plant communities were published from the sand dunes of the East Sea in South Korea and Japan, along the Pacific coast of Japan and on some islands of the Okhotsk Sea. In South Korea, this community is enriched by the species *Salsola komarovii*, *Typha angustifolia*, and *Chenopodium glaucum* as described by Min & Kim (1999). With the name Caricetum pumilae from the class Glehnietea, it was published by Ihm et al. (2001). Miyawaki (1981–1983, 1988) found this community with *Carex pumila* in the islands of Kyushu and Hokkaido. However, these communities contain species typical for sea sand dunes (*Carex kobomugi*, *Calystegia soldanella*, *Glehnia littoralis*). The species composition of these communities is similar to the stands growing on the Korean seacoast (see Mucina & Dostálek 1985).
REF Ohba et al. (1973), Kim & Nam (1996), Jung (2000)

Communities of rocky and wall habitats

CL Selaginello tamariscini-Potentilletea dickinsii Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek hoc loco (Tab. 4: A–O)
NT Potentilletalia dickinsii Ohba 1973

Note: *Selaginella involvens* (Sw.) Spring and *S. tamariscina* (Beauv.) Spring are very similar taxa, both described in 1843. *S. tamariscina* was also formerly considered as various forms of *S. involvens*. At the time of our botanical research in North Korea (1986–1990), the species *S. tamariscina* was not included in the available Floras of that region. Under the name *S. involvens*, the species was set in the list of plant species names published in North Korea (Do & Im 1976, Ri & Hoang 1984). The figure in the former publication (p. 965, species No. 2893) is identical to *S. tamariscina* in current publications. Both species have often changed names in various Floras of both Korean states (e.g. Pak 2005). Their determination in the field is not simple and diagnostic characteristics are not easily evident. In our paper (Kolbek et al. 1997, 1998), the species occurring in the rocky vegetation was for these reasons wrongly named *Selaginella involvens*. According to the latest determination handbooks (Lee; T.-B. 1999, 2003, Oh & Pak 2001, Anonymous 2005, Lee; Y.-N. 2006, Park 2007) and the original description of both taxa, the plants occurring in the author's relevés of the rocky vegetation in the northern part of the Korean Peninsula must be correctly named as *S. tamariscina.* Consequently, the syntaxa names Selaginello involventis-Potentilletea dickinsii, Selaginellion involventis, and Lepisoro ussuriensis-Selaginelletum involventis must be corrected as follows: Selaginello tamariscini-Potentilletea dickinsii Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek, Selaginellion tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek, and Lepisoro ussuriensis-Selaginelletum tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek (Weber et al. 2000, Art. 43).

OR Potentilletalia dickinsii Ohba 1973
NT Potentillion dickinsii Ohba 1973
These plant communities occur on the semi-dry, sunny or shaded rocks in the colline and montane belts of Japan and the Korean Peninsula. Originally, the order was described with only this one alliance (Ohba 1973a, b). Kolbek et al. (1997) included the newly described alliance Selaginellion tamariscini.

ALL Potentillion dickinsii Ohba 1973
NT Agrostio hideoi-Potentilletum dickinsii Ohba 1973
These plant communities occur on the dry and semi-dry, sunny rocks in the colline and montane belts of Japan and the Korean Peninsula. In North Korea, only one association belongs to this alliance.

Rhododendro mucronulati-Potentilletum dickinsii Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: A)
NT Kolbek et al. (1997): Table 1, relevé 21
SM This is an open two- to three-layered herb and grass community, 10–50 cm in height, poor in species (3–11, A7). In the open crest habitats, *Potentilla dickinsii* and the graminoids, such as *Carex lanceolata*, *Arundinella hirta*, *Spodiopogon sibiricus*, and *Calamagrostis langsdorfii* are predominant. *Rhododendron mucronulatum*, *R. micranthum*, *Weigela florida*, and *Betula chinensis* represent the woody plants. Luxuriant thalli of foliaceous lichens, including *Hemerocaulon* sp., *Cladia aggregata*, *Thallus primarius*, *Umbilicaria* sp., and *Peltigera* sp., are the typical feature of this community. The cover of the herb and moss layers ranges from 10–85 % (A46) and 0–90 % (A26), respectively.
V The community is relatively homogeneous in species composition. Differences in the floristic composition do not reflect differences in the orientation of the cliffs.
SE It occurs most frequently on rocks or big boulders in the forest and in shallow clefts of steep (25)80–90° (A80) granodiorite cliffs. It colonises sunny, dry and windswept rock edges and crests of various orientations exposed to water and wind erosion at an altitude of 200–890 m.
D It is relatively frequent in the Sujangsan, Kumgangsan, and Chonmasan Mountains.
MI This is a naturally developed unit without direct human influence.
C Analogous stands are reported from the clefts of granite walls in the surroundings of Seoul in South Korea. These stands may be syndynamically related to the shrubby *Potentilla dickinsii-Betula chinensis* community. A community with similar physiognomy but different species composition, Agrostio hideoi-Potentilletum dickinsii, was described in central Japan.
REF Ohba (1973a, b), Kim & Kim (1988)

ALL Selaginellion tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek hoc loco
NT Lepisoro ussuriensis-Selaginelletum tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek (see below)
DS *Amitostigma gracile*, *Commelina communis*, *Parthenocissus tricuspidata*, *Pilea peploides*, *Sedum spectabile*, *S. verticullatum*, *Selaginella tamariscina*
These plant communities occur on semi-dry and shaded rocks in the colline and montane belts of North Korea. The alliance comprises eight associations and two com-

Table 4. Communities of rocky and wall habitats.
A – Rhododendro mucronulati-Potentilletum dickinsii; B – Artemisio keiskeanae-Chrysanthemetum coreani; C – Amitostigmato gracilis-Sedetum polytrichoidis; D – Davallietum mariesii; E – Lepisoro ussuriensis-Selaginelletum tamariscini; F – Woodsio polystichoidis-Orostachyetum erubescentis; G – Sedetum sarmentoso-middendorffiani; H – Commelino communis-Sedetum sarmentosi; I – Parietario micranthae-Pileaetum peploidis; J – *Camptosorus sibiricus-Pilea peploides* community; K – *Oxalis stricta-Microlepia pilosella* community; L – Patrinio saniculaefoliae-Mukdenietum rossii; M – Mukdenio rossii-Selaginelletum rossii; N – Dryopterido saxifragae-Saxifragetum fortunei; O – *Saxifraga fortunei-Boehmeria spicata* community

	Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	Number of relevés	24	25	20	5	9	6	9	11	6	5	3	28	24	43	4
	Average number of species	7	12	9	4	5	8	8	12	8	10	8	11	11	8	16
	Rhododendro mucronulati-Potentilletum dickinsii, Potentillion dickinsii															
	Potentilla dickinsii	**100^{a4}**	16^{+a}	15^{+a}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**68ra**	33^{+a}	9^{+1}	*0*$^{..}$
	Rhododendron micranthum	**21^{r1}**	0$^{..}$	0$^{..}$	0$^{..}$	11^{rr}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Artemisio keiskeanae-Chrysanthemetum coreani															
	Chrysanthemum coreanum	42ra	**100^{14}**	20^{+1}	0$^{..}$	0$^{..}$	17^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	29^{r1}	21^{r1}	9^{+a}	*0*$^{..}$
	Allium thunbergii	8^{r+}	**44ra**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Lilium amabile	0$^{..}$	**24ra**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Pedicularis resupinata	0$^{..}$	**16^{r+}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Amitostigmato gracilis-Sedetum polytrichoidis															
	Sedum polytrichoides	8^{r+}	**56ra**	**100^{14}**	0$^{..}$	0$^{..}$	33^{1a}	0$^{..}$	0$^{..}$	0$^{..}$	40^{++}	*0*$^{..}$	7^{+1}	8^{+1}	7^{r1}	***3^{++}***
	Orthodon grosseserratum	0$^{..}$	8^{r1}	**25^{+a}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Davallietum mariesii															
	Davallia mariesii	4^{bb}	0$^{..}$	0$^{..}$	**100^{35}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	4^{rr}	2^{bb}	*1*$^{++}$
	Lepisoro ussuriensis-Selaginelletum tamariscini															
	Selaginella tamariscina	8^{+1}	28ra	25ra	40^{11}	**100^{a4}**	0$^{..}$	0$^{..}$	0$^{..}$	33^{+1}	0$^{..}$	*0*$^{..}$	14^{r1}	0$^{..}$	14^{r1}	*1*^{rr}
	Woodsio polystichoidis-Orostachyetum erubescentis															
	Orostachys erubescens	0$^{..}$	16^{+1}	20^{r1}	0$^{..}$	22^{+1}	**100^{b4}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	4^{rr}	2^{++}	*0*$^{..}$
	Woodsia polystichoides	0$^{..}$	0$^{..}$	10^{1a}	0$^{..}$	0$^{..}$	**83^{r1}**	11^{++}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	4^{rr}	4^{++}	9^{+a}	***4^{+1}***
	Sedetum sarmentoso-middendorffiani															
	Pseudostellaria davidii	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**22^{r+}**	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Corydalis speciosa	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***22^{1a}***	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	4^{++}	0$^{..}$	*0*$^{..}$
	Commelino communis-Sedetum sarmentosi															
	Sedum sarmentosum	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**67^{+4}**	**100^{13}**	17^{++}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Artemisia asiatica	0$^{..}$	4^{rr}	15^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	11^{++}	**82ra**	33^{++}	0$^{..}$	*0*$^{..}$	4^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$
	Humulus japonica	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**64^{r1}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Taraxacum officinalis	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**55^{r+}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	*Agropyron *transiens*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**45^{+1}**	17^{++}	0$^{..}$	*1*$^{++}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Glechoma hederacea	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**36^{r+}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
M	*Plagiothecium cavifolium*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**27^{aa}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Rumex acetosella	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**27^{+1}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
M	*Brachythecium plumosum*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**18^{+1}**	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Parietario micranthae-Pileaetum peploidis															
	Parietaria micrantha	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**50^{1a}**	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	***Camptosorus sibiricus-Pilea peploides* community**															
	Pilea peploides	0$^{..}$	4^{++}	30ra	0$^{..}$	0$^{..}$	17^{mm}	0$^{..}$	0$^{..}$	**83^{+3}**	**100^{11}**	*0*$^{..}$	0$^{..}$	4^{++}	7^{r+}	*0*$^{..}$
M	*Polytrichum juniperinum*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**80^{aa}**	*1*$^{++}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
M	*Pleurozium schreberi*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**60^{aa}**	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	***Oxalis stricta-Microlepia pilosella* community**															
	Oxalis stricta	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	9^{rr}	0$^{..}$	0$^{..}$	***3^{++}***	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
	Microlepia pilosella	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	40^{+1}	***2^{a4}***	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$
	Patrinio saniculaefoliae-Mukdenietum rossii															
	Patrinia saniculaefolia	21ra	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**68ra**	38^{+1}	2^{++}	*0*$^{..}$

Table 4. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Number of relevés	24	25	20	5	9	6	9	11	6	5	3	28	24	43	4
Sanguisorba hakusanensis	17^{r1}	16^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**61ra**	17^{+1}	0$^{..}$	*0*$^{..}$
Thalictrum coreanum	13^{+1}	4^{rr}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**36^{r4}**	4^{11}	0$^{..}$	*0*$^{..}$
Pedicularis apodochila	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**11^{r1}**	0$^{..}$	0$^{..}$	*0*$^{..}$
Mukdenio rossii-Selaginelletum rossii															
Selaginella rossii	13^{+m}	8^{+1}	5^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**29^{+4}**	**83^{+5}**	16^{+1}	***3*^{aa}**
Pentactina rupicola	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	4^{++}	**21^{+3}**	0$^{..}$	*0*$^{..}$
Dryopterido saxifragae-Saxifragetum fortunei															
Saxifraga oblongifolia	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	**14^{+a}**	*0*$^{..}$
***Saxifraga fortunei-Boehmeria spicata* community**															
M *Fissidens cristatus*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***4*^{a4}**
Boehmeria spicata	4^{++}	4^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	17^{++}	0$^{..}$	*2*^{1a}	0$^{..}$	0$^{..}$	0$^{..}$	***4*^{13}**
M *Plagiomnium tezukae*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***3*^{aa}**
M *Schistidium apocarpum*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***3*^{1a}**
M *Climacium japonicum*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***3*$^{+a}$**
Polystichum tripteron	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	***3*$^{+1}$**
Lactuca bungeana	0$^{..}$	0$^{..}$	15^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	18^{r+}	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	***3*$^{+1}$**
Deutzia glabrata	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	12^{+a}	***3*^{r1}**
Selaginellion tamariscini															
Sedum spectabile	0$^{..}$	**28^{r1}**	**15^{r1}**	**20^{++}**	**11^{++}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	40^{r+}	*0*$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
*Tripogon *coreensis*	0$^{..}$	**8^{11}**	**15^{+a}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	40^{aa}	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Commelina communis	0$^{..}$	0$^{..}$	**45^{+a}**	0$^{..}$	0$^{..}$	**67^{r1}**	**56^{+a}**	**73ra**	**33^{1a}**	0$^{..}$	*0*$^{..}$	0$^{..}$	4^{++}	0$^{..}$	*0*$^{..}$
Parthenocissus tricuspidata	0$^{..}$	0$^{..}$	**10^{+a}**	0$^{..}$	0$^{..}$	**17^{++}**	**56^{+3}**	**64^{13}**	0$^{..}$	**80^{1a}**	*1*^{rr}	0$^{..}$	4^{11}	2^{++}	*0*$^{..}$
Saxifragion fortunei															
Saussurea nivea	0$^{..}$	0$^{..}$	5^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**39^{+3}**	**21ra**	**2^{rr}**	*0*$^{..}$
Saxifraga fortunei	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	20^{++}	*0*$^{..}$	**18^{+a}**	**67^{+3}**	**100^{14}**	***4*^{a4}**
Dryopteris saxifraga	8^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	17^{++}	0$^{..}$	*0*$^{..}$	**14^{++}**	**17^{r+}**	**30^{rb}**	***2*$^{r+}$**
Dryopteris subtripinnata	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**11^{r+}**	**4^{++}**	**9^{++}**	*0*$^{..}$
Carex siderosticta	0$^{..}$	28ra	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	11^{++}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**7^{r+}**	**25^{r1}**	**28^{+a}**	*0*$^{..}$
Gymnocarpium jessoense	0$^{..}$	0$^{..}$	5^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**4^{rr}**	**4^{11}**	**16^{+a}**	***3*$^{+1}$**
Woodsia manchuriensis	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	**0$^{..}$**	**4^{++}**	**19^{+1}**	*0*$^{..}$
Selaginello tamariscini-Potentilletea dickinsii															
Mukdenia rossii	50^{+1}	0$^{..}$	0$^{..}$	20^{++}	**56^{+a}**	0$^{..}$	0$^{..}$	0$^{..}$	17^{++}	20^{aa}	*0*$^{..}$	**93^{13}**	**75^{r3}**	37^{+a}	***4*$^{++}$**
Lepisorus ussuriensis	8^{+1}	0$^{..}$	**20^{+4}**	0$^{..}$	**67^{+b}**	50^{++}	11^{11}	0$^{..}$	33^{+1}	20^{++}	*0*$^{..}$	7^{1a}	13^{r1}	30^{+1}	***4*$^{+1}$**
Androsace cortusaefolia	8^{r1}	0$^{..}$	5^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	21^{+b}	46^{+a}	2^{11}	*0*$^{..}$
Amitostigma gracile	0$^{..}$	40ra	45^{rm}	0$^{..}$	11^{11}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	18^{r+}	21^{+1}	9^{+1}	*0*$^{..}$
Neoniphopsis linearifolia	0$^{..}$	8^{+a}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	11^{++}	0$^{..}$	17^{11}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Sedum verticullatum	0$^{..}$	8^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	44^{+1}	0$^{..}$	17^{++}	20^{++}	*0*$^{..}$	0$^{..}$	8^{rr}	23^{+1}	*0*$^{..}$
Dennstaedtia hirsuta	0$^{..}$	8^{rr}	0$^{..}$	0$^{..}$	22^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	50^{++}	0$^{..}$	*0*$^{..}$	0$^{..}$	8^{r1}	14^{+a}	*0*$^{..}$
Camptosorus sibiricus	0$^{..}$	4^{++}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	50ra	**60^{1a}**	*0*$^{..}$	0$^{..}$	8^{++}	16^{+m}	*1*^{rr}
Sedum middendorffianum	0$^{..}$	4^{++}	0$^{..}$	0$^{..}$	11^{11}	**83^{+3}**	**67^{a5}**	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	8^{11}	5^{+1}	*0*$^{..}$
Asplenium incisum	0$^{..}$	0$^{..}$	10^{r+}	20^{rr}	11^{rr}	17^{++}	0$^{..}$	0$^{..}$	50ra	40ra	*2*^{1a}	29^{r1}	17^{r+}	19ra	*0*$^{..}$
Other species															
Carex lanceolata	**67^{+1}**	**68^{+a}**	40ra	**60^{+a}**	**56^{+1}**	50^{r+}	0$^{..}$	45^{r1}	17^{++}	0$^{..}$	*0*$^{..}$	**61^{r1}**	**67^{r1}**	0$^{..}$	*0*$^{..}$
Rhododendron mucronulatum	46^{r1}	20^{r1}	5^{++}	40^{+1}	33^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	40^{r+}	*0*$^{..}$	**75^{r1}**	50ra	35^{r1}	*1*$^{++}$
Spodiopogon sibiricus	25^{+1}	32^{+a}	**55ra**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	9^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$	21^{r1}	13^{r1}	0$^{..}$	*0*$^{..}$
Weigela florida	25^{r1}	16^{r+}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**60ra**	*0*$^{..}$	18^{r+}	21^{r1}	7^{+1}	*0*$^{..}$
Arundinella hirta	21^{+b}	**44^{+3}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Artemisia keiskeana	13^{++}	**56^{+b}**	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	17^{++}	20^{rr}	*0*$^{..}$	11^{r+}	8^{rr}	12^{r+}	*0*$^{..}$
Pinus densiflora	8^{+1}	20^{r+}	20^{r+}	0$^{..}$	11^{rr}	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	4^{rr}	5ra	*0*$^{..}$

Table 4. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Number of relevés	24	25	20	5	9	6	9	11	6	5	3	28	24	43	4
Peucedanum terebintaceum	8^{++}	24^{r+}	10^{+a}	0··	0··	0··	22^{++}	0··	0··	0··	*0*··	14^{r+}	13^{++}	0··	*0*··
Diarrhena japonica	4^{11}	12^{+1}	15^{+a}	0··	11^{++}	0··	22^{+1}	0··	17^{++}	0··	*0*··	50^{ra}	17^{+a}	0··	*0*··
Chrysanthemum indicum	4^{++}	20^{r1}	10^{r+}	0··	0··	0··	0··	18^{+a}	0··	**60**$^{r+}$	*0*··	0··	0··	0··	*0*··
Fraxinus rhynchophylla	4^{rr}	8^{r+}	10^{rr}	0··	0··	0··	22^{rr}	0··	0··	0··	*0*··	7^{++}	4^{11}	9^{+a}	*0*··
Melampyrum roseum	4^{rr}	16^{+1}	30^{r1}	0··	11^{11}	0··	0··	0··	0··	0··	*0*··	7^{ra}	0··	0··	*0*··
Calamagrostis arundinacea	0··	36^{1b}	25^{+1}	20^{++}	0··	0··	0··	0··	17^{++}	20^{++}	*0*··	18^{r1}	21^{+1}	7^{+1}	*0*··
Aster maackii	0··	24^{+a}	20^{ra}	0··	0··	0··	0··	0··	0··	0··	*0*··	0··	0··	0··	*0*··
Setaria viridis	0··	16^{+1}	30^{+a}	0··	0··	50^{++}	0··	0··	0··	0··	*1*^{rr}	0··	0··	0··	*0*··
Lespedeza bicolor	0··	12^{+1}	10^{r+}	0··	0··	0··	0··	0··	0··	0··	*0*··	14^{r1}	13^{+1}	2^{11}	*0*··
Lactuca raddeana	0··	12^{r+}	10^{r+}	0··	0··	0··	0··	0··	17^{11}	20^{rr}	*0*··	0··	8^{r+}	0··	*0*··
Viola mandshurica	0··	4^{++}	0··	0··	0··	0··	11^{11}	27^{++}	0··	0··	*1*^{aa}	0··	0··	0··	*0*··
Astilbe chinensis	0··	4^{rr}	0··	0··	0··	0··	0··	0··	0··	20^{11}	*0*··	18^{ra}	29^{+1}	14^{r1}	*0*··
Arthraxon hispidus	0··	0··	5^{11}	0··	0··	0··	11^{aa}	27^{r+}	0··	0··	*0*··	0··	0··	0··	*0*··
Spiraea japonica	0··	0··	5^{++}	0··	0··	0··	0··	0··	0··	20^{++}	*0*··	4^{++}	17^{r+}	5^{rr}	*0*··
Deutzia prunifolia	0··	0··	0··	0··	22^{++}	17^{++}	0··	0··	0··	0··	*0*··	0··	17^{+a}	14^{1a}	*0*··
Chylocalyx senticosus	0··	0··	0··	0··	0··	0··	33^{r+}	45^{r1}	0··	0··	*0*··	0··	0··	0··	*0*··
Lactuca indica	0··	0··	0··	0··	0··	0··	22^{11}	0··	17^{++}	0··	*0*··	0··	0··	0··	*0*··
Poa nemoralis	0··	0··	0··	0··	0··	0··	22^{+1}	0··	0··	0··	*0*··	0··	0··	0··	*0*··
Erigeron canadensis	0··	0··	0··	0··	0··	0··	11^{++}	27^{+1}	0··	0··	*1*$^{++}$	0··	0··	0··	*0*··
Number of accessoric species	10	33	25	4	7	8	20	29	9	5	9	26	41	52	5

munities, and differs from the previous one mainly by the presence of shade-tolerant species, which often dominate. The communities of the alliance occur in much more northerly locations than communities of Potentillion dickinsii.

Artemisio keiskeanae-Chrysanthemetum coreani Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: B)

NT Kolbek et al. (1997): Table 2, relevé 10

SM This is an open, poor to rich in species, two-layered, grass-herb community. The number of species spans from 4 to 24 (A12). Stands are dominated by *Chrysanthemum coreanum* and reach the height between 20 and 30 cm in the lower layer and 90 cm in the higher layer due to the presence of some grasses, such as *Arundinella hirta* and *Calamagrostis arundinacea*. The cover of the herb layer varies between 10 and 90 % (A54). The moss layer covers 0–80 % (A33).

V Based on floristic and ecological differences, three subassociations are distinguished:

1. arundinelletosum hirtae Kolbek, Jarolímek & Valachovič 1997
2. orostachyetosum erubescentis Kolbek, Jarolímek & Valachovič 1997
3. asteretosum maackii Kolbek, Jarolímek & Valachovič 1997

SE The community occurs mostly on northerly oriented slopes on periodically moist, open or slightly shaded rock beds of various orientation and inclination (10–75°, A25) in the colline to montane (rarely subalpine) belts at altitudes of 130–500(1390) m. A typical habitat is represented by granodiorite rocks with tabular layering covered by a thin layer of primitive organo-mineral soil accumulated in the soil pockets below the rock steps. The rock slabs form stair-like steps of various breadth about 10–20 cm in height. The substrate is probably of windborne as well as water-borne origin.

D This community is relatively frequent in the Chonmasan and Sujangsan Mountains and in the vicinity of Sohungho Lake (Kumgangsan Mountains). In the Myohyangsan Mountains, it was found only in fragments in the subalpine belt.

MI This is a naturally developed unit without direct human influence.

C This community is not known in the surrounding countries.

Amitostigmato gracilis-Sedetum polytrichoidis Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: C)

NT Kolbek et al. (1997): Table 3, relevé 9

SM This is an open, two-layered community of low herbs and mosses (up to 20 cm in height). The number of species attains (2)5–19 (A10). The cover of the herb layer fluctuates between 10 and 65 % (A43), in the moss layer 10–90 % (A32). *Bryum* sp., *Sanionia uncinata*, *Entodon angustifolius*, *Schistidium apocarpum*, *Hypnum hamulosum*, *Plagiomnium trichomanes*, *Racomitrium canescens*, and *Thuidium philibertii* are the most frequent bryophytes.

V The association has been divided to the following two subassociations:

1. spodiopogonetosum sibirici Kolbek, Jarolímek & Valachovič 1997
2. lepisoretosum ussuriensis Kolbek, Jarolímek & Valachovič 1997
The moderately shaded to shaded habitats (big boulders or little rocks) surrounded by deciduous forests can be successively overgrown by *Parthenocissus tricuspidata*, gradually suppressing low-grown species typical of the community.
SE The community occupies habitats on the tops of the large granodiorite boulders or rocks with moderate inclinations 0–50(70°) (A28). The stands are found in the colline belt (50–510 m a.s.l.) in slightly shaded to shaded sites on east- or north-facing slopes. A decreasing proportion of the fine soil negatively affects the number of species. If more organogenic material accumulates, the ecesis of seedlings of woody plants is more successful.
D This community is relatively frequent in the Kumgangsan and Sujangsan Mountains.
MI It is a naturally developed unit without direct human influence.
C This community is not known in the surrounding countries.

Davallietum mariesii Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: D)
NT Kolbek et al. (1997): Table 4, relevé 4
SM This is an open, two-layered community, very poor in species, dominated by the fern *Davallia mariesii* and with very variable cover of both layers. The number of species is two to six (A4). The cover of the herb layer varies between 15 and 85 % (A53), depending on the density and vitality of the fern rootstock and the number of leaves. The moss layer covers 20–80 % (A43). The height of the herb layer does not exceed 20 cm. The community is very decorative.
V In this community, no important floristic variability was recognised.
SE The dominant species is a typical petrophyte firmly fixed to the rock surface by its creeping rootstock. The community occurs on rocks and big boulders of various orientations with a steep inclination of 70–90° (A80), or below rock overhangs. Its stands grow on the surfaces of rough granodiorite compact rocks at altitudes of 110–400 m. These habitats are dry, exposed to sunshine or partly shaded by surrounding rocks or trees (*Pinus densiflora* and *Quercus mongolica*). The community prefers rock edges with low accumulation of (aeolian) material.
D This community is scattered in the southern part of North Korea in the Sujangsan and Chonmasan Mountains (the surroundings of Kaesong) and around Lake Sohungho.
MI This is a blocked stadium of succession without direct human impact.
C This community is not known in the surrounding countries.

Lepisoro ussuriensis-Selaginelletum tamariscini Kolbek, Jarolímek & Valachovič 1997 nom. corr. Kolbek & Jarolímek hoc loco
(Tab. 4: E)
NT Kolbek et al. (1997): Table 5, relevé 3
DS *Carex lanceolata* (c), *Lepisorus ussuriensis* (c), *Mukdenia rossii* (c), *Selaginella tamariscina* (ch, c, d)
SM This is a two- to three-layered community of ferns and bryophytes, very poor in species (2–7, A5). The stands are only 2–15(30) cm high. The cover of the herb layer is 20–75 % (A50); the moss layer covers 20–80 % (A60). Bryophytes, e.g. *Anomodon minor*, *Chandonanthus birmensis*, *Schistidium apocarpum*, *Leucobryum glaucum*, *Weissia* sp., and the lichens *Cladonia* sp., *Pertusaria* sp., *Ramalina* sp., and *Umbilicaria esculenta* were found.
V The community without inside variability.
SE The community colonises shallow clefts on shaded rock walls at lower altitudes between 180 and 780 m in the belt of deciduous forests. It occurs on shaded rocks in forests close to mountain brooks. The habitats of this community are usually represented by natural walls of granodiorite boulders or rock blocks facing predominantly toward the north with a very steep inclination (70–90°, A83). Marked fluctuations in the moisture of the substrate, from the extreme drought in the spring and autumn to long-term wetting during the monsoons, is typical for these habitats. The community usually occurs in the shape of moss pillows with a few herb species. The acidity of the water flowing down the rock surface attains pH values of 4.9–5.2. A real soil layer is not developed here.
D This community is relatively frequent in the Myohyangsan, Kumgangsan, and Ljongaksan Mountains.
MI This is a naturally developed community without direct human impact.
C This community is not known in the surrounding countries.

Woodsio polystichoidis-Orostachyetum erubescentis Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: F)
NT Kolbek et al. (1997): Table 6, relevé 5
SM Woodsio-Orostachyetum is a community with the conspicuous succulent *Orostachys erubescens* as the dominant species, attaining a height of about 10 cm, germinating well in moss cushions. The number of species varies between five and nine (A8). The cover of the herb layer attains 20–65 % (A48). The species *Setaria viridis*, *Commelina communis*, and *Elscholzia patrini* indicate human disturbance of the habitat. The moss layer is very rich and covers 40–90 % (A70). *Atrichum *gracile*, *Brachythecium buchananii*, *B. populeum*, *Campylium chrysophyllum*, *Entodon rubicundus*, *Gollania ruginosa*,

Herpetineuron toccoae, *Jamesoniella autumnalis*, *Lejeunea compacta*, *L. japonica*, *Mnium laevinerve*, *Polytrichum alpinum*, and *Thuidium kanedae* are the most frequent bryophytes.
V The community shows low variability in the species composition of stands.
SE The community overgrows sun-flecked boulder tops and inclined rock slabs predominantly facing south at altitudes of 250–790 m. Inclination attains (5)30° to 70° (A43). The almost smooth plates are at first overgrown by bryophytes and subsequently in succession by succulents. The thin soil layer and the non-decomposed leaf litter can be deposited only on rock protrusions or around the sprouts of *Parthenocissus tricuspidata*. Exceptionally, the seedlings of woody plants can root in the rock crevices.
D This community is found scattered in natural habitats in the Myohyangsan Mountains and also in artificial habitats in the surroundings of the temples of Sangwonam and Hwayangam, and in the ancient Confucian School at Kaesong.
MI Many stands of the community were found near tourist tracks and the species composition was affected by the penetration of several synanthropic species. The initial stadium with *Orostachys erubescens* also can occur in man-made habitats, such as old roofs.
C In Japan, Ohba (1973a, b) published two species-poor relevés of Sedetum japonicae-erubescentis. One relevé with *Orostachys japonica* was published by Miyawaki (1984) in the region of Kinki. A community with *Woodsia polystichoides* was reported by Miyawaki (1988) from Hokkaido. All of these communities are distinct in species composition from Woodsio polystichoidis-Orostachyetum erubescentis.

Sedetum sarmentoso-middendorffiani Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: G)
NT Kolbek et al. (1997): Table 7, relevé 3
SM This is a two to three-layered community of succulents and bryophytes, very poor in species (4–13) (A8). The cover of the herb layer is rather high at 50–95 % (A70). In the herb layer, *Sedum middendorffianum*, *S. sarmentosum*, and *S. verticullatum* predominate with an average height of 15 cm. Because of the sufficient moisture content of the soil and of the partly-open character of the stands, woody plants (e.g. *Micromeles alnifolia*, *Fraxinus rhynchophylla*, *Acer mono*, *A. tschonoskii*, *Quercus dentata*) from the neighbouring forest communities can also encroach here and form a weak shrub layer. The moss layer covers 0 to 50 %. Mosses, such as *Entodon* sp., *Schistidium apocarpum*, *Herpetineuron toccoae*, *Leucobryum* sp., *Plagiomnium cuspidatum*, and *Polytrichum* sp., are the most frequent.
V Some stands with different floristic composition are dominated by *Parthenocissus tricuspidata*. Stands with analogous composition also occur on low stone walls.
SE The community grows on shaded and moist rocks and boulders of granodiorite at altitudes from 100 to 800 m with various orientations. The inclination varies from 10 to 57° (A39).
D This community is frequent in the Myohyangsan Mountains, especially in the surroundings of old Buddhist temples (Hwayangam and Sangwonam) and rare in the Kumgangsan Mountains.
MI The community occupies both natural and anthropogeneous habitats.
C This community is not known in the surrounding countries.

Commelino communis-Sedetum sarmentosi Kolbek & Valachovič 1996
(Tab. 4: H)
NT Kolbek & Valachovič (1996): Table 1, relevé 7
SM This is an open community with the dominants *Sedum sarmentosum* and *Parthenocissus tricuspidata*, which determine the conspicuous physiognomy. During the flowering period, *Commelina communis* also becomes significant. The cover of the herb layer varies from 10 to 50 % (A31). The number of species in the herb layer attains 7–14 (A11). The moss layer was observed in only one third of relevés with cover from 20 to 35 % (A28).
V Species-richer stands are dominated by *Parthenocissus tricuspidata*.
SE This community is found on low granite walls in settlements and walls bordering river banks at altitudes of 100–180 m. Walls can be oriented to all aspects. Their inclination varies between (20)40–90° (A61). Walls are colonised by species of different ecological demands, ranging from typical oligotrophic to nutrient-demanding, from xerophilous to mesophilous, and from heliophilous to sciophilous species.
D This community is relatively frequent in the territory of the Kumgangsan Mountains.
MI The community was observed only on artificial habitats (old walls, paved river navigations).
C No other relevant data or references are known.

Parietario micranthae-Pileaetum peploidis Kolbek, Jarolímek & Valachovič 1997
(Tab. 4: I)
NT Kolbek et al. (1997): Table 8, relevé 3
SM This is a two-layered community, rather poor in species. The name giving species predominate. Pteridophytes are an important component of stands. The number of species in the herb layer is 6–10 (A8); its cover attains 10–50 % (A25). The cover of the moss layer fluctuates from 0 to 75 % (A45).
V The community without inside variability.
SE The stands of Parietario-Pileaetum prefer shady and moderately moist sites. They are usually found below rock overhangs on moist, loamy substrates, often in disturbed habitats at altitudes from 50 to 460 m with an

inclination of 15–105° (A60). The soil forms only a very thin layer; it consists mostly of drifted leaf litter with admixed sand from the weathered substrata.
D This community is found scarcely in the Sujangsan, Myohyangsan, and Kumgangsan Mountains.
MI The community grows also on artificial habitats and broken stones.
C This community is not known in the surrounding countries.

Camptosorus sibiricus-Pilea peploides community sensu Kolbek & Valachovič (1996)
(Tab. 4: J)
SM Besides the dominant species *Parthenocissus tricuspidata*, *Camptosorus sibiricus* and constant *Pilea peploides*, a typical taxon is also the grass *Tripogon *coreensis*. The cover of both the herb and moss layers is very low [10–30 % (A19) and 0–20 % (A13), respectively]. The number of species varies between 7 and 12 (A9).
V Due to the low number of relevés, the variability is not clear. In one relevé, *Parthenocissus tricuspidata* was exchanged with *Asplenium incisum* and *Mukdenia rossii*.
SE Habitats are formed by old granite walls which are dry to mesic, insolated for the greater part of the day. Northern and eastern exposures at altitudes of 300–500 m prevail. The inclination is very high (80–90°, A85).
D This community is rare on the Sujangsansong Ruins in the East Sujangsan Mountains and at one locality near the Kuryongpopo Waterfall in the Kumgangsan Mountains.
MI The community occurs on old artificial walls.
C This community is similar to Japanese Camptosoretum sibirici Nakamura in Miyawaki 1983.

Oxalis stricta-Microlepia pilosella community sensu Kolbek & Valachovič (1996)
(Tab. 4: K)
SM Stands are very poor in species. The dominants are the ferns *Microlepia pilosella* and *Asplenium incisum*, and significant species of rock crevices. The cover of typical stands varies between 60 and 70 % (A65), in less developed stands only to 20 %. The moss layer is only poorly developed with cover below 10 %. The number of species varies between seven and eight (A7).
V In typical stands, both ferns occur as dominants, while in less developed and young initial stands, one or both ferns are usually absent.
SE This community is found on dry and generally insolated walls at altitudes of 10–120 m. The inclination of most habitats is 90°, with various orientations.
D This community is rare in the town of Hedju, in Manvolde, and on the walls of the royal tomb of Kongmin near the town of Kaesong.
MI This community is found on old walls with long-term succession and without recent human influence.
C This community is not known in the surrounding countries.

OR Saxifragetalia fortunei Kolbek, Valachovič & Jarolímek 1998
NT Saxifragion fortunei Kolbek et al. 1998

ALL Saxifragion fortunei Kolbek, Valachovič & Jarolímek 1998
NT Mukdenio rossii-Selaginelletum rossii Kolbek et al. 1998
Communities of moist rocks in the colline and montane belts in Korea. The order and alliance in North Korea contain three associations and two communities.

Patrinio saniculaefoliae-Mukdenietum rossii Kolbek, Valachovič & Jarolímek 1998
(Tab. 4: L)
NT Kolbek et al. (1998): Table 1, relevé 6
SM This is an open, two-layered, species-poor community noted for the presence of plant species of very humid habitats. The cover of the herb layer varies between 10 and 85 % (A40). The physiognomy of stands is determined by *Mukdenia rossii*, especially conspicuous in the autumn with its red-coloured leaves. The number of vascular plants fluctuates between 4 and 16 (A11). The moss layer covers 5–40(50) % (A19). Mosses such as *Brachythecium albicans*, *Campylopus fragilis*, *Chandonanthus birmensis*, *Dicranodontium dennudatum*, *Grimmia unicolor*, *Plagiothecium succulentum*, *Racomitrium canescens*, and *Schistidium apocarpum* are found in this community.
V *Sanguisorba hakusanensis*, *Saussurea nivea*, and the Korean endemic *Thalictrum coreanum* are typical for moist rocks situated in deep canyons of the Kumgangsan Mountains. They should be recognised as different species with moist variants.
SE Steep, coarse-grained siliceous (granodiorites) rock faces with resistant veins of quartz are the typical habitats of the community. It occurs at altitudes of 150–890 m, with an optimum at 400–600 m, in variously oriented slopes with an inclination mostly between 60–120° (A76).
D This is a widespread endemic community in the Kumgangsan Mountains.
MI This is a community of natural habitats without human influence.
C In other mountain ranges, with lower suboceanic character, the association is substituted by the community Mukdenio rossii-Selaginelletum rossii. Especially in the Kumgangsan Mountains, the transitions between Patrinio-Mukdenietum and Mukdenio-Selaginelletum androsacetosum cortusaefoliae are frequent.

Mukdenio rossii-Selaginelletum rossii Kolbek, Valachovič & Jarolímek 1998
(Tab. 4: M)
NT Kolbek et al. (1998): Table 2, relevé 2
SM This is a two-layered, open and species-poor plant community which occurs on rock steps. *Selaginella rossii*

builds overhanging garlands and fosters the retention of water and humus. The average height of lower herbs is 25 cm, but some herbs may reach 80 cm. The cover of the herb and moss layers is 15–90 % (A50) and 0–95 % (A35), respectively. The number of species in the herb layer varies between 5 and 18 (A11). In the moss layer, *Barbula unguiculata*, *Bartramia pomiformis*, *Brachythecium buchananii*, *B. plumosum*, *Cephaloziella divaricata*, *Frullania *obscura*, *Herbertus aduncus*, *Herpetineuron toccotae*, *Herzogiella perrobusta*, *H. turfacea*, *Hylocomium splendens*, *Myuroclada maximowiczii*, *Oxystegus tenuirostris*, *Plagiochila trabeculata*, *Pohlia longicollis*, *Polytrichum alpinum*, *Radula* sp., and *Tritomaria exsecta* were recorded most frequently.

V Two subassociations are distinguished:

1. typicum Kolbek, Valachovič & Jarolímek 1998

2. androsacetosum cortusaefoliae Kolbek, Valachovič & Jarolímek 1998. The differential species of this subassociation (*Androsace cortusaefolia* and above all the very rare protected shrub *Pentactina rupicola*; Son et al. 2005) are endemic species of the Korean Peninsula.

SE The siliceous rocks supporting *Mukdenio-Selaginelletum* are predominantly north-facing and very steep (20–90°, A73). They are situated in deep, narrow valleys above streams at altitudes of 140–600 m. Thin trickles of water running along vertical fissures are typical for this habitat.

D This community is frequent in the Myohyangsan, Chonmasan, and Kumgangsan Mountains.

MI This is a natural community without direct human impact.

C This community is not known in the surrounding countries.

Dryopterido saxifragae-Saxifragetum fortunei Kolbek, Valachovič & Jarolímek 1998
(Tab. 4: N)

NT Kolbek et al. (1998): Table 3, relevé 7

SM This is a two-layered herb and moss plant community. The species-rich moss synusia covers (10–100 %, A65). The cover of the herb layer attains 10–75 % (A40); the average height of the herb layer ranges from 10–25 cm. The number of species varies between 2 and 14 (A8). The most important species is *Saxifraga fortunei*, which gives a conspicuous aspect during flowering time. Thanks to moist and shady conditions, sciophilous ferns are very frequent in the community. Among the mosses, the most frequent are *Barbula unguiculata*, *Brachythecium buchananii*, *Fissidens cristatus*, *Herzogiella perrobusta*, *H. turfacea*, *Lejeunea compacta*, *Racomitrium fasciculare*, *Thamnobryum sandei*, *Thuidium glaucinum*, and *T. kanedae*.

V *Saxifraga oblongifolia* is an indicator of high altitude (e.g. the subalpine belt in the Myohyangsan Mountains). Drier stands in montane and submontane belts, especially in the Sujangsan Mountains, are short of hygrophytes, such as *Mukdenia rossii*; more frequent are mesophilous plants, such as *Selaginella tamariscina*. The species *Gymnocarpium jessoense*, *Camptosorus sibiricus*, *Selaginella tamariscina*, *Deutzia prunifolia*, *Astilbe chinensis*, and *Weigela praecox* occur more frequently in some stands, but their differential value is questionable. No lower units were distinguished.

SE This community has been recorded on trickling rocky walls near waterfalls and springs, mainly on northern slopes with an inclination of (30)50–130° (A73). Permanent water spray is the specific ecological factor here. At higher altitudes, water spray is replaced by the condensation of fog. Both types of aerial moisture support the existence of a mostly hygrophilous rock-fissure community. Stands were found in a wide range of altitudes from 150 to 725 m (or 1300–1550 m, respectively).

D This community is frequently found in the Myohyangsan, Kumgangsan, Sujangsan, and Chonmasan Mountains.

MI This is a natural community without direct human impact.

C This community is not known in the surrounding countries.

Saxifraga fortunei-Boehmeria spicata community sensu Kolbek & Valachovič (1996)
(Tab. 4: O)

SM The dominant species are *Saxifraga fortunei*, the small shrub *Boehmeria spicata*, and *Selaginella rossii*. The number of species varies between 10 and 13 (A11). The cover of the herb layer fluctuates from 25 to 75 % (A45), whereas the cover of the moss layer is high at 70–80 % (A76).

V In a low number of relevés, no significant variability was observed.

SE The community is found on shaded and very moist granite walls at altitudes 140–200 m and on northwest-facing walls of deep canyons, mostly in the vicinity of waterfalls or streams with an inclination of 70–85° (A80). The high air humidity and almost permanent influence of the water spray correlate with the presence of a high number of typical species of wet rock habitats.

D This community is rare near the Pagion Waterfall in the Chonmasan Mountains.

MI This community occurs on old artificial walls with long succession and without recent human influence.

C This community is not known in the surrounding countries.

Selaginella stauntoniana community sensu Kolbek, Valachovič & Jarolímek (1998)
Only one relevé was recorded: exp. W, slope 80°, area 20 m^2, E_1 = 80 %, E_0 = 7 %, June 15, 1990.
E_1: *Selaginella stauntoniana* 5, *Mukdenia rossii* 1, *Carex duvalina* 1, *Lespedeza daurica* +, *Artemisia messer-*

schmidtiana +, *Diarrhena japonica* +, *Commelina communis* +, *Chrysanthemum* cf. *cinerariefolium* +, *Allium* sp. +, *Lactuca bungeana* r.
SE These stands grow on limestone rocky walls along the river.
D This community was observed near the Ponghari monument above the Taedonggang River southwest of Pyongyang.
C This community is not known in the surrounding countries.

Alpine tundra vegetation

CL Carici rupestris-Kobresietea bellardii Ohba 1974
OR Caricetalia tenuiformis Ohba 1968
ALL Phyllodocion nipponicae Miyawaki et al. 1968
High mountain alpine dwarf shrub tundra communities found on nutrient-rich substrata in Northeast Asia.

Dryado tschonoskii-Rhododendretum aurei Dostálek sen., Dostálek jr., Mucina & Hoang 1988
(Tab. 5)
NT Dostálek et al. (1988): Table 3, relevé 2
SM This is a subalpine and alpine dwarf shrub tundra community with dominant small shrubs and an open herb layer (5–80 %, A46). In the sampled relevés, 71 species of vascular plants were found in the range of (4)12–31 (A20). The thin moss layer covers 1–85 % (A30); only total cover of the moss layer was registered. The shrub layer is poorly developed (with only 5–30 % cover in some relevés). Low stands are 10–25 cm in height, rarely higher.
V The heterogeneity of the species composition is high: only 14 species belong to the V and IV constancy classes; however, the number of species in the I and II constancy classes reaches 54. Within the association, three subassociations, including two variants, are distinguished:
1. typicum Kolbek & Jarolímek 2007
2. erigeronetosum thunbergii Kolbek & Jarolímek 2007
3. papaveretosum radicatae Kolbek & Jarolímek 2007
   A. var. *Bistorta vivipara* sensu Kolbek & Jarolímek (2007)
   B. var. *Bistorta incana* sensu Kolbek & Jarolímek (2007)
SE The stands are situated at altitudes of 1920–2400 m on the southeastern slope of Mt. Paektusan under a strong wind impact. They are adapted to the short vegetation period from (the end of May) June to August (September) and the rough climate conditions. The Chinese meteorological station located near the caldera indicates a mean annual temperature of –7.4 °C and average precipi-

Table 5. Alpine tundra vegetation.

	Dryado tschonoskii-Rhododendretum aurei
Number of relevés	99
Average number of species	20
Dryado tschonoskii-Rhododendretum aurei	
*Festuca *koreano-alpina*	**99**$^{+4}$
Dryas tschonoskii	**90**$^{+4}$
Oxytropis anertii	**89**^{ra}
Zygadenus sibiricus	**79**^{r1}
Lloydia serotina	**56**^{ra}
Papaver radicatum	**54**^{r1}
Hedysarum alpinum	**23**^{r1}
Rhododendron confertissimum	**10**^{r3}
Phyllodocion nipponicae	
Potentilla nivea	**78**^{ra}
Tofieldia nuda	**76**^{ra}
Saxifraga laciniata	**72**$^{+a}$
Androsace capitata	**69**^{ra}
Bistorta incana	**53**^{r1}
Senecio kawakami	22^{r+}
Minuartia arctica	16^{r+}
Salix arctica	15^{r1}
Phyllodoce coerulea	**14**$^{+3}$
Gentiana jamesii	12ra
Caricetalia tenuiformis, Carici rupestris-Kobresietea bellardii	
Saussurea alpicola	**79**^{ra}
Carex rupestris	**78**$^{+b}$
Chrysanthemum zawadskii	**76**^{ra}
Bistorta vivipara	**51**$^{+1}$
Tilingia tachiroei	46^{r1}
Pedicularis verticillata	42^{r1}
Juniperus sibirica	29ra
Agrostis flaccida	22^{+a}
Luzula nipponica	22^{r1}
Aquilegia japonica	20^{r1}
*Erigeron *glabratus*	17^{r1}
Allium chinense	12^{r1}
Rhodiola rosea	11^{r1}
Other species	
Bupleurum euphorbioides	**84**^{r1}
Vaccinium vitis-idaea	**69**^{r3}
Vaccinium uliginosum	**65**$^{+4}$
Parnassia palustris	**58**^{r1}
Rhododendron aureum	**48**^{r4}
Larix olgensis	38ra
Orostachys malacophylla	31^{r1}
Adenophora tetraphylla	26^{r1}
T *Larix olgensis*	**17**^{13}
Number of accessoric species	34

tation of 1,346 mm (Qian 1992). The Korean climate station located near Lake Samjiyon indicates a mean annual temperature of –1.5 °C (min. –40.7 °C, max. 28.8 °C), mean annual precipitation of 842.5 mm, height of the snow cover of 43 cm, depth of the frozen soil of 150 cm and 57 % sunshine (personal comm. of Prof. Ch.-S. Kim). The climate station located at 1,400 m a.s.l., about 30 km from the caldera, indicates a mean annual temperature of 0.7 °C and a mean annual precipitation of 909 mm (Anonymous 1976). The unit occupies habitats on raw volcanic ash without a differentiated soil profile. This ash is of variable granularity and is often fluffy. Some parts of surface are not overgrown by plants. The recently formed humus layer is thin (maximally several centimetres thick). The more stable layer of litter in well-developed stands underlies the development of a more developed soil profile. The acidity of the soil ranges from pH 5.0 to 5.6 (Dostálek 1995).

D This community is common in the Changbaishan Mountains, on the slopes of the volcano Mt. Paektusan on the Korean side of the Korean-Chinese boundary.

MI Small areas of the stands are exposed to hiking activity. Other direct influences were not observed.

C These or similar communities have also been described from the Chinese side of the volcano, but mostly without phytocoenological relevés (Zhu & Rowe 1987); only the species composition was mentioned. Therefore, the correct comparison of these stands is impossible. Ohba (1974) has also described similar communities in Japan.

REF Miyawaki et al. (1969), Chang (1990), Chang et al. (1990, 1991, 1992, 1998), Šrůtek & Kolbek (1994), Okitsu (1996a), Choung (1998), Kil et al. (1998), Kim & Yun (1998), Lee et al. (1998), Yim & Shim (1998), Kong & Watts (1999)

Broad-leaved and mixed forests

CL Querco-Fagetea crenatae Miyawaki et al. 1968 em. Kim (1990) 1992 (Tab. 6: A–I)

Subclass Quercenea mongolicae Kim 1992

OR Rhododendro-Quercetalia mongolicae Kim 1992

ALL Pino koraiensis-Quercion mongolicae Kim 1990

Syn.: Rhododendro-Quercion mongolicae Song 1988 em. Takeda, Nakanishi & Choe 1994

These are mixed and deciduous oak forests occurring mainly at higher elevations in the central part of the Korean Peninsula. Similar continental forest formations are known from southern Manchuria and Primorye (eastern Siberia). They represent a natural connection between subalpine coniferous forests in the north and temperate broad-leaved forests in the south. Stands of these forests are typified by their higher abundance of various fern species, such as *Athyrium coreanum*, *Dryopteris crassirhizoma*, *Polystichum tripteron*, and frequent occurrence of conifers, *Abies nephrolepis* and most commonly *Pinus koraiensis*. Kim (1990, 1996) floristically characterised the alliance in South Korea. He also mentioned *Euonymus*, *Saussurea*, *Tilia*, and *Ligularia* as typical genera of this unit (all present also in relevés from North Korea). The tree and shrub layers very often contain trees of scree forests, such as various *Acer* and *Tilia* species, *Cornus controversa*, and *Magnolia sieboldii*. All these species differentiate this vegetation from the alliance Lindero-Quercion mongolicae, which comprises the associations occurring in the southern part of the Korean Peninsula, mainly at lower altitudes. The similar alliance Pino koraiensis-Abietion nephrolepidis described in the mountains of Sikhote-Alin by Gumarova (1993) has roughly the same floristic composition. The dominant trees there are also *Pinus koraiensis* and *Abies nephrolepis*, along with some species of *Acer* and *Euonymus*, and numerous ferns. Yim (1995) described the species composition and distribution of deciduous broad-leaved forests in Korea and divided them into five groups. Forest phytosociological data from this alliance were included to the survey of deciduous temperate forests published by Krestov et al. (2006). In North Korea, Li & Li (1986) published (Myohyangsan Mountains) communities of the class Pineto-Quercetea mongolicae, which occured at altitudes of (340)500–600(800) m and communities of the class Quercetea mongolicae at 600–800(1100) m.

In North Asia, Ermakov et al. (2000) desribed the class Querco mongolicae-Betuletea davuricae Ermakov & Petelin in Ermakov 1997 with some associations vicarious to North Korean broad-leaved forests. Forest ecosystems of East and Southeast Asia were generally described by Box et al. (1995).

Lychno-Quercetum mongolicae Kim 1990
(Tab. 6: A)

Syn.: Fraxino-Abietetum koreanae Song 1988

SM This association includes the mesic pine-oak mixed forests of montane belts. Stands are relatively open and light. The tree layer cover varies from 40 and 90 % (A68), the shrub layer from 15 and 80 % (A51) and the herb layer from 20 and 70 % (A41). The number of vascular plants varies between (16)23 and 53(86) (A41). Mosses occur scarcely [0–15(60) %, A5]. *Primula jezoana* and *Viola diamantica*, rare or Korean-endemic taxa, have a close affinity to this association. Some other species also seem to be weakly characteristic of this association, such as *Angelica gigas*, *Lychnis cognata*, *Pseudostellaria palibiniana*, and *Tripterygium regelii*. Some differential species delimited by Kim (1990), such as *Disporum ovale*, *Melampyrum roseum*, *Polygonatum *pluriflorum*, and *Smilax nipponica*, occur in North Korea in a somewhat different combination.

Table 6. Broad-leaved and mixed forests.
A – Lychno-Quercetum mongolicae; B – Vaccinio-Quercetum mongolicae; C – Parthenocisso-Fraxinetum rhynchophyllae; D – Festuco ovinae-Pinetum densiflorae; E – Saso-Quercetum mongolicae; F – Artemisio-Quercetum mongolicae; G – Syneilesio palmatae-Carpinetum laxiflorae; H – Lilio lancifolii-Rhododendretum schlippenbachii; I – *Indigofera kirilowii-Securinega suffruticosa* community

Community		A	B	C	D	E	F	G	H	I
Number of relevés		21	5	11	17	21	40	7	8	4
Average number of species		47	34	50	50	42	33	46	33	33
Lychno-Quercetum mongolicae										
T	*Betula schmidtii*	**62**$^{+3}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Astilbe thunbergii	**38**$^{+a}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*1*$^{++}$
	Schizandra chinensis	**24**$^{+a}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Viola diamantica	**24**$^{++}$	0$^{\cdot\cdot}$	9^{++}	0$^{\cdot\cdot}$	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Betula schmidtii*	**19**$^{+3}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{11}	8^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Actinidia polygama*	**19**$^{+a}$	0$^{\cdot\cdot}$	9^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Ligularia fischeri	**14**^{1a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Angelica gigas	**14**$^{+a}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{++}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Lychnis cognata	**10**^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Primula jezoana	**10**^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Pseudostellaria palibiniana	**5**^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Vaccinio-Quercetum mongolicae										
	Saussurea conandrifolia	5^{++}	**80**$^{+a}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	*Geranium *hirsutum*	0$^{\cdot\cdot}$	**60**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Tilia taquetii*	0$^{\cdot\cdot}$	**60**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Isodon japonicus	5^{11}	**40**$^{+1}$	9^{++}	6^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Halenia corniculata	0$^{\cdot\cdot}$	**40**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Lonicera chrysantha	0$^{\cdot\cdot}$	**40**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Duchesnea indica	0$^{\cdot\cdot}$	**40**$^{++}$	0$^{\cdot\cdot}$	6^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Acer barbinerve	0$^{\cdot\cdot}$	**40**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Sorbus amurensis*	0$^{\cdot\cdot}$	**40**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Caulophyllum robustum	10^{+1}	**40**$^{r+}$	0$^{\cdot\cdot}$	6^{rr}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Lonicera chrysantha*	0$^{\cdot\cdot}$	**20**$^{++}$	0$^{\cdot\cdot}$	12^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Tilia taquetii	0$^{\cdot\cdot}$	**20**$^{++}$	9^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Parthenocisso-Fraxinetum rhynchophyllae										
	Parthenocissus tricuspidata	10^{+1}	20^{++}	**73**$^{+a}$	29^{+a}	10^{++}	18ra	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Deutzia glabrata	0$^{\cdot\cdot}$	20^{11}	**45**$^{+a}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	3^{11}	0$^{\cdot\cdot}$	25^{++}	*0*$^{\cdot\cdot}$
S	*Staphylea bumalda*	5^{aa}	0$^{\cdot\cdot}$	**45**$^{+1}$	0$^{\cdot\cdot}$	5^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Sorbaria stellipila	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**45**$^{+1}$	0$^{\cdot\cdot}$	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Lactuca bungeana	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**45**$^{++}$	12^{++}	5^{++}	5^{+1}	14^{++}	50^{r+}	*0*$^{\cdot\cdot}$
S	*Deutzia glabrata*	5^{++}	0$^{\cdot\cdot}$	**36**$^{+a}$	0$^{\cdot\cdot}$	5^{11}	5^{11}	14^{11}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Sorbaria stellipila*	5^{++}	0$^{\cdot\cdot}$	**36**$^{+1}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Aster tataricus	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**36**$^{+1}$	0$^{\cdot\cdot}$	5^{++}	3^{++}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S	*Codonopsis pilosula*	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**18**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Rubia hexaphylla	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**18**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Hedera rhombea	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**18**$^{r+}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Festuco ovinae-Pinetum densiflorae										
	Atractylodes koreana	5^{rr}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**94**$^{+1}$	5^{++}	25^{r1}	14^{11}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Iris rossi	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**65**$^{+a}$	0$^{\cdot\cdot}$	8^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Sophora flavescens	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**65**^{r1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Saussurea eriophylla	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**59**$^{+1}$	0$^{\cdot\cdot}$	15ra	14^{rr}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Clematis mandshurica	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**53**^{r1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Polystichum polyblepharon	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**47**$^{+1}$	0$^{\cdot\cdot}$	8^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Potentilla fragarioides	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**47**^{r1}	19^{r+}	23^{+1}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	*Lilium *partheneion*	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**41**$^{+1}$	0$^{\cdot\cdot}$	5^{r+}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Asparagus oligoclonus	5^{++}	0$^{\cdot\cdot}$	9^{rr}	**41**$^{++}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
	Prunus nakaii	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**29**$^{+1}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$

Table 6. cont.

Community	A	B	C	D	E	F	G	H	I
Number of relevés	21	5	11	17	21	40	7	8	4
Prunella asiatica	0··	0··	0··	**29**$^{+1}$	0··	0··	0··	0··	*0*··
Stipa extremiorientalis	0··	0··	0··	**24**$^{+a}$	0··	3^{++}	0··	0··	*0*··
Artemisia japonica	0··	0··	0··	**24**$^{+1}$	0··	10^{+1}	0··	0··	*0*··
Platycodon grandiflorus	0··	0··	0··	**24**$^{+1}$	0··	13^{r+}	0··	13^{++}	*0*··
*Rubia *pratensis*	0··	0··	0··	**24**^{r1}	0··	0··	0··	0··	*0*··
Rhaponticum uniflorum	0··	0··	0··	**24**$^{r+}$	0··	0··	0··	0··	*0*··
Stevenia axillaris	0··	0··	0··	**24**$^{r+}$	0··	0··	0··	0··	*0*··
Festuca ovina	0··	0··	0··	**18**$^{+a}$	0··	3^{++}	0··	0··	*0*··
Lespedeza daurica	0··	0··	0··	**18**$^{++}$	0··	0··	0··	0··	*0*··
Patrinia villosa	0··	0··	0··	**18**$^{++}$	0··	13^{++}	0··	0··	*0*··
S *Prunus nakaii*	0··	0··	0··	**12**^{1a}	0··	0··	0··	0··	*0*··
S *Lespedeza daurica*	0··	0··	0··	**6**$^{++}$	0··	0··	0··	0··	*0*··
Saso-Quercetum mongolicae									
*Sasamorpha *borealis*	0··	0··	0··	0··	**62**^{14}	0··	0··	0··	*0*··
T *Quercus serrata*	5^{11}	0··	0··	0··	**62**$^{+4}$	8^{r1}	0··	0··	*0*··
S *Callicarpa dichotoma*	10^{r+}	0··	0··	0··	**57**$^{+1}$	5^{++}	14^{++}	0··	*0*··
T *Quercus variabilis*	0··	0··	0··	0··	**48**^{14}	**20**^{r3}	0··	0··	*0*··
Quercus serrata	0··	0··	0··	0··	**33**^{r1}	8^{+1}	14^{rr}	0··	*0*··
Callicarpa dichotoma	5^{++}	0··	0··	0··	**14**$^{++}$	0··	0··	0··	*1*$^{++}$
Artemisio-Quercetum mongolicae									
Pteridium aquilinum	0··	0··	0··	0··	5^{11}	**28**^{ra}	0··	0··	*0*··
Syneilesio palmatae-Carpinetum laxiflorae									
T *Carpinus laxiflora*	**14**^{a3}	0··	0··	0··	**29**$^{+3}$	10^{+a}	**100**^{15}	0··	*0*··
S *Carpinus laxiflora*	14^{r1}	0··	0··	0··	33^{+a}	8^{+1}	**100**$^{+3}$	0··	*0*··
Carpinus laxiflora	10^{+1}	0··	0··	0··	10^{++}	5^{++}	**57**$^{+1}$	0··	*0*··
Disporum smilacinum	0··	0··	0··	0··	19^{+1}	5^{+a}	**43**$^{+a}$	0··	*0*··
T *Castanea crenata*	10^{+a}	0··	**18**^{13}	12^{+1}	5^{aa}	**5**^{a4}	**43**$^{+a}$	0··	*0*··
S *Viburnum wrightii*	0··	0··	0··	0··	5^{11}	0··	**43**$^{++}$	0··	*0*··
Corylus mandshurica	0··	0··	0··	0··	0··	0··	**43**$^{++}$	0··	*0*··
Asperula maximowiczii	0··	0··	9^{++}	6^{++}	10^{++}	8^{++}	**43**$^{++}$	0··	*0*··
Castanea crenata	0··	0··	0··	18^{++}	0··	3^{rr}	**43**$^{r+}$	0··	*0*··
Thalictrum coreanum	0··	0··	0··	0··	0··	3^{++}	**29**^{ma}	0··	*0*··
S *Corylus mandshurica*	5^{++}	0··	0··	0··	0··	0··	**29**$^{+1}$	0··	*0*··
Galium trifloriforme	0··	0··	0··	0··	0··	0··	**29**$^{++}$	0··	*0*··
Viburnum wrightii	0··	0··	0··	0··	5^{++}	3^{++}	**29**$^{++}$	0··	*0*··
Osmunda claytoniana	0··	0··	0··	0··	0··	0··	**29**$^{++}$	0··	*0*··
Smilax nipponica	5^{++}	0··	0··	6^{++}	10^{++}	3^{11}	**29**$^{++}$	0··	*0*··
Lilio lancifolii-Rhododendretum schlippenbachii									
Polygonatum humile	0··	0··	0··	0··	0··	8^{++}	0··	**100**$^{++}$	*0*··
Vaccinium koreanum	10^{+a}	40^{+a}	0··	0··	14^{+1}	**18**^{13}	0··	**88**$^{+3}$	*0*··
S *Lespedeza bicolor*	10^{+1}	20^{11}	36^{+a}	0··	10^{++}	28^{+b}	29^{+1}	**88**$^{+a}$	*0*··
Lespedeza bicolor	0··	40^{++}	45^{+a}	35^{+1}	5^{++}	20^{+1}	29^{++}	**88**$^{+m}$	*0*··
Lilium lancifolium	0··	0··	0··	18^{+1}	0··	8^{r+}	0··	**88**^{r1}	*0*··
Hemerocallis minor	0··	0··	9^{++}	24^{+1}	5^{rr}	10^{r+}	0··	**88**$^{+1}$	*0*··
Chrysanthemum coreanum	5^{11}	0··	0··	0··	0··	3^{++}	0··	**75**$^{+1}$	*0*··
Asplenium sarelii	0··	0··	0··	0··	0··	0··	0··	**63**$^{+1}$	*0*··
S *Vaccinium koreanum*	10^{+1}	0··	0··	0··	5^{11}	8^{+a}	0··	**50**$^{+a}$	*0*··
Potentilla dickinsii	5^{11}	0··	0··	0··	0··	8^{+1}	0··	**38**$^{++}$	*0*··
Sedum polytrichoides	0··	0··	0··	0··	0··	10^{r+}	0··	**38**$^{r+}$	*0*··
Selaginella helvetica	0··	0··	0··	0··	0··	0··	0··	**25**^{11}	*0*··

Table 6. cont.

	Community	A	B	C	D	E	F	G	H	I
	Number of relevés	21	5	11	17	21	40	7	8	4
	***Indigofera kirilowii-Securinega suffruticosa* community**									
S	*Securinega suffruticosa*	0··	0··	0··	0··	0··	3++	0··	0··	**4**1b
	Miscanthus sinensis	0··	0··	9++	**53**+a	0··	33+a	0··	0··	**4**+m
	Aster ageratoides	0··	0··	9++	0··	5++	5r+	0··	0··	**4**+1
	Rubus crataegifolius	38ra	2011	36+1	0··	14+1	8+1	29++	0··	**4**+1
	Smilax sieboldii	14r+	0··	27+1	24+a	511	8++	0··	0··	**4**r+
	Paraixeris denticulata	10r+	0··	0··	12++	5rr	15r+	14++	0··	**3**++
S	*Rosa multiflora*	0··	0··	0··	12++	5++	0··	0··	0··	**2**a3
S	*Ligusticum obtusifolium*	0··	0··	0··	6++	0··	5r1	0··	0··	**2**a3
	Boehmeria spicata	0··	0··	911	0··	0··	0··	0··	0··	**2**+1
	Chrysanthemum lavandulaefolium	0··	0··	0··	0··	0··	0··	0··	0··	**2**++
	Pino koraiensis-Quercion mongolicae									
	Athyrium coreanum	**48**rm	**20**++	**45**+a	0··	24++	3++	29+1	0··	*0*··
T	*Pinus koraiensis*	**38**+4	**40**++	**9**44	0··	0··	0··	0··	0··	*0*··
S	*Magnolia sieboldii*	**38**+a	**60**r+	**45**+a	0··	33+a	0··	14++	0··	*0*··
	Dryopteris crassirhizoma	**33**+a	**20**++	**45**+a	0··	0··	311	0··	0··	*0*··
	Viola collina	**33**++	**60**++	**36**+1	12++	5++	0··	0··	0··	*0*··
T	*Magnolia sieboldii*	**29**+a	**0**··	**9**11	0··	511	3aa	1411	0··	*0*··
S	*Pinus koraiensis*	**24**r1	**80**+1	**9**++	0··	10++	3++	0··	0··	*0*··
	Pinus koraiensis	**24**++	**60**r+	**0**··	0··	10r+	3++	0··	0··	*0*··
T	*Cornus controversa*	**19**+a	**20**11	**45**r1	0··	5aa	0··	0··	0··	*0*··
	Actinidia polygama	**19**+a	**40**++	**18**11	0··	0··	0··	0··	0··	*0*··
	Bupleurum longeradiatum	**19**ra	**40**++	**0**··	0··	0··	0··	0··	0··	*0*··
	Magnolia sieboldii	**19**+1	**20**++	**18**r+	6rr	5++	5+1	0··	0··	*0*··
S	*Cornus controversa*	**19**+1	**0**··	**27**+1	0··	511	0··	0··	0··	*0*··
	Diarrhena japonica	**19**r1	**60**++	**64**+1	0··	10rr	5+1	14++	0··	*0*··
S	*Acer tschonoskii*	**14**+a	**0**··	**0**··	0··	0··	0··	0··	0··	*0*··
S	*Acer tegmentosum*	**14**+1	**0**··	**45**++	0··	0··	0··	0··	0··	*0*··
	Campanula punctata	**14**++	**20**11	**27**r+	0··	0··	0··	0··	0··	*0*··
T	*Acer tegmentosum*	**10**1a	**0**··	**0**··	0··	0··	0··	0··	0··	*0*··
	Aconitum triphyllum	**10**1m	**20**++	**36**r1	0··	0··	0··	0··	0··	2++
S	*Acer triflorum*	**10**+1	**20**++	**9**++	0··	0··	0··	0··	0··	*0*··
	Acer tegmentosum	**10**r1	**0**··	**18**++	0··	0··	0··	0··	0··	*0*··
T	*Acer triflorum*	**5**11	**0**··	**9**11	0··	0··	0··	0··	0··	*0*··
	Cornus controversa	**5**++	**0**··	**9**++	0··	0··	0··	0··	0··	*0*··
	Pedicularis resupinata	**5**++	**0**··	**9**++	0··	0··	3++	0··	0··	*0*··
	Acer tschonoskii	**5**++	**0**··	**0**··	0··	0··	0··	0··	0··	*0*··
	Acer triflorum	**5**++	**0**··	**0**··	0··	0··	0··	0··	0··	*0*··
	Abies holophylla	**5**++	**0**··	**0**··	0··	0··	3++	0··	0··	*0*··
T	*Abies nephrolepis*	**0**··	**20**11	**9**++	0··	0··	0··	0··	0··	*0*··
T	*Betula ermanii*	**0**··	**20**11	**0**··	0··	0··	0··	0··	0··	*0*··
S	*Acer ukurundense*	**0**··	**20**++	**9**rr	0··	0··	0··	0··	0··	*0*··
S	*Abies nephrolepis*	**0**··	**20**++	**0**··	0··	0··	0··	0··	0··	*0*··
	Rhododendro mucronulati-Pinion densiflorae									
S	*Juniperus rigida*	10r+	0··	0··	**88**ra	0··	40ra	0··	**63**+1	2++
	Meehania urticifolia	14aa	0··	0··	**65**+a	511	0··	0··	0··	2r+
	Juniperus rigida	0··	0··	0··	**53**r1	0··	5++	0··	**63**+1	*0*··
	Hieracium umbellatum	0··	0··	0··	**24**r1	0··	0··	0··	0··	*0*··
	Leibnitzia anandria	0··	0··	9++	**18**+1	0··	0··	0··	0··	*0*··
	Lindero-Quercion mongolicae									
S	*Lespedeza maximowiczii*	24+a	0··	0··	0··	**86**+3	**33**ra	**0**··	0··	*0*··

Table 6. cont.

Community	A	B	C	D	E	F	G	H	I
Number of relevés	21	5	11	17	21	40	7	8	4
Lespedeza maximowiczii	5[11]	0[··]	9[++]	12[++]	**62[+1]**	**28[+a]**	**43[+1]**	0[··]	*0*[··]
Syneilesis palmata	10[1a]	0[··]	0[··]	12[r1]	**52[ra]**	**15[+a]**	**57[+1]**	38[++]	*0*[··]
S *Solenolantana carlesii*	5[11]	0[··]	0[··]	0[··]	**19[++]**	**3[rr]**	**14[rr]**	0[··]	*0*[··]
Codonopsis lanceolata	5[++]	0[··]	0[··]	0[··]	**19[r+]**	**3[rr]**	**0**[··]	0[··]	*1*[++]
T *Quercus Mc-cormickii*	0[··]	0[··]	0[··]	0[··]	**14[1a]**	**3[11]**	**0**[··]	0[··]	*0*[··]
S *Quercus variabilis*	0[··]	0[··]	0[··]	0[··]	**10[1a]**	**20[13]**	**14[aa]**	0[··]	*1*[rr]
S *Quercus serrata*	5[++]	0[··]	0[··]	0[··]	**14[+1]**	**15[+a]**	**0**[··]	0[··]	*0*[··]
Quercus variabilis	0[··]	0[··]	0[··]	0[··]	**14[+1]**	**15[r1]**	**29[++]**	0[··]	*0*[··]
S *Rhus javanica*	0[··]	0[··]	0[··]	0[··]	**14[+1]**	**18[r1]**	**14[rr]**	0[··]	*3*[+1]
S *Rhus verniciflura*	0[··]	0[··]	0[··]	0[··]	**10[++]**	**10[+a]**	**0**[··]	0[··]	*0*[··]
S *Quercus Mc-cormickii*	0[··]	0[··]	0[··]	0[··]	**10[++]**	**5[+1]**	**0**[··]	0[··]	*0*[··]
Oplismenus undulatifolius	10[aa]	0[··]	0[··]	0[··]	**10[++]**	**3[rr]**	**14[++]**	0[··]	*0*[··]
T *Rhus javanica*	0[··]	0[··]	0[··]	0[··]	**5[11]**	**3[++]**	**0**[··]	0[··]	*0*[··]
S *Codonopsis lanceolata*	0[··]	0[··]	0[··]	0[··]	**5[++]**	**0**[··]	**0**[··]	0[··]	*0*[··]
Rhus javanica	0[··]	0[··]	0[··]	0[··]	**5[++]**	**13[++]**	**0**[··]	0[··]	*0*[··]
Solenolantana carlesii	0[··]	0[··]	0[··]	0[··]	**5[++]**	**3[rr]**	**0**[··]	0[··]	*0*[··]
Quercus Mc-cormickii	0[··]	0[··]	0[··]	0[··]	**5[++]**	**0**[··]	**0**[··]	0[··]	*0*[··]
Weigelo floridae-Fagarion schinifoliae									
Atractylodes ovata	5[++]	0[··]	0[··]	0[··]	19[+1]	33[+1]	14[++]	**100[+1]**	*1*[++]
S *Fagara schinifolia*	5[++]	20[11]	18[++]	24[13]	5[++]	23[+a]	29[+1]	**88[+a]**	*4*[+a]
S *Weigela florida*	29[+1]	0[··]	9[++]	0[··]	29[++]	**18[r3]**	**57[++]**	**88[+1]**	*4*[13]
Weigela florida	5[11]	20[++]	9[11]	0[··]	0[··]	3[rr]	29[++]	**38[++]**	*0*[··]
S *Indigofera kirilowii*	0[··]	0[··]	0[··]	12[++]	0[··]	8[+a]	0[··]	0[··]	*4*[1a]
Rhododendro-Quercetalia mongolicae									
S *Acer pseudosieboldianum*	**95[+3]**	**100[m3]**	**91[a3]**	0[··]	**100[+3]**	40[ra]	**86[+3]**	**88[+1]**	*1*[11]
T *Quercus mongolica*	**86[+5]**	**100[45]**	**73[+3]**	**53[a3]**	**76[15]**	**55[+4]**	**100[a4]**	0[··]	*0*[··]
T *Acer pseudosieboldianum*	**81[+3]**	0[··]	18[1a]	0[··]	**57[+3]**	**10[13]**	29[++]	0[··]	*0*[··]
Isodon excisus	**62[+a]**	0[··]	0[··]	0[··]	33[r1]	5[r+]	0[··]	0[··]	*2*[+1]
Acer pseudosieboldianum	**62[+a]**	**80[+1]**	**82[1b]**	0[··]	**67[+a]**	25[ra]	**57[+1]**	38[+1]	*0*[··]
S *Fraxinus rhynchophylla*	**57[+a]**	0[··]	45[+a]	**59[r1]**	**57[+1]**	38[+m]	**71[+1]**	25[++]	*2*[+1]
S *Quercus mongolica*	**57[r1]**	**60[++]**	**73[+1]**	**76[+3]**	38[+a]	**80[+3]**	**86[+a]**	**100[a3]**	*1*[++]
Fraxinus rhynchophylla	**52[+a]**	**80[r1]**	**73[+1]**	**59[+1]**	33[r1]	35[rb]	**71[++]**	38[+1]	*1*[++]
Vitis amurensis	**52[r1]**	0[··]	36[r1]	**59[r1]**	48[rm]	8[r+]	43[+1]	0[··]	*2*[+m]
S *Rhododendron schlippenbachii*	48[+a]	**100[+4]**	18[1m]	0[··]	**67[+3]**	**58[r3]**	**100[13]**	**100[13]**	*0*[··]
Ainsliaea acerifolia	**38[+3]**	**60[b3]**	18[+a]	0[··]	**71[+a]**	8[r1]	0[··]	0[··]	*0*[··]
S *Rhododendron mucronulatum*	**38[r3]**	20[++]	18[+1]	**71[13]**	38[+a]	**88[+4]**	**100[1a]**	**100[a3]**	*1*[++]
S *Styrax obassia*	38[ra]	0[··]	**64[+a]**	12[+1]	**86[+3]**	25[ra]	43[++]	0[··]	*0*[··]
Hepatica asiatica	33[1a]	40[++]	9[aa]	0[··]	10[r1]	5[+1]	43[+1]	0[··]	*0*[··]
T *Prunus leveilleana*	33[+a]	20[++]	18[11]	6[++]	29[+a]	13[+1]	14[++]	0[··]	*0*[··]
Carex lanceolata	33[+a]	0[··]	36[+1]	**82[+a]**	**76[+a]**	**70[+3]**	**86[+1]**	0[··]	*1*[++]
Melampyrum roseum	33[+a]	**100[+a]**	18[++]	6[++]	33[ra]	**63[r3]**	**57[+1]**	25[++]	*0*[··]
S *Tilia amurensis*	33[+a]	0[··]	0[··]	0[··]	19[+1]	0[··]	0[··]	0[··]	*0*[··]
S *Benzoin obtusilobum*	**29[13]**	0[··]	0[··]	**53[+a]**	**100[1a]**	25[+b]	**71[1a]**	0[··]	*3*[+a]
T *Fraxinus rhynchophylla*	29[+a]	0[··]	**64[14]**	12[++]	33[+a]	10[+1]	14[++]	0[··]	*0*[··]
T *Styrax obassia*	29[+a]	0[··]	0[··]	0[··]	**38[+3]**	3[rr]	14[++]	0[··]	*0*[··]
Quercus mongolica	29[+1]	**60[++]**	**82[+1]**	**76[+b]**	38[+1]	**55[+a]**	43[++]	**63[+1]**	*0*[··]
S *Corylus heterophylla*	29[+1]	0[··]	27[ra]	41[+b]	19[+1]	**23[r3]**	29[+a]	0[··]	*0*[··]
T *Tilia amurensis*	29[+1]	0[··]	0[··]	0[··]	0[··]	3[++]	0[··]	0[··]	*0*[··]
S *Stephanandra incisa*	**24[+3]**	0[··]	27[+b]	6[++]	**71[+a]**	25[ra]	**86[+a]**	0[··]	*3*[+4]
Benzoin obtusilobum	24[+a]	0[··]	9[++]	47[ra]	**81[+a]**	30[ra]	**100[+1]**	38[++]	*0*[··]
S *Maackia amurensis*	24[+1]	0[··]	0[··]	41[+1]	24[++]	10[++]	0[··]	0[··]	*0*[··]

Table 6. cont.

Community	A	B	C	D	E	F	G	H	I
Number of relevés	21	5	11	17	21	40	7	8	4
Maackia amurensis	24^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{+1}	10^{++}	10^{+1}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Palura paniculata*	24^{++}	20^{++}	0$^{\cdot\cdot}$	24^{+1}	43^{+a}	8^{+1}	43^{11}	0$^{\cdot\cdot}$	*1*^{11}
S *Aralia elata*	24^{r+}	0$^{\cdot\cdot}$	27^{r1}	6^{rr}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*2*$^{++}$
Astilbe koreana	19^{+a}	40^{++}	**55**$^{++}$	18^{+a}	29^{+a}	10^{r+}	29^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Micromeles alnifolia*	19^{+1}	40^{++}	36^{11}	35^{+a}	33^{+1}	28^{+b}	**57**$^{+1}$	**88**$^{+1}$	*1*$^{++}$
T *Pinus densiflora*	**14**^{13}	20^{++}	73^{14}	**100**^{a4}	**71**^{ra}	**93**^{r4}	**71**$^{+a}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Prunus leveilleana*	14^{+1}	0$^{\cdot\cdot}$	45^{r1}	**53**$^{+1}$	24^{+1}	20^{rb}	14^{11}	13^{11}	*0*$^{\cdot\cdot}$
Tripterygium regelii	14^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Vitis amurensis*	14^{r1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{+a}	14^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Corylus *thunbergii*	14^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{++}	13ra	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*1*$^{++}$
Styrax obassia	14^{++}	0$^{\cdot\cdot}$	45^{+a}	12^{rr}	38^{+1}	20^{+1}	**57**$^{r+}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Rhus trichocarpa*	14^{r+}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	12^{11}	48^{++}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
T *Tilia mandshurica*	10^{aa}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	10^{+1}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Tilia mandshurica*	10^{+a}	0$^{\cdot\cdot}$	9^{++}	0$^{\cdot\cdot}$	5^{++}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Tripterigium regelii*	10^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	19^{+a}	3^{aa}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Rhododendron schlippenbachii	5^{11}	**100**$^{+a}$	9^{11}	0$^{\cdot\cdot}$	24^{+1}	35^{+a}	**71**$^{+1}$	**88**$^{+1}$	*1*$^{++}$
T *Maackia amurensis*	5^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	29^{11}	10^{+1}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Prunus leveilleana	5^{11}	0$^{\cdot\cdot}$	45^{r+}	12^{++}	5^{rr}	5^{++}	29^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Corylus heterophylla	5^{++}	0$^{\cdot\cdot}$	18^{r1}	12^{+a}	5^{11}	10ra	14^{++}	0$^{\cdot\cdot}$	*1*$^{++}$
Pinus densiflora	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	41^{r1}	24^{r+}	30^{r1}	43^{r+}	**75**$^{+1}$	*1*^{rr}
T *Micromeles alnifolia*	5^{++}	40^{+1}	**36**^{a4}	0$^{\cdot\cdot}$	10^{+a}	23^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Pinus densiflora*	5^{++}	20^{rr}	9^{++}	35^{+a}	10^{+1}	**60**$^{+4}$	0$^{\cdot\cdot}$	**88**^{14}	*1*^{rr}
Hosta longipes	5^{++}	20^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	14^{+m}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Hosta sieboldiana	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Tilia mandshurica	5^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Stephanandra incisa	5^{rr}	20^{++}	36^{+a}	6^{rr}	29^{+1}	5^{++}	**57**$^{+1}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Carex nanella	0$^{\cdot\cdot}$	**60**$^{+1}$	36^{+1}	**6**^{33}	0$^{\cdot\cdot}$	13^{+a}	14^{++}	**100**^{1a}	*0*$^{\cdot\cdot}$
Euonymus alata	0$^{\cdot\cdot}$	**60**$^{++}$	**64**$^{+1}$	24^{+1}	0$^{\cdot\cdot}$	8^{++}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Euonymus alata*	0$^{\cdot\cdot}$	20^{++}	9^{11}	47^{r1}	0$^{\cdot\cdot}$	10^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Rhododendron mucronulatum	0$^{\cdot\cdot}$	20^{++}	18^{r+}	**47**$^{+3}$	5^{++}	38^{+a}	**71**$^{+1}$	**88**$^{+1}$	*0*$^{\cdot\cdot}$
Aralia elata	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	27^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Fagara schinifolia	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	27^{++}	**82**$^{+1}$	5^{++}	10^{+1}	14^{rr}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Micromeles alnifolia	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{r1}	12^{+1}	5^{++}	8^{++}	14^{++}	13^{++}	*0*$^{\cdot\cdot}$
Indigofera kirilowii	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	**76**$^{+a}$	0$^{\cdot\cdot}$	15^{+1}	29^{r+}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Rhus trichocarpa	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{++}	10^{++}	8^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Palura paniculata	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{r+}	14^{r+}	3^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Tilia amurensis	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	5^{rr}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Querco-Fagetea crenatae									
Carex siderosticta	**81**$^{+a}$	**100**^{1b}	**73**$^{+1}$	29^{+a}	**62**$^{+a}$	40^{+a}	**100**^{ma}	**75**^{1a}	*0*$^{\cdot\cdot}$
Aster scaber	**62**$^{+1}$	**60**$^{++}$	36^{+1}	**53**$^{+1}$	**62**^{rm}	33^{+1}	**86**$^{r+}$	13^{++}	*1*$^{++}$
S *Acer mono*	**57**$^{+a}$	20^{++}	**100**$^{+a}$	6^{++}	33^{+m}	8^{++}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
T *Acer mono*	**43**$^{+3}$	0$^{\cdot\cdot}$	18^{11}	0$^{\cdot\cdot}$	33^{+a}	5^{++}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Acer mono	43^{+1}	0$^{\cdot\cdot}$	**73**^{r1}	6^{rr}	10^{+a}	8^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Euonymus oxyphylla*	38ra	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	6^{11}	29^{+1}	8ra	29^{r1}	0$^{\cdot\cdot}$	*1*$^{++}$
T *Carpinus cordata*	**33**^{13}	0$^{\cdot\cdot}$	9^{11}	0$^{\cdot\cdot}$	**19**$^{+4}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Carpinus cordata*	29^{+a}	20^{11}	9^{++}	0$^{\cdot\cdot}$	14^{+a}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
T *Actinidia arguta*	29^{+1}	0$^{\cdot\cdot}$	**18**^{a3}	0$^{\cdot\cdot}$	14^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Asarum heterotropoides	29^{++}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	18^{r+}	5^{++}	8^{r1}	43^{+1}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
T *Kalopanax pictus*	19^{+1}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	19^{+a}	3^{11}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
Viola keiskei	19^{++}	**60**$^{+1}$	27^{+1}	0$^{\cdot\cdot}$	19^{+b}	18^{+a}	43^{+1}	25^{++}	*1*$^{++}$
Kalopanax pictus	19^{++}	0$^{\cdot\cdot}$	18^{+1}	6^{rr}	10^{r+}	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$
S *Kalopanax pictus*	19^{r+}	0$^{\cdot\cdot}$	9^{++}	6^{++}	24^{++}	5^{+1}	14^{++}	0$^{\cdot\cdot}$	*0*$^{\cdot\cdot}$

Table 6. cont.

	Community	A	B	C	D	E	F	G	H	I
	Number of relevés	21	5	11	17	21	40	7	8	4
	Carpinus cordata	14++	0..	0..	0..	5++	0..	0..	0..	0..
	Actaea asiatica	101a	0..	0..	0..	0..	0..	0..	0..	0..
S	*Actinidia kolomicta*	10++	0..	911	0..	511	0..	0..	0..	0..
	Paris verticillata	10r+	0..	0..	0..	0..	3++	0..	0..	0..
	Euonymus oxyphylla	10rr	0..	0..	611	19++	0..	29r+	0..	0..
S	*Actinidia arguta*	5++	0..	2713	0..	14+1	0..	0..	0..	2+1
	Actinidia kolomicta	5++	0..	18+1	0..	0..	0..	0..	0..	0..
	Smilacina japonica	0..	0..	45+1	6rr	5++	0..	0..	0..	0..
	Actinidia arguta	0..	0..	36+a	0..	511	311	0..	0..	0..
	Pyrola japonica	0..	0..	27r1	12r+	14r+	18+1	43++	0..	0..
S	*Quercus acutissima*	0..	0..	18++	24+1	10+1	8+a	0..	0..	0..
	Athyrium yokoscense	0..	0..	18++	0..	5++	3++	1411	0..	0..
T	*Quercus dentata*	0..	0..	9aa	**47+3**	0..	**1313**	14++	0..	0..
S	*Quercus dentata*	0..	0..	9++	**53+3**	0..	**30+4**	0..	0..	0..
	Quercus dentata	0..	0..	9++	**53+a**	0..	18rm	14++	0..	1++
T	*Quercus acutissima*	0..	0..	0..	**35+3**	**1413**	511	0..	0..	0..
	Quercus acutissima	0..	0..	0..	35r1	0..	5+1	0..	0..	0..
T	*Carpinus coreana*	0..	0..	0..	0..	**14a3**	0..	0..	0..	0..
S	*Carpinus coreana*	0..	0..	0..	0..	10+a	0..	0..	0..	0..
	Carpinus coreana	0..	0..	0..	0..	5++	0..	0..	0..	0..
	Athyrium vidalii	0..	0..	0..	0..	0..	0..	1411	0..	0..
	Other species									
	Artemisia keiskeana	**52+a**	**80+1**	18+1	**47+3**	43r1	**75+a**	**86ra**	**100+m**	0..
	Solidago virga-aurea	**52+a**	0..	1811	0..	0..	0..	0..	0..	0..
	Dryopteris sp.	38+a	0..	0..	0..	5++	5++	0..	0..	1++
S	*Lespedeza hedysaroides*	**33+3**	0..	0..	0..	33+a	**38+3**	1411	0..	1aa
	Calamagrostis arundinacea	**33+3**	0..	0..	6++	29r1	28+a	29r+	0..	1++
	Cardamine leucantha	29+a	0..	45+b	0..	0..	0..	0..	0..	0..
	Spodiopogon sibiricus	**24+3**	0..	911	**9413**	43+1	**78+a**	**86++**	**100+a**	**3+a**
S	*Rubus crataegifolius*	24r1	0..	0..	0..	14r+	5++	0..	0..	0..
S	*Euonymus pauciflora*	24r1	0..	0..	0..	5++	0..	0..	0..	0..
S	*Rhamnus davurica*	24++	0..	9++	0..	33+a	15+1	0..	0..	1..
	Rubia chinensis	24++	0..	0..	0..	5++	3++	0..	0..	0..
	Viola acuminata	**19+3**	0..	45+1	18++	5rr	0..	0..	0..	0..
S	*Betula schmidtii*	**19+3**	0..	0..	0..	511	8+1	0..	0..	0..
	*Polygonatum *pluriflorum*	19r1	0..	0..	0..	511	8+1	0..	0..	0..
	Dioscorea quinqueloba	19r+	0..	36r1	0..	0..	5++	0..	0..	0..
S	*Pueraria lobata*	14+1	0..	18++	1211	0..	8aa	0..	0..	0..
	Lespedeza cyrtobotrya	14++	0..	0..	24++	0..	18+a	1411	0..	0..
	Viola chaerophylloides	14++	0..	27+1	0..	19r1	3++	0..	0..	0..
	Lepisorus ussuriensis	14r+	0..	18r1	6++	5++	8++	0..	0..	0..
	Sanicula chinensis	14r+	0..	36++	6rr	0..	0..	0..	0..	0..
	Rubia cordifolia agg.	1011	0..	18+1	35r+	5++	0..	0..	0..	1++
S	*Lonicera praeflorens*	10+1	0..	0..	24+1	5++	3++	0..	0..	0..
	Smilax sp.	10++	0..	0..	0..	19r+	8r1	14++	0..	0..
	Dryopteris subtripinnata	10++	0..	0..	0..	5++	0..	29+1	0..	0..
S	*Deutzia prunifolia*	10r+	0..	9aa	1211	5++	**25+3**	0..	0..	0..
S	*Viburnum dilatatum*	511	0..	0..	0..	19+1	5+1	14rr	0..	0..
	Lysimachia clethroides	5++	0..	18+1	**65+1**	33+1	23ra	29++	0..	2++
	Peucedanum terebintaceum	5++	**60+1**	9++	47+1	0..	28r+	29r+	50+1	0..
	Deutzia prunifolia	5++	0..	0..	12++	0..	15+1	0..	0..	0..
S	*Morus mongolica*	5++	0..	27++	0..	5++	0..	0..	0..	0..

Table 6. cont.

Community		A	B	C	D	E	F	G	H	I
Number of relevés		21	5	11	17	21	40	7	8	4
S	*Ligustrina reticulata*	5^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	5^{++}	$0^{\cdot\cdot}$	29^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Lonicera praeflorens	5^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	29^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Liparis krameri	5^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	3^{++}	29^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Solidago japonica	$0^{\cdot\cdot}$	**80^{++}**	36^{+1}	12^{++}	10^{++}	28^{+1}	**86^{+1}**	13^{++}	1^{rr}
	Smilax china	$0^{\cdot\cdot}$	40^{++}	9^{11}	12^{+1}	$0^{\cdot\cdot}$	15^{ra}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Syringa palibiniana	$0^{\cdot\cdot}$	40^{++}	18^{+1}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
T	*Populus davidiana*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**27^{13}**	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Agrimonia pilosa	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	27^{++}	18^{+a}	10^{++}	3^{++}	29^{++}	**75^{r+}**	$0^{\cdot\cdot}$
	Ligusticum tenuissimum	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	9^{11}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	3^{rr}	$0^{\cdot\cdot}$	25^{++}	$0^{\cdot\cdot}$
	Allium komarovianum	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	9^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	18^{++}	29^{++}	25^{r+}	2^{++}
	Chrysanthemum indicum	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	47^{+1}	5^{++}	33^{ra}	14^{++}	**75^{+1}**	2^{+1}
	Gentiana scabra	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	18^{+1}	$0^{\cdot\cdot}$	13^{r+}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$
	Arundinella hirta	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	12^{11}	5^{++}	23^{+a}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	1^{11}
	Saussurea nivea	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	43^{+1}	**75^{++}**	$0^{\cdot\cdot}$
	Sanicula tuberculata	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	29^{++}	25^{++}	$0^{\cdot\cdot}$
Number of accessoric species		138	9	97	132	79	132	11	4	17

V In North Korea, the association is divided into two subassociations:
1. disporetosum ovalae Kim 1992
2. astilbetosum thunbergii Kolbek, Jarolímek & Valachovič 2003

SE This community occurs on north- and south-facing slopes with an inclination of 15–45° at altitudes between 320 and 1230 m. In central North Korea, the frequent mist and high air humidity in the mountain valleys are the most typical physical features of these habitats. The soils are nutrient-rich and humid, acidic to moderately acidic (pH 4.6–5.6), rather poor in the lower layers of the horizon. The A_0 layer is richest, with a higher content of nitrates. The whole profile is characterised by a high ratio of magnesium to calcium.

D The best developed stands of this community, practically with a complete set of diagnostic taxa, occurred below Mt. Pobwangbong in the Myohyangsan Mountains and on several localities in the Kumgangsan Mountains. Only one atypical relevé was recorded in the Sujangsan Mountains at a lower altitude.

MI These stands are often replaced by cultivated forests and their species-rich composition is strongly changed and depleted.

C Kim (1990) similarly characterised the optimal conditions for this community, namely at altitudes from 900 to 1300 m and a humid climate. The author divided the association into two subassociations: disporetosum ovalae and galietosum.

REF Kim (1992), Kolbek et al. (2003a)

Vaccinio-Quercetum mongolicae Kim 1990
(Tab. 6: B)

Syn.: Corylo-Quercetum mongolicae Song 1988, *Quercus mongolica-Pinus koraiensis* community Nakanishi & Choi 1986 p. p. min.

SM *Quercus mongolica* is the dominant tree in the tree layer with cover 70–90 % (A79); the most abundant shrubs in the shrub layer (50–85 % cover, A63) are broad-leaved *Rhododendron schlippenbachii* and young individuals of *Acer pseudosieboldianum*. The open herb layer with 35–60 % (A51) cover is not rich and is composed mainly of acidophilous species such as *Melampyrum roseum* and *Vaccinium koreanum*, and relatively humus-loving *Ainsliaea acerifolia*, *Astilbe koreana*, and *Hepatica asiatica*. The number of vascular plants varies between 19 and 40 (A29). The dryness and acidity of the soils result in low cover of lichens and mosses 0–15 % (A8).

V In North Korea, two subassociations are distinguished:
1. abietosum holophyllae Kim 1990
2. hostetosum longipes Kim 1990

SE This community occurs mainly on southern and western slopes with an inclination of 16 to 40°. In North Korea, it is found only at higher elevations at altitudes between 820 and 1210 m. Large granite boulders with moist soil between them represent the typical ecological conditions of this community, which occupies rocky granite plates on open, extremely sunny slopes with shallow, nutrient-poor soils. The soil is acidic to moderately acidic (pH 3.9–4.9). The upper layer is rich in organic nitrogen and nitrates, whereas the lower layer is markedly poorer, especially in magnesium; the content of nitrogen and carbon also decreases downward.

D Stands of the association were found only in the Myohyangsan Mountains.

MI The woody species composition and structure of these stands are in some cases affected by farming activities leading to degraded forest stages. This community is occasionally established in South Korea as a secondary community after Lychno-Quercetum mongolicae on the upper slopes (Kim 1990).
C It has been described in southern Korea (the Taebaek Mountains, Sobaek Mountains, and other ranges) at around 1000 m. Corylo-Quercetum mongolicae (and similarly Lespedezo-Quercetum serratae) were also described in South Korea by Takeda et al. (1994).
REF Kim (1996), Gumarova (1993), Kolbek et al. (2003a)

Parthenocisso tricuspidati-Fraxinetum rhynchophyllae Kolbek, Jarolímek & Valachovič 2003 (Tab. 6: C)
NT Kolbek et al. (2003a): Table 8.9, relevé 7
SM In the tree layer with 65–85 % (A74) cover is dominated by *Fraxinus rhynchophylla*, *Pinus densiflora*, and *Micromeles alnifolia*. Oaks (*Quercus mongolica* and *Q. dentata*) are less important. A relatively dense shrub layer is typical with 30–75 % (A56) cover, with thickets of *Acer pseudosieboldianum* and other maple species together with other woody species, such as *Magnolia sieboldii*. The trunks of trees are overgrown by *Parthenocissus tricuspidata*. Trees are also frequently decorated with lianas of *Actinidia arguta* climbing through all vertical layers and creating impenetrable thickets in some places. *Rhododendron* species are practically absent. In the open herb layer with cover of 15–75 % (A49), herbs are less frequent than tree seedlings. The number of vascular plants varies between 24 and 46(62) (A41). In some stands, mosses and lichens occur with low cover (0–40 %, A18).
V Some stands are deforested and consequently managed by the introduction of conifers such as *Pinus koraiensis* and *Larix olgensis*, or by preference for *Pinus densiflora* and *Quercus mongolica*.
SE Typical stands grow on north-exposed rocky slopes with an inclination of 15–35° and shattered rocky crests. These habitats provide the optimum humid conditions for the development of mesic forests on the shallow but fresh nutrient-rich soil scattered among granite boulders. The community has been recorded at altitudes between 330 and 700 m, but its distribution is limited in particular areas by shallow soil. The soils are acidic to moderately acidic (pH 3.8–5.9) and the exchangeable acidity is very high. The upper humus layer differs markedly in its higher nutrient content; some samples show a higher content of nitrates. The debris character of the soil, with a higher content of humus and moisture, is completed by a higher content of calcium that may come from snail shells. It is among the richest soils analysed in the region.
D Most of the typical relevés were recorded near the Habiro Monastery and Kuchung Waterfall in the Myohyangsan Mountains.
MI These forests are probably under long-term pressure of human activities.
C Kim (1990: Table 2) classified a similar Carpino-Quercetum serratae within the alliance Callicarpo-Quercion serratae Kim 1990.

ALL Rhododendro mucronulati-Pinion densiflorae Kim & Yim 1988
Forests of Japanese red pine (*Pinus densiflora*) occur on lower hill slopes with dry sandy soils in various disturbed habitats. This alliance includes the remains of pine forests on poor soils of rocky ridges and secondary forests under (strong) human influence. A similar but not identical unit was described in Japan as Pinion densiflorae Suzuki-Takeda 1966. The alliance is characterised by *Pinus densiflora*, *Juniperus rigida*, and *Rhododendron mucronulatum* in the tree and shrub layers and by *Festuca ovina* as the typical grass (Krestov et al. 2006). It consists of the associations Rhododendro-Pinetum densiflorae Suzuki-Takeda & Usui 1952 (Miyawaki 1986, 1987) from Japan, Rhododendro mucronulati-Pinetum densiflorae Kim & Yim 1986, the *Juniperus rigida-Pinus densiflora* community known from the periphery of Seoul (Kim & Kim 1988), and Festuco ovinae-Pinetum densiflorae Song 1992 (Kim & Yim 1988). Only the latter occurs in North Korea. Li & Li (1986) described communities of the *Pinus densiflora* formation in the Myohyangsan Mountains at an altitude of 200–250(520) m. The forest phytosociological data from this alliance were included in the survey of the deciduous temperate forests published by Krestov et al. (2006). The pine forests in East Asia were also comprehensively described by Nakagoshi (1995).

Festuco ovinae-Pinetum densiflorae Song 1992 (Tab. 6: D)
Syn.: *Juniperus rigida-Pinus densiflora* community p. p.
SM In the open tree layer with 55–85 % (A70) cover, *Pinus densiflora* is the dominant tree, and *Quercus mongolica* occurs mainly with low frequency or is missing entirely. In North Korea, this species is more related to the Lindero-Quercion. Other oak species (*Quercus dentata* and *Q. acutissima*) are also regularly present in relevés from North Korea. *Juniperus rigida*, *Quercus mongolica*, *Rhododendron mucronulatum*, and *Benzoin obtusilobum* are common in the regularly developed shrub layer with 30–60 % (A49) cover. Several other, smaller woody species are present in the herb layer, such as *Fagara schinifolia* and *Lespedeza bicolor.* The herb layer covers 20–70 % (A50) and is characterised by the presence of sedges like *Carex lanceolata* and grasses such as *Festuca ovina*, *Miscanthus sinensis*, and *Spodiopogon sibiricus*. The character species, such as *Atractylodes koreana*, *Iris rossi*, *Lilium *partheneion*, *Rhaponticum uniflorum*, *Sophora flavescens*, and *Platycodon grandiflorus*, occurred in our relevés only in this association and con-

nected our relevés with phytocoenoses described in South Korea. The number of vascular plants varies between 27 and 49(66) (A43). Mosses and lichens occur sparsely with low cover (0–20 %, A3).
V Two subassociations are distinguished:
1. peucedanetosum terebintacei Kolbek, Jarolímek & Valachovič 2003
2. lilietosum partheneioni Kolbek, Jarolímek & Valachovič 2003
SE This association is found on gentle slopes (10–33°) at altitudes from 140 to 260 m.
It is a more acidophilous and species-rich community than the association Vaccinio-Quercetum mongolicae. The community contains plant elements related to fine-grained sandy soils with a higher content of nutrients, humus, and moisture. The soils are moderately acidic or acidic (pH 4.7–6.2), relatively poor, and with low mineral content. The calcium content is low, corresponds to the organic content, and is of organic origin.
D This association is found in the foothills of the Ljongaksan and Taesongsan Mountains in the northern central part of the Korean Peninsula.
MI *Pinus densiflora* forests are common throughout the Korean Peninsula, except for the high mountain ranges in the north. Pollen analysis (Uh 1991) has shown that deciduous forests were replaced by pine forests about 3000 years ago. Later, farmers accelerated the destruction of oak forests, and now mostly pine forests represent secondary anthropogenic forests, occurring mostly around settlements (Nakagoshi 1995, Hong 1998). The main floristic elements occur also in all layers in human-affected pine forests, except for oaks, which were exploited and substituted by *Pinus densiflora*.
C This association has been described in southern Korea (northern Kyongsang Province) during a study of vegetation changes around the Andong Dam area (Song 1992b). Forest communities dominated by *Pinus densiflora* in the tree layer and *Juniperus rigida* in the shrub layer, from the Imha Dam area, were also described by Kim et al. (1995). All authors noted the occurrence of *Quercus variabilis* in South Korean pine forests.
REF Li & Li (1986), Miyawaki (1986, 1987), Uh (1991), Kolbek et al. (2003a)

ALL Lindero-Quercion mongolicae Kim 1990
Syn.: Carpinion laxiflorae Kim & Yim 1986, Acero-Quercion mongolicae Kim & Yim 1988, Rhododendro-Quercion mongolicae Kim 1988, Callicarpo-Quercion serratae Kim 1990
This is the central alliance of the order Rhododendro-Quercetalia mongolicae. It includes communities with frequently occurring *Quercus*, *Rhododendron*, *Lespedeza*, and the name-giving *Benzoin obtusilobum* (syn. *Lindera obtusiloba*). Other species, such as *Callicarpa dichotoma*, *Carpinus laxiflora*, *Rhus javanica*, *R. verniciflura*, and other taxa of these genera differentiate this alliance from Pino-Quercion.
The distribution centre of the alliance lies in South Korea, where it occupies lower elevations in the submontane belt. In North Korea, it is restricted to the foothills of the Kumgangsan Mountains. Associations of this alliance are more closely related to the southern woodlands of the suballiance Callicarpo-Quercenion Kim 1992. Coniferous trees are absent, and dwarf bamboo (*Sasamorpha *borealis*), *Disporum smilacinum*, and other more thermophilous species are found. Dominating oaks, e.g. *Quercus acutissima*, *Q. aliena*, *Q. mc-cormickii*, *Q. serrata*, and *Q. variabilis*, are not as abundant as *Q. mongolica*, but they are more characteristic for this vegetation type. *Codonopsis lanceolata*, *Lysimachia clethroides*, *Oplismenus undulatifolius*, and *Syneilesis palmata* appear to have found optimum conditions in this alliance. The forest phytosociological data from this alliance were included in the survey of deciduous temperate forests published by Krestov et al. (2006).
The associations Ainsliaeo-Quercetum mongolicae Song et al. 1999 and Syneilesio-Quercetum serratae Song et al. 1999, described in South Korea, are typical representatives of this alliance. In South Korea, these associations regularly contain the species *Carpinus tschonoskii*, *Corylus sieboldiana*, *Fraxinus sieboldiana*, *Isodon inflexus*, *Saussurea gracilis*, *Viola albida*, *V. rossii*, and many others (Song et al. 1999). On the other hand, many species occurring frequently in North Korean units, such as *Asperula maximowiczii*, *Carpinus laxiflora*, *Quercus dentata*, *Rhus javanica*, *Saussurea nivea*, and *Solenolantana carlesii*, were not found in the syntaxa described in South Korea.

Saso-Quercetum mongolicae Kim 1990
(Tab. 6: E)
Syn.: Rhododendro-Quercetum mongolicae Kim & Yim 1988, Quercetum variabilis Kim & Yim 1988
SM This association groups the mesic bamboo-oak woodlands of the Korean Peninsula. *Quercus serrata* and *Q. variabilis* are the tree layer dominants but can be replaced by *Q. mongolica* in more northern regions. Canopy cover varies from 60 to 90 % (A79), and shrub layer cover can also be high at 40–75 % (A55). *Acer pseudosieboldianum*, *Benzoin obtusilobum*, *Styrax obassia*, *Stephanandra incisa*, and *Callicarpa dichotoma* are the main shrub species. The cover of the open herb layer is 20–75 % (A53), with *Sasamorpha *borealis* (syn.: *Sasa borealis*) dominant in typical stands. It is accompanied by species with lower cover, such as *Carex lanceolata*, *C. siderosticta*, *Ainsliaea acerifolia*, *Syneilesis palmata*, or *Astilbe koreana.* The number of vascular plants varies between (17)25 and 45(59) (A34). The moss layer is mostly absent or achieves only low cover (0–20 %, A3).

V Only one subassociation (Saso-Quercetum mongolicae quercetosum variabilis Kim 1990) occurring in North Korea is divided to two variants:

A. var. typicum sensu Kolbek et al. (2003a)

B. var. *Potentilla fragarioides* sensu Kolbek et al. (2003a)

SE This association represents the most thermophilous forests in North Korea. Stands of the association occur at lower altitudes, usually from 160 to 300 m, exceptionally up to 600 m, on slopes of 5 to 45°. They do not prefer any particular orientation. The rocky soils are mixed with coarse gravel and fine-grained clay. A thick mull horizon is a typical feature of the habitat. Contrary to the deeper soil horizons, it is moist due to persistent precipitation and morning hazes in the vegetation period. The soil is acidic to moderately acidic (pH 4.2–5.2) and poor in nutrients. The great difference between the actual and exchangeable acidity suggests that these soils are also vulnerable to leaching. The soils are poor in carbon and calcium but rich in magnesium relative to calcium.

D This community reaches its northern limit in the Kumgangsan Mountains; only some related subunits occur in the more continental conditions of the Chonmasan Mountains and Sujangsan Mountains.

MI On steep slopes with forest boulders, forest management is practically impossible.

C This association was described in South Korea and divided into two subassociations: (1) pinetosum koraiensis Kim 1990 is typical only for southern Korea; (2) quercetosum variabilis Kim 1992 also occurs in the northern Korean Peninsula, where it reaches its northern limit. Kim et al. (1995: Table 1) published the synoptic vegetation table of Saso-Quercetum mongolicae. Song (1988) described the similar community Corylo-Quercetum mongolicae var. Sasamorpha borealis as new for South Korea and Song (2001b) also described the *Sasa borealis* subcommunity of the *Stephanandra incisa-Quercus mongolica* community.

REF Kim & Yim (1988), Kim (1990, 1992, 1996), Takeda et al. (1994), Song et al. (1995, 1999)

Artemisio-Quercetum mongolicae Kim 1990

(Tab. 6: F)

Syn.: Lindero-Quercetum mongolicae Song et al. 1995

SM *Pinus densiflora* and in some places *Quercus mongolica* are the dominant trees. The canopy of the tree layer achieves 20–95 % (A59) cover. Apparently, oak occurred there more often before, but now young oaks are important only in the shrub layer, which is in some places very dense and attains cover from 15 to 85 % (A54). The cover of the herb layer varies between 10 and 85 % (A37). In this way, both the vertical and horizontal structure of the community has partially changed, but the herb layer composition has remained typical. Under the local light and soil conditions, various sciophilous plants can increase. The number of vascular plants varies between (10)19 and 46(61) (A29). Mosses and lichens occur only scarcely with low cover 0–20 % (A2).

V Infraassociation variability is high and consequently three subassociations (incl. two variants) are distinguished in North Korea:

1. juniperetosum rigidae Kim 1992

A. var. typicum sensu Kolbek et al. (2003a)

B. var. calamagrostiosum arundinacei sensu Kolbek et al. (2003a)

2. deutzietosum prunifoliae Kolbek, Jarolímek & Valachovič 2003

3. styracetosum obassiae Kim 1992

SE This community occurs in southern Korea at altitudes of 400–1200 m (cf. Kim 1992). In northern Korea, it is found at altitudes between 30 and 790 m on flat plains to slopes of 55°. The soils are acidic to moderately acidic (pH 3.9–5.2) and mostly devoid of nitrates. The soil can contain organic substances in the form of undecomposed leaves and higher amounts of calcium, potassium, and magnesium. If the soils are too dry, there is no decomposition of organic substances and leaching into deeper soil layers is inhibited.

D Xerophytic oak forests occur commonly throughout the Korean Peninsula. In the northern Korean Peninsula, they are found in the Myohyangsan, Ljongaksan, Sujangsan, Chonmasan, and Kumgangsan Mountains, and in surroundings of Kaesong.

MI *Pinus densiflora* is the dominant tree of most stands, but mostly as a result of long-term, intensive human impact. *Quercus mongolica* grows at lower density in man-influenced forests near settlements.

C Both subassociations described by Kim (1992) occur in the central part of the peninsula; a third subassociation is described as new and is unknown in South Korea. Song (2001c) published many relevés belonging to this association from Kyongbuk-Province, South Korea, as a *Pinus densiflora* community and *Pinus densiflora-Quercus variabilis* community.

REF Kim (1990)

Syneilesio palmatae-Carpinetum laxiflorae Kolbek, Jarolímek & Valachovič 2003

(Tab. 6: G)

NT Kolbek et al. (2003a): Table 8.13, relevé 3

SM Oak-hornbeam forests of moderate species richness are dominated by *Quercus mongolica* and *Carpinus laxiflora* in the tree layer. *Pinus densiflora* occurs regularly in low abundance. The cover of the tree canopy varies between 60 and 95 % (A74). A dense shrub layer with 60–80 % (A71) is composed largely of the rhododendrons *Rhododendron schlippenbachii* and *R. mucronulatum*, and both dominant species of the tree layer. Besides these, the well-developed shrub layer also includes species such as *Viburnum wrightii*, *Stephanandra incisa*, and *Weigela florida*. On the other hand, the herb layer has lower cover

of 25–60 % (A39) due to the shade cast by the trees and shrubs. It is represented by a group of typical diagnostic species of shady habitats: *Syneilesis palmata*, the characteristic species of the association, plus graminoids and herbs, such as *Carex lanceolata*, *C. siderosticta*, *Spodiopogon sibiricus*, *Aster scaber*, *Artemisia keiskeana*, etc. The number of vascular plants varies between 26 and 41 (A36). Mosses or lichens are rare and with low cover (0–5 %, A2).
V Only seven relevés could not reflect the entire variability of this unit.
SE This community appears to prefer north-facing slopes of around 15–37° at low altitudes from 100 to 420 m. The soil is shallow and rocky, with a thin layer of decomposing litter. It is acidic (pH 4.2) and poor in nutrients, showing minimal organic content and a higher proportion of clay components than in the other soils analysed.
D The community was recorded only in the Sujangsan Mountains.
MI Through unsuitable forest management, the relatively rich herb layer may be degraded by *Carex lanceolata* and various grasses.
C This association represents transitional forest vegetation between the South Korean alliance Lindero-Quercion mongolicae and northern types of deciduous oak forest. Saso-Quercetum mongolicae quercetosum variabilis (without *Sasamorpha *borealis*) is the contact community. Song et al. (1995) described a related unit, Lindero-Quercetum mongolicae, on Mt. Sobaek. This association is differentiated by the absence of *Pinus densiflora*, the low constancy of *Carpinus laxiflora*, and the presence of *Sasamorpha *borealis*. Song et al. (1999) published two similar associations, Syneilesio-Quercetum serratae and Ainsliaeo-Quercetum mongolicae, as new.
REF Takeda et al. (1994)

ALL Weigelo floridae-Fagarion schinifoliae Kolbek, Jarolímek & Valachovič 2003
NT Lilio lancifolii-Rhododendretum schlippenbachii Kolbek, Jarolímek & Valachovič 2003
This alliance includes shrubs and other open communities around deciduous broad-leaved forests in Korea. Therefore, most of the woody plants come from the surrounding forest communities dominated by *Quercus mongolica* or *Pinus densiflora*. These occur with high constancy in the order Rhododendro-Quercetalia mongolicae. Miyawaki (1986) noted three similar associations in the order Weigelo-Alnetalia firmae Ohba & Sugawara 1979 in similar situations in Japan. A formation of large shrubs without a true tree layer was analysed in the Sujangsan Mountains on sites where the development of a deep soil profile is hampered. This edaphically conditioned community occurs naturally on slab-like substrates of a certain inclination, such as stratified plates of granodiorites, partly compact, and partly disintegrated. The shrubs are anchored in the fissures and weathering furrows of the substrate, resulting in open stands with relatively species-rich shrub and herb layers. These stands usually do not exceed 3–4 m in height and physiognomically resemble Central European blocked scrub stands on slopes. They are stable for a long time. Similar stands are also formed in deforested areas, where shrubs and coppice forms of trees, as well as a thriving development of heliophilic grasses, sedges, and sometimes geophytes, is stimulated by the light available after felling.

Lilio lancifolii-Rhododendretum schlippenbachii Kolbek, Jarolímek & Valachovič 2003
(Tab. 6: H)
NT Kolbek et al. (2003a): Table 8.14, relevé 1
SM The shrub layer has high cover (60–90 %, A74) but cover is less in the herb layer (30–60 %, A46); the moss layer is sparse with low cover (up to 20 %, A9). The number of vascular plants varies between 21 and 31. The dominant woody plants are dwarf *Quercus mongolica*, in combination with *Lespedeza bicolor* and the rhododendrons *Rhododendron schlippenbachii* and *R. mucronulatum*. *Vaccinium koreanum* is present in the shrub layer, but even more in the herb layer. Light-demanding heliophytes, such as *Carex nanella*, *Artemisia keiskeana*, *Hemerocallis minor*, *Chrysanthemum coreanum*, and some geophytes, such as *Lilium lancifolium*, *Polygonatum humile*, *Allium komarovianum*, and rarely also *Scilla scilloides*, characterise this community. Their growth is possible due to the humid microclimate under the shrubs and open gaps between rock steps.
V The community is relatively homogeneous. *Carex siderosticta* and *Asplenium sarelii* may be missing in some stands.
SE This community of shallow substrates frequently occurs on extremely steep northern to southeastern slopes (30 to 48°) 590–630 m in altitude. The soil is obviously fresh and moist. The only soil sample available suggests very acidic soils (pH 3.8) and points to very poor soil from which alkaline cations are washed out.
D This community often occurs in the Sujangsan Mountains.
MI Direct human impact was not noted, but evidence of selective tree felling was found (e.g. *Castanea sativa*). Secondary developed stands may be the result of ongoing cutting of selected trees (mainly oaks).
C This community was described as new and it is not known in the surrounding countries.
REF Miyawaki (1986)

Indigofera kirilowii-Securinega suffruticosa community sensu Kolbek et al. (2003a)
(Tab. 6: I)
SM This community occurs in stands of widely varying density: the shrub layer cover is 50–90 % (A69), the herb

layer cover is 20–40 % (A29) without any mosses or lichens. Shrubs, such as *Indigofera kirilowii*, *Securinega suffruticosa*, *Stephanandra incisa*, and some others may occur. Atypical conditions provide opportunities for the development of unique combinations of plant species. Some species are very rare in forest communities but are more characteristic of wetlands, e.g. *Miscanthus sinensis*, *Phragmites communis*, *Sanguisorba officinalis*, and *Thalictrum contortum.* Xerophytic taxa such as *Carex nanella* or *Artemisia keiskeana*, typical for Lilio lancifolii-Rhododendretum schlippenbachii, are absent and differentiate both units. The number of vascular plants varies between 29 and 39 (A34).
V In some relevés, *Rosa multiflora*, *Stephanandra incisa*, and *Ligustrum ovalifolium* prevailed.
SE South- or west-oriented slopes with an inclination of 15–35° and altitude of 200–400 m are typical habitats of the community. Many sites are bare rocky substrates on rock surfaces wetted by runoff water.
D The community was only found in the Sujangsan Mountains.
MI This community is natural or in many places is a clearing community defined as a man-limited blocked succession phase with soil erosion.
C No relevant data from surrounding countries have been registered.

Coniferous forests

CL Vaccinio-Piceetea Br.-Bl. 1939 (Tab. 7: A–G)
OR Abieti nephrolepidis-Piceetalia jezoensis Song 1992
ALL Laricion olgensis Kolbek, Jarolímek & Valachovič 2003
NT Ledo decumbentis-Laricetum olgensis Kolbek, Jarolímek & Valachovič 2003
The larch forest communities of the mountain taiga have *Larix olgensis*, *Abies nephrolepis*, *Picea koraiensis*, and *P. jezoensis* as the dominant species. The alliance occurs in eastern Asia within the distribution area of *Larix olgensis*, i.e. the northern Korean Peninsula and adjacent mountain regions of northeastern China. Communities of the alliance are found at altitudes between 1190 and 1950 m in the Changbaishan Mountains. In the "light taiga", the dominant species is *Larix olgensis.* In the "dark taiga", *Abies nephrolepis* and various *Picea* species (mainly *P. jezoensis*, *P. koraiensis*) are dominant and *Larix olgensis* is less important. Stands are remarkably rich in moss and vascular plant species. Shrubs of the genus *Rhododendron*, *Ribes*, *Lonicera*, *Betula*, and *Clematis* occur rather frequently. The habitats are situated on gentle slopes or in plains with favourable precipitation.
Similar vicariant alliances dominated by *Larix sibirica* were described by Ermakov et al. (2000) within the class Rhytidio rugosi-Laricetea sibiricae Korotkov & Ermakov 1999 and the order Carici pediformis-Laricetalia sibiricae Ermakov in Ermakov, Korolyuk & Lashchinski 1991.

Rhododendro aurei-Laricetum olgensis Dostálek sen., Dostálek jun., Mucina & Hoang 1988
(Tab. 7: A)
NT Dostálek et al. (1988)
SM Giant specimens of *Larix olgensis* are the typical physiognomic feature of these thin park-like larch forests. *Rhododendron aureum* dominates in the shrub layer. Its height depends on elevation, 1.5(2) m at the lowest altitude (1740 m) but barely 0.5 m at the highest altitude (1950 m). *Rhododendron aureum* also occurs above the tree line (tundra belt), to 10–15 cm in height, and it also retains this small size if grows at low elevations. Stands of this association are species-rich, and the subassociations are well-connected with specific elevations. The number of vascular plants varies between 15 and 49 (A27). The dominant species of the tree layer is *Larix olgensis*, with cover of (10)20–60 % (A38). *Picea jezoensis* and *P. koraiensis* are subdominant species at the highest situated locations. *Rhododendron aureum*, with cover of 0–40 % (A11), dominates the shrub layer. *Picea jezoensis*, *Dasiphora fruticosa*, and more rarely other woody species accompany it. The herb layer covers 45–85 % (A66) and is composed of *Juniperus sibirica*, *Phyllodoce coerulea*, *Vaccinium vitis-idaea*, *V. uliginosum*, *Linnaea borealis*, *Festuca ovina*, *Calamagrostis langsdorfii*, *Solidago japonica*, *Sanguisorba parviflora*, *Gentiana jamesii*, etc. The thick moss layer covers 15–95 % (A69) and consists of *Ptilium crista-castrensis*, *Pleurozium schreberi*, *Cladonia rangiformis*, *C. uncialis*, *Hylocomium splendens*, *Rhytidium rugosum*, etc.
V Within the association, four subassociations are distinguished:
1. typicum Kolbek, Jarolímek & Valachovič 2003
2. salicetosum arcticae Kolbek, Jarolímek & Valachovič 2003
3. gentianetosum algidae Kolbek, Jarolímek & Valachovič 2003
4. pyroletosum dahuricae Kolbek, Jarolímek & Valachovič 2003

SE The soil of Rhododendro-Laricetum is poor, very to moderately acidic (pH 3.3–5.2), and lacking in nitrates. Dostálek (1995) gives an acidity of pH 4.3. It is covered by an acidic litter and humus layer. The lower layer of the horizon is more basic, probably due to contact with volcanic tuff and ash. The substrate of these raw soils has good mineral content and well-balanced moisture. This substrate is also well-aerated. The community is observed on eastern and northeastern slopes.
D The association consists of larch forest at the highest elevations of all coniferous forests found in the Changbaishan Mountains. It reaches the timberline and then

Table 7. Coniferous forests.
A – Rhododendro aurei-Laricetum olgensis; B – Goodyero repentis-Piceetum jezoensis; C – Carici peiktusani-Abietetum nephrolepidis; D – Ledo decumbentis-Laricetum olgensis; E – Dryopterido fragranti-Rhododendretum dahurici; F – Taxo-Pinetum pumilae; G – Thujo koraiensis-Piceetum jezoensis

Community		A	B	C	D	E	F	G
Number of relevés		41	12	18	27	18	3	4
Average number of species		34	32	35	27	26	26	32
Rhododendro aurei-Laricetum olgensis								
S	*Rhododendron aureum*	**88**^{r4}	0$^{..}$	11^{+1}	0$^{..}$	0$^{..}$	*1*^{bb}	*0*$^{..}$
	Aquilegia japonica	**46**$^{+1}$	17^{r+}	11^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Allium thunbergii	**46**^{r1}	8^{rr}	0$^{..}$	15^{+1}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Parnassia palustris	**41**$^{+1}$	0$^{..}$	0$^{..}$	11^{++}	0$^{..}$	*1*^{11}	*0*$^{..}$
	Agrostis flaccida	**34**$^{+b}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Anthoxanthum nipponicum	**34**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Tofieldia nuda	**29**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
M	*Cladonia uncialis*	**24**$^{+a}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Goodyero repentis-Piceetum jezoensis								
	Goodyera repens	5^{++}	**92**$^{+1}$	6^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
T	*Usnea longissima*	0$^{..}$	**67**^{11}	0$^{..}$	7^{11}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
S	*Usnea longissima*	0$^{..}$	**67**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Lycopodium cryptomerianum	2^{++}	**33**$^{+a}$	6^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Listera nipponica	0$^{..}$	**33**^{11}	6^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Calypso bulbosa	2^{++}	**33**$^{+1}$	6^{rr}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
M	*Peltigera lepidota*	0$^{..}$	**25**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Carici peiktusani-Abietetum nephrolepidis								
	Carex nanella	5^{11}	0$^{..}$	**78**$^{+a}$	15^{+1}	0$^{..}$	*0*$^{..}$	*1*^{11}
	Carex peiktusani	15^{+1}	25^{++}	**67**$^{+a}$	19^{+m}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
S	*Prunus padus*	0$^{..}$	0$^{..}$	**61**$^{+a}$	4^{++}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Cerastium frucatum	0$^{..}$	0$^{..}$	**61**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Sanguisorba tenuifolia	0$^{..}$	0$^{..}$	**44**$^{+1}$	11^{++}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Prunus padus	0$^{..}$	0$^{..}$	**28**$^{++}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
S	*Ribes komarovii*	0$^{..}$	0$^{..}$	**22**$^{+1}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
S	*Acer tegmentosum*	0$^{..}$	0$^{..}$	**22**$^{++}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Ledo decumbentis-Laricetum olgensis								
	Ledum decumbens	5^{+1}	0$^{..}$	0$^{..}$	**85**$^{+4}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Artemisia stolonifera	15^{r1}	0$^{..}$	0$^{..}$	**78**$^{+a}$	0$^{..}$	*0*$^{..}$	*2*^{11}
T	*Betula platyphylla*	0$^{..}$	0$^{..}$	28^{1a}	**63**^{13}	44^{+a}	*0*$^{..}$	*0*$^{..}$
	Potentilla cryptotaenia	2^{++}	0$^{..}$	6^{++}	**41**$^{+1}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Fragaria orientalis	0$^{..}$	0$^{..}$	0$^{..}$	**33**$^{+1}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
	Valeriana fauriei	2^{++}	0$^{..}$	0$^{..}$	**33**$^{++}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
S	*Betula paishanensis*	0$^{..}$	0$^{..}$	0$^{..}$	**26**^{a3}	0$^{..}$	*0*$^{..}$	*0*$^{..}$
M	*Cladonia termiformis*	0$^{..}$	0$^{..}$	0$^{..}$	**26**$^{++}$	0$^{..}$	*0*$^{..}$	*0*$^{..}$
Dryopterido fragranti-Rhododendretum dahurici, Rhododendro dahurici-Acerion barbinervi								
S	*Rhododendron dahuricum*	0$^{..}$	0$^{..}$	0$^{..}$	**7**^{44}	**100**$^{+5}$	*0*$^{..}$	*0*$^{..}$
M	*Sphagnum girgensohnii*	0$^{..}$	8^{++}	0$^{..}$	4^{aa}	**100**$^{+5}$	*0*$^{..}$	*0*$^{..}$
M	*Cladonia *grisea*	10^{+a}	17^{++}	0$^{..}$	0$^{..}$	**89**$^{+a}$	*0*$^{..}$	*0*$^{..}$
M	*Cladonia amaurocraea*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**72**$^{+a}$	*0*$^{..}$	*0*$^{..}$
	Dryopteris fragrans	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**72**^{ra}	*0*$^{..}$	*0*$^{..}$
	Rhododendron dahuricum	0$^{..}$	0$^{..}$	0$^{..}$	7^{+a}	**61**$^{+a}$	*0*$^{..}$	*0*$^{..}$
	Acer barbinerve	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**56**$^{+a}$	*0*$^{..}$	*2*^{11}
M	*Oncophorus wahlenbergii*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**56**$^{++}$	*0*$^{..}$	*0*$^{..}$
	Sedum middendorffianum	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**50**$^{+1}$	*0*$^{..}$	*0*$^{..}$
	Polypodium viriginianum	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**44**$^{+1}$	*0*$^{..}$	*0*$^{..}$
M	*Anastrophyllum minutum*	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	**39**$^{++}$	*0*$^{..}$	*0*$^{..}$

Table 7. cont.

Community		A	B	C	D	E	F	G
Number of relevés		41	12	18	27	18	3	4
M	*Polytrichum commune*	0··	0··	0··	0··	**33**$^{+a}$	*0*··	*0*··
M	*Abietinella abietina*	0··	0··	0··	0··	**33**$^{+1}$	*0*··	*0*··
M	*Peltigera scabrosa*	0··	0··	0··	0··	**33**$^{++}$	*0*··	*0*··
M	*Cladonia pyxidata*	0··	0··	0··	0··	**28**$^{+a}$	*0*··	*0*··
M	*Lophozia excisa*	0··	0··	0··	0··	**28**$^{++}$	*0*··	*0*··
M	*Peltigera leucophlebia*	0··	0··	0··	0··	**28**$^{++}$	*0*··	*0*··
Taxo-Pinetum pumilae								
S	*Pinus pumila*	0··	0··	0··	0··	0··	*3*^{b5}	*0*··
S	*Tripterigium regelii*	0··	0··	0··	0··	0··	*1*^{bb}	*0*··
S	*Lonicera sachalinensis*	0··	0··	0··	0··	0··	*1*^{aa}	*0*··
	Cimicifuga davurica	0··	0··	0··	0··	0··	*1*^{aa}	*0*··
	Phegopteris decursive-pinnata	0··	0··	0··	0··	0··	*1*^{aa}	*0*··
	Primula jezoana	0··	0··	0··	0··	0··	*1*^{11}	*0*··
	Paris verticillata	0··	0··	0··	0··	0··	*1*^{11}	*0*··
	Geranium dahuricum	0··	0··	0··	0··	0··	*1*^{11}	*0*··
	Galium kamtschaticum	0··	0··	0··	0··	0··	*1*^{11}	*0*··
	Aquilegia oxysepala	0··	0··	0··	0··	0··	*1*$^{++}$	*0*··
	Aconitum villosum	0··	0··	0··	0··	0··	*1*$^{++}$	*0*··
	Paeonia japonica	0··	0··	0··	0··	0··	*1*^{rr}	*0*··
Thujo koraiensis-Piceetum jezoensis								
	*Scabiosa *alpina*	0··	0··	0··	0··	0··	*0*··	*3*$^{++}$
	Trisetum sibiricum	0··	0··	0··	0··	0··	*0*··	*2*^{1a}
	Aconitum triphyllum	0··	0··	0··	0··	0··	*0*··	*2*^{1a}
	Lycopodium serratum	0··	0··	0··	0··	0··	*0*··	*2*$^{+1}$
	Polystichum tripteron	0··	0··	0··	0··	0··	*0*··	*2*$^{+1}$
	Swertia veratroides	0··	0··	0··	0··	0··	*0*··	*2*$^{++}$
	Adenophora mandshurica	0··	0··	0··	0··	0··	*0*··	*1*$^{++}$
	Adenophora koreana	0··	0··	0··	0··	0··	*0*··	*1*$^{++}$
Laricion olgensis								
T	*Larix olgensis*	100^{a4}	**83**$^{+1}$	100^{14}	100^{14}	**72**$^{+3}$	*0*··	*0*··
	Sanguisorba parviflora	**66**^{r1}	0··	**11**$^{++}$	**59**^{r1}	0··	*0*··	*0*··
S	*Larix olgensis*	**51**^{rb}	**25**$^{r+}$	**39**$^{+a}$	**93**$^{+3}$	**67**$^{+1}$	*0*··	*0*··
	Viola sachalinensis	**46**$^{+1}$	**92**$^{+1}$	**22**$^{++}$	**7**$^{++}$	0··	*0*··	*0*··
	Saussurea alpicola	**41**^{r1}	**50**$^{++}$	**17**$^{++}$	0··	0··	*0*··	*0*··
	Larix olgensis	**37**^{r1}	**8**^{rr}	**11**$^{+1}$	**70**$^{+m}$	33^{r1}	*0*··	*0*··
	Lonicera edulis	**34**^{r1}	0··	**94**$^{+3}$	**96**$^{+a}$	0··	*0*··	*0*··
S	*Picea koraiensis*	**29**^{rb}	**33**$^{+a}$	**28**$^{+a}$	**26**$^{+1}$	0··	*0*··	*0*··
	Ribes horridum	**29**$^{+a}$	**42**$^{+1}$	**11**^{11}	**19**$^{+1}$	0··	*0*··	*0*··
T	*Picea koraiensis*	**27**^{ra}	**33**$^{+1}$	**28**$^{+a}$	**4**$^{++}$	0··	*0*··	*0*··
	Pyrola dahurica	**22**$^{+1}$	0··	**11**$^{++}$	0··	0··	*0*··	*0*··
	Picea koraiensis	**17**^{r1}	**33**$^{++}$	**11**$^{+1}$	**4**$^{++}$	0··	*0*··	*0*··
	Bupleurum longeradiatum	**12**$^{+1}$	0··	**33**$^{+1}$	**30**$^{+1}$	0··	*0*··	*0*··
	Salix arctica	**12**^{r1}	0··	**11**$^{++}$	**22**$^{+1}$	0··	*0*··	*0*··
S	*Ribes horridum*	**10**$^{+1}$	0··	0··	0··	0··	*0*··	*0*··
	Ostericum maximowiczii	**5**$^{++}$	0··	**50**^{ra}	**37**$^{++}$	0··	*0*··	*0*··
	Iris dichotoma	**5**$^{++}$	0··	**39**$^{+1}$	**15**$^{+1}$	0··	*0*··	*0*··
	Pseudostellaria heterophylla	**2**^{11}	**33**$^{+1}$	**39**$^{+1}$	0··	0··	*0*··	*0*··
	Rhododendron parvifolium	**2**$^{++}$	0··	0··	**15**$^{+m}$	0··	*0*··	*0*··
S	*Malus baccata*	0··	0··	**17**$^{+1}$	**15**$^{++}$	0··	*0*··	*0*··
S	*Sorbus sambucifolia*	0··	0··	**17**$^{+a}$	**4**^{rr}	0··	*0*··	*0*··
S	*Spiraea ulmifolia*	0··	0··	**17**$^{r+}$	0··	0··	*0*··	*0*··

Table 7. cont.

Community		A	B	C	D	E	F	G
Number of relevés		41	12	18	27	18	3	4
	Sorbus sambucifolia	0··	0··	**17**^{r1}	0··	0··	*0*··	*0*··
S	*Rhododendron parvifolium*	0··	0··	**6**^{11}	**19**$^{+3}$	0··	*0*··	*0*··
T	*Prunus padus*	0··	0··	**6**$^{++}$	0··	0··	*0*··	*0*··
	Spiraea ulmifolia	0··	0··	**6**$^{++}$	0··	0··	*0*··	*0*··
	Malus baccata	0··	0··	**6**^{rr}	0··	0··	*0*··	*0*··
S	*Populus davidiana*	0··	0··	0··	**11**$^{++}$	0··	*0*··	*0*··
T	*Populus davidiana*	0··	0··	0··	**4**^{11}	0··	*0*··	*0*··
Abieti nephrolepidis-Piceion jezoensis								
S	*Betula ermanii*	0··	0··	0··	0··	22^{1a}	***2***^{aa}	***2***^{ab}
T	*Betula ermanii*	0··	0··	0··	0··	17^{+a}	*0*··	***2***$^{+1}$
	*Calamagrostis *hirsuta*	0··	0··	0··	0··	0··	***3***$^{+a}$	***3***^{a3}
S	*Thuja koraiensis*	0··	0··	0··	0··	0··	***3***$^{+a}$	***3***^{13}
S	*Syringa wolfi*	0··	0··	0··	0··	0··	***2***^{1a}	***1***$^{++}$
	Dryopteris crassirhizoma	0··	0··	0··	0··	0··	***2***$^{+a}$	***1***$^{++}$
	Syringa wolfi	0··	0··	0··	0··	0··	***1***^{aa}	***1***$^{++}$
S	*Acer tschonoskii*	0··	0··	0··	0··	0··	***1***^{11}	*0*··
	Betula ermanii	0··	0··	0··	0··	0··	***1***^{11}	***2***$^{+1}$
	Acer ukurundense	0··	0··	0··	0··	0··	***1***$^{++}$	*0*··
T	*Acer ukurundense*	0··	0··	0··	0··	0··	*0*··	***1***^{aa}
S	*Acer ukurundense*	0··	0··	0··	0··	0··	*0*··	***1***^{aa}
Abieti nephrolepidis-Piceetalia jezoensis								
	Picea jezoensis	49^{r1}	**100**$^{+a}$	39^{+1}	37^{r+}	0··	*0*··	*0*··
S	*Picea jezoensis*	46ra	**100**^{a3}	50^{+a}	19^{r1}	0··	*1*^{11}	*2*^{1a}
	Clintonia udensis	44^{+m}	**92**$^{+1}$	**72**$^{+1}$	0··	0··	*1*^{rr}	*2*^{11}
T	*Picea jezoensis*	**37**$^{+3}$	**100**^{34}	28^{+1}	0··	0··	*0*··	***2***^{a3}
S	*Lonicera edulis*	37ra	17^{r+}	**83**$^{+3}$	30^{+a}	6^{++}	*0*··	*0*··
	Abies nephrolepis	32^{+1}	**100**$^{+a}$	**94**^{r1}	4^{rr}	33^{++}	*0*··	*0*··
S	*Abies nephrolepis*	29^{+b}	**100**$^{+3}$	**33**^{a3}	11^{+1}	**72**^{r1}	*2*^{r1}	*0*··
T	*Abies nephrolepis*	20^{+a}	**100**^{13}	**100**$^{+4}$	0··	11^{11}	*0*··	*1*$^{++}$
	Clematis ochotensis	17^{++}	33^{+1}	**67**$^{+1}$	0··	0··	*1*^{rr}	*0*··
	Pyrola japonica	12^{+a}	0··	0··	0··	0··	*0*··	*0*··
S	*Rosa davurica*	10^{r+}	0··	**83**$^{+a}$	7^{++}	**78**$^{+a}$	*0*··	*0*··
	Rosa davurica	10^{r+}	8^{++}	**72**^{r1}	**74**^{r1}	**61**$^{+a}$	*0*··	*0*··
	*Ledum *maximum*	2^{aa}	17^{r+}	**72**$^{+3}$	**48**$^{+4}$	**83**$^{+5}$	*0*··	*0*··
S	*Clematis ochotensis*	2^{rr}	0··	6^{++}	4^{++}	0··	*0*··	*0*··
	Sorbus amurensis	2^{rr}	0··	22^{++}	0··	0··	*0*··	*1*$^{++}$
	Ligularia fischeri	0··	25^{+1}	33^{+a}	0··	0··	*1*$^{++}$	***3***^{13}
S	*Betula platyphylla*	0··	0··	39^{+1}	**52**$^{+3}$	**83**$^{+a}$	*0*··	*0*··
S	*Sorbus amurensis*	0··	0··	39^{+1}	4^{++}	50^{+a}	*1*$^{++}$	*0*··
T	*Sorbus amurensis*	0··	0··	22^{+1}	0··	22^{1a}	*0*··	*0*··
	Betula platyphylla	0··	0··	22^{++}	26^{++}	0··	*0*··	*0*··
	Thalictrum contortum	0··	0··	17^{++}	15^{+1}	0··	*1*$^{++}$	*2*$^{++}$
S	*Physocarpus amurensis*	0··	0··	6^{++}	0··	0··	*0*··	*0*··
Vaccinio-Piceetea								
	Juniperus sibirica	**100**^{r3}	**83**$^{+a}$	39^{+a}	37^{+b}	0··	*0*··	*0*··
	Phyllodoce coerulea	**95**^{r3}	**92**$^{+3}$	0··	0··	0··	*0*··	*0*··
	Vaccinium vitis-idaea	**93**$^{+b}$	**92**$^{+1}$	**100**$^{+a}$	**100**$^{+4}$	28^{+1}	*0*··	*0*··
	Vaccinium uliginosum	**61**$^{+b}$	8^{++}	22^{1a}	**81**$^{+4}$	0··	*0*··	*0*··
	Linnaea borealis	**56**^{1a}	**100**^{13}	**94**^{m3}	22^{1m}	0··	*0*··	*0*··
	Lycopodium complanatum	41^{+a}	**100**$^{+a}$	33^{+1}	4^{++}	0··	*0*··	*0*··
	Orthilia secunda	22^{+1}	25^{11}	50^{+a}	0··	0··	*0*··	*0*··

Table 7. cont.

Community		A	B	C	D	E	F	G
Number of relevés		41	12	18	27	18	3	4
	Hieracium umbellatum	20+1	0..	0..	41++	0..	*0..*	*0..*
	Majanthemum dilatatum	17+1	**58+1**	**83r3**	22+m	0..	*0..*	*0..*
S	*Vaccinium uliginosum*	15ra	0..	17+a	0..	0..	*0..*	*0..*
	Pedicularis resupinata	12+1	0..	11++	11++	0..	*0..*	*0..*
S	*Juniperus sibirica*	10+1	0..	0..	0..	0..	*0..*	*0..*
	*Lycopodium *nipponicum*	7+1	331m	**67+a**	19+1	28+1	*0..*	*0..*
	Ligularia jamesii	5++	0..	11+1	0..	0..	*0..*	*0..*
	Lycopodium selago	5r+	0..	0..	0..	0..	*0..*	*0..*
	Chimaphila japonica	2++	0..	611	0..	0..	*0..*	*0..*
	Lycopodium alpinum	2++	0..	0..	0..	0..	*0..*	*0..*
	Lycopodium annotinum	2++	0..	0..	0..	0..	*0..*	*0..*
	Pyrola incarnata	0..	**83r+**	**89+a**	19+1	0..	*0..*	*0..*
	Oxalis acetosella	0..	0..	33+1	0..	0..	*111*	*1++*
S	*Lonicera chrysantha*	0..	0..	22+1	0..	0..	*0..*	*0..*
	Lonicera chrysantha	0..	0..	17+1	0..	0..	*1aa*	*2++*
	Lycopodium obscurum	0..	0..	11+1	0..	0..	*0..*	*1++*
	Lycopodium chinensis	0..	0..	0..	0..	11+1	*0..*	*0..*
	Majanthemum bifolium	0..	0..	0..	0..	0..	*111*	*1bb*
S	*Pinus koraiensis*	0..	0..	0..	0..	0..	*0..*	*111*
T	*Pinus koraiensis*	0..	0..	0..	0..	0..	*0..*	*111*
Other species								
M	*Ptilium crista-castrensis*	**78+4**	**100a5**	**9415**	**48a4**	**67a5**	*0..*	*0..*
	Festuca ovina	**78+3**	**58r+**	6++	**67+3**	0..	*0..*	*1++*
	Calamagrostis langsdorfii	**78r3**	**83+a**	**67+a**	**100+4**	0..	*0..*	*0..*
	Solidago japonica	**71+a**	**100+m**	**94+1**	**52+1**	0..	*0..*	*1++*
	Dasiphora fruticosa	**63r4**	0..	11++	**74+4**	0..	*0..*	*0..*
M	*Pleurozium schreberi*	**61+5**	**92a4**	**7814**	**81a5**	**61a3**	*0..*	*0..*
	Gentiana jamesii	**51r1**	42++	0..	19++	0..	*0..*	*0..*
	Gymnadenia conopsea	49+1	0..	0..	26r1	0..	*0..*	*0..*
	Potentilla coreana	44++	**58r1**	0..	30+1	0..	*0..*	*0..*
M	*Cladonia rangiformis*	**37+3**	811	0..	0..	0..	*0..*	*0..*
	Taraxacum sp.	37r1	0..	0..	0..	0..	*0..*	*0..*
M	*Hylocomium splendens*	**3413**	251b	**644**	0..	**72+4**	*0..*	*0..*
M	*Rhytidium rugosum*	341a	0..	28+a	111a	44+a	*0..*	*0..*
	Bupleurum euphorbioides	29+1	0..	0..	11++	0..	*0..*	*0..*
	Geranium eriostemon	27+1	17++	11++	0..	0..	*0..*	*0..*
S	*Dasiphora fruticosa*	24+a	0..	22+1	22+m	0..	*0..*	*0..*
	Dianthus superbus	24ra	0..	0..	26++	0..	*0..*	*0..*
M	*Cladonia stellaris*	**20+3**	0..	0..	11+1	33+b	*0..*	*0..*
M	*Cetraria laevigata*	20+a	25+1	0..	19+a	0..	*0..*	*0..*
	Prunella vulgaris	17+1	33++	0..	0..	0..	*0..*	*0..*
	Pseudostellaria sylvatica	7+1	0..	28+1	0..	0..	*0..*	*0..*
	Gentiana scabra	7++	0..	0..	26r+	0..	*0..*	*1++*
M	*Cladonia arbuscula*	5ab	0..	0..	0..	22+a	*0..*	*0..*
M	*Dicranum polysetum*	2++	**6713**	0..	0..	50+a	*0..*	*0..*
	Hypericum ascyron	2++	0..	22++	19++	0..	*1++*	*0..*
M	*Drepanocladus uncinatus*	0..	42++	0..	0..	**56++**	*0..*	*0..*
M	*Thuidium philibertii*	0..	42++	0..	0..	39++	*0..*	*0..*
M	*Cladonia maxima*	0..	33++	0..	4++	22+a	*0..*	*0..*
M	*Cladonia furcata*	0..	17++	0..	48+a	0..	*0..*	*0..*
M	*Peltigera aphthosa*	0..	811	0..	0..	22+a	*0..*	*0..*
	Phegopteris polypodioides	0..	0..	33+a	0..	0..	*111*	*0..*

Table 7. cont.

Community		A	B	C	D	E	F	G
Number of relevés		41	12	18	27	18	3	4
	Pteridium aquilinum	0··	0··	22^{+a}	7^{+1}	0··	*0··*	*0··*
M	*Aulacomium palustre*	0··	0··	0··	7^{ab}	22^{++}	*0··*	*0··*
M	*Dicranum fragilifolium*	0··	0··	0··	0··	22^{+1}	*0··*	*0··*
M	*Entodon compressus*	0··	0··	0··	0··	22^{++}	*0··*	*0··*
	Daphne kamtschatica	0··	0··	0··	0··	22^{++}	*0··*	*0··*
Number of accessoric species		74	7	22	22	31	33	49

continues in thin, patchy forms (krummholz), continuously changing into the low shrub tundra of the association Dryado tschonoskii-Rhododendretum aurei (Dostálek et al. 1988, Kolbek & Jarolímek 2007).
MI The stands are mostly protected and not heavily exploited. Only individual trees are cut.
C In Nakamura et al. (2007), similar communities were classified in Abieti-Piceetalia jezoensis Miyawaki, Ohba & Okuda 1968 or Abieti nephrolepidis-Piceion jezoensis Song 1991.
REF Kolbek et al. (2003a), Šrůtek et al. (2003b)

Goodyero repentis-Piceetum jezoensis Kolbek, Jarolímek & Valachovič 2003
(Tab. 7: B)
NT Kolbek et al. (2003a): Table 8.2, relevé 2
SM The physiognomy of the association is determined by the nearly 100 % cover of a thick moss layer and dense shrub and tree layers, consisting of coniferous species shading lower layers. The main tree layer dominant is *Picea jezoensis*, accompanied by *Abies nephrolepis*, *Picea koraiensis*, and *Larix olgensis*. The tree layer, with cover from 70 to 90 % (A74), is very dense and creates very dark shade for the lower layers. Similarly, the shrub layer, with cover of 30–60 % (A46), restricts the light reaching the herb layer. Low cover in the herb layer [10–35(50) %, A30], with few species, is typical for these stands; *Linnaea borealis* and *Phyllodoce coerulea* are the most frequent herbs, though *Goodyera repens*, *Lycopodium complanatum*, *Vaccinium vitis-idaea*, and *Pyrola incarnata* also occur regularly in stands of this association. The number of vascular plants varies between 18 and 30 (A23). Moss cushions up to 60(80) cm thick cover 90–95 % (A94) of the ground surface, and the herbs are rooted in this mat. *Ptilium crista-castrensis* and *Pleurozium schreberi* are the dominants of the moss layer. Lichen cover is low.
V Two subassociations are distinguished within the association:
1. usneetosum longissimae Kolbek, Jarolímek & Valachovič 2003
2. listeretosum nipponicae Kolbek, Jarolímek & Valachovič 2003
SE This association was found in the Changbaishan Mountains, in a wide area around Mt. Paektusan, on gentle slopes (5–15°) with eastern or northeastern orientation at an elevation of 1630–1770 m. Small fluctuations in soil moisture would be expected due to the densely closed moss layer. The soils are acidic, with pH values about 4.0. Nitrates are essentially absent, and the amounts of other anions, including phosphates, are very low.
D This association represents dark taiga, stands of which were found only in the mountains along the boundary between North Korea and China. Their distribution is probably wider in other high mountains of North Korea and in neighbouring parts of China and Russia.
MI The stands in North Korea are mostly protected and not exploited.
C In Nakamura et al. (2007), similar communities were classified in Abieti-Piceetalia jezoensis Miyawaki, Ohba & Okuda 1968 or Abieti nephrolepidis-Piceion jezoensis Song 1991. Communities with *Picea jezoensis* in Abieto-Piceetea jezoensis were also described by Li & Li (1986) in the Myohyangsan Mountains at an altitude of 1100–1600 m.
REF Krestov & Nakamura (2002), Šrůtek et al. (2003b)

Carici peiktusani-Abietetum nephrolepidis Kolbek, Jarolímek & Valachovič 2003
(Tab. 7: C)
NT Kolbek et al. (2003a): Table 8.3, relevé 13
SM This association combines coniferous forests with various proportions of *Larix olgensis* and *Abies nephrolepis* in both the tree and shrub layers. It is relatively species-rich and well-differentiated from the other associations. The cover of the tree layer varies between 50 and 90 % (A74) and the shrub layer between 5 and 45 % (A22). *Abies nephrolepis* penetrates into various communities of coniferous forest, but in this association, plays the role of dominant or subdominant. The dominant tree species determines the floristic composition and cover of the herb layer which attains 20–90 % (A63). Number of vascular plants varies between (10)23 and 46 (A28). *Ptilium crista-castrensis* and *Pleurozium schreberi* dominate in the thick moss layer with cover of 40–95 % (A80).
V Within the association, three subassociations are distinguished:
1. iridetosum dichotomae Kolbek, Jarolímek & Valachovič 2003

2. phegopteridetosum polypodioidis Kolbek, Jarolímek & Valachovič 2003
3. lycopodietosum complanati Kolbek, Jarolímek & Valachovič 2003
SE This association was found at altitudes of 1360–1450 m, on plains or slightly sloping relief (up to 5°). The soils are rather acidic (pH ± 3.8), poor in carbon and calcium. The anion content is low.
D This association is a transitional unit between the light larch forests and the dark taiga (represented in North Korea by Goodyero-Piceetum jezoensis, see above) found in the Changbaishan Mountains.
MI The stands are individually and selectively cut.
C In Nakamura et al. (2007), similar communities were classified in Abieti-Piceetalia jezoensis Miyawaki, Ohba & Okuda 1968 or Abieti nephrolepidis-Piceion jezoensis Song 1991. Gumarova (1993) published on Sikhote-Alin communities dominated by *Abies nephrolepis*.
REF Šrůtek et al. (2003b)

Ledo decumbentis-Laricetum olgensis Kolbek, Jarolímek & Valachovič 2003
(Tab. 7: D)
NT Kolbek et al. (2003a): Table 8.4, relevé 6
SM *Larix olgensis* dominates in the tree layer, with a high constancy of *Betula platyphylla* as well. Tree cover varies between (5)20 and 75 % (A47). The stands are thin and light. The same species, together with *Lonicera edulis*, thus constitutes a rich shrub layer with cover of (5)20–75 % (A41). The cover of the herb layer is 30–90 % (A67). The most important role in the floristic composition of this community is played by species adapted to higher groundwater levels and species growing on repeatedly wet substrates, such as *Ledum decumbens*, *L. *maximum*, *Betula platyphylla*, *Dianthus superbus*, *Salix arctica*, *Achillea ptarmica*, *Sanguisorba parviflora*, *Rhododendron parvifolium*, and *Vaccinium uliginosum*. The number of vascular plants varies between 12 and 35 (A22). Moss and lichens create a thick layer with cover of 20–95 % (A71).
V Within the association, four subassociations are distinguished:
1. linnaeetosum borealis Kolbek, Jarolímek & Valachovič 2003
2. potentilletosum cryptotaeniae Kolbek, Jarolímek & Valachovič 2003
3. brometosum jezoensis Kolbek, Jarolímek & Valachovič 2003
4. betuletosum paishanensis Kolbek, Jarolímek & Valachovič 2003
SE Stands of this association occupy large areas. They usually occur on plateaus or very gentle slopes, on slightly undulating terrain with depressions, and with higher groundwater levels. This community typically develops at altitudes between 1190 and 1400(1600) m. Only smaller stands are found on plains or in depressions at higher elevation. The soils are rather acidic (pH 4.2–4.8) and poor in carbon and calcium. In similar stands, Dostálek (1995) gave acidity levels between pH 4.6 and 5.6. Both the C:N and Ca:Mg ratios are balanced. The anion content is low.
D The lowest belt of forests dominated by *Larix olgensis* lies in the high mountains near Paektusan volcano near Samjiyon Lake, which naturally keeps a higher groundwater level.
MI The stands of Ledo-Laricetum at the lowest elevations of the *Larix olgensis*-dominated forest are significantly affected by human activities. People systematically cut some tree species, mainly *Larix olgensis*. The resulting canopy gaps permit greater development of the shrub layer. It is curious, however, that lumbering does not affect the structure and floristic composition of the community very much. Reconstruction of the community, up to the subassociation level, is possible even at heavily impacted locations around villages.
C In Nakamura et al. (2007), similar communities were classified in Ledo palustris-Laricetalia cajanderi Ermakov 2004 or Ledo palustris-Laricion cajanderi Ermakov 2004.
REF Ermakov (2004)

ALL Rhododendro dahurici-Acerion barbinervi Kolbek, Jarolímek & Valachovič 2003
NT Polysticho retroso-paleacei-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003; see below: Dryopterido fragranti-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003 corr. Kolbek & Jarolímek
The alliance comprises the shrub and mantle communities of coniferous and deciduous forests at higher altitudes of eastern Asia. The tree layer usually does not exceed 30 % cover. The shrub layer often has a high cover, but there are also stands with low shrub layer cover, which can physiognomically be called mantle communities. Due to regular soil cultivation for agriculture, natural shrub and mantle communities occur only sporadically in the landscape. Such communities develop regularly as forest mantles, however, in less accessible mountains and higher hill country, on sites rather remote from settlements, or in habitats where forests are edaphically hindered. Their occurrence around talus and rocks is edaphically conditioned and represents disclimax stages of primary succession. In the northern part of the Korean Peninsula, this alliance is represented by only one recently identified association.

Dryopterido fragranti-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003 nom. corr. Kolbek & Jarolímek hoc loco
(Original name: Polysticho retroso-paleacei-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003)
(Tab. 7: E)
Note: According to the new determination handbooks (Lee T.-B. 1999, 2003, Oh & Pak 2001, Anonymous 2005, Lee Y.-N. 2006, Park 2007), the determination of the fern *Polystichum retroso-paleaceum* giving the association name Polysticho retroso-paleacei-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003 is wrong. The right name of the fern is *Dryopteris fragrans* (L.) Schott and the name of the association must be corrected as follows: Dryopterido fragranti-Rhododendretum dahurici Kolbek, Jarolímek & Valachovič 2003 nom. corr. Kolbek & Jarolímek (Weber et al. 2000, Art. 43).
NT Kolbek et al. (2003a): Table 8.5, relevé 3
SM Stands of this community are dense shrub thickets mainly of *Rhododendron dahuricum* accompanied by *Betula platyphylla*, *Acer barbinerve*, etc. Trees occur only occasionally (*Larix olgensis*, *Betula platyphylla*, rarely *Sorbus amurensis* and *Abies nephrolepis*), with a low canopy of 5–45 % (A17) cover. The shrub layer cover can reach 5–90 % cover (A50). The herb layer with cover of 5–90 % (A50) consists of *Ledum *maximum*, *Dryopteris fragrans*, *Polypodium viriginianum*, *Lycopodium clavatum*, *L. chinensis*, *Camptosorus sibiricus*, and *Lepisorus ussuriensis*. The number of vascular plants varies between 11 and 21 (A17). The moss and lichen layers are physiognomically important, with regularly high cover of 80–95 % (A94). *Sphagnum girgensohnii*, *Pleurozium schreberi*, *Ptilium crista-castrensis*, and *Hylocomium splendens* are the most abundant species. *Cladonia *grisea*, *C. amarocraea*, and *Oncophorus wahlenbergii* occur with high constancy.
V The association is divided into two subassociations:
1. ledetosum maximi Kolbek, Jarolímek & Valachovič 2003
2. sorbetosum amurensis Kolbek, Jarolímek & Valachovič 2003
SE This is a synecologically conditioned shrub community exclusively related to ventarol cracks at the margins of lava flows. Stands grow at altitudes of 950–1000 m, on 30–40° slopes with northern, northeastern or northwestern orientation on boulders on the mountainside. The soil in one sample was very acidic (pH 3.8), as can be expected nearby volcanic vapours containing sulphur dioxide.
D All stands of this association were found around the village of Naegok in the Changbaishan Mountains. This association would be expected along lava flows at the foot of volcanoes in North Korea and China.
MI In these stands, no human impact was observed.
C Similar ventarol-bound communities are not described from other volcano areas of Northeast Asia.

ALL Abieti nephrolepidis-Piceion jezoensis Song 1991
This alliance includes isolated subalpine coniferous forests in northeastern Asia (cf. Song 1991a, 1992a). In Korea, these communities occur at the highest summits in the central and southern parts of the country. More northern areas have developed continental coniferous forests, described here as the new alliance Laricion olgensis. The alliance is determined by the presence of the species *Acer ukurundense*, *A. tschonoskii*, *Lonicera sachalinensis*, *Rhododendron schlippenbachii*, *Syringa wolfi*, *Thuja koraiensis*, *Tripterygium regelii*, and *Vaccinium koreanum*, whereas typical boreal species of the Vaccinio-Piceetea are almost absent. In North Korea, Li & Li (1986) have described the communities Abieto-Piceetea jezoensis in the Myohyangsan Mountains at an altitude of 1100–1600 m, but without typification and with incomplete floristic composition of the phytocoenological relevés.

Taxo-Pinetum pumilae Song & Nakanishi 1985
(Tab. 7: F)
SM In the dense shrub stands with cover of the shrub layer at 30–100 % (A72) *Pinus pumila* dominates, with lower abundance of *Thuja koraiensis* and *Rhododendron aureum*, solitary individuals of *Betula ermanii* and *Syringa wolfi*, and rarely *Abies nephrolepis*. *Thuja koraiensis*, *Tripterygium regelii*, *Lonicera sachalinensis*, and *Acer tschonoskii* are characteristic species of higher syntaxa. The height of dwarf pine shrubs is around 50–120 cm. The herb layer with 10–90 % (A43) cover is species poor, frequently with only *Calamagrostis *hirsuta.* The number of vascular plants varies between (5)35 and 38 (A26). A well-developed moss layer with cover of 0–40 % (A15) was not determined.
V Okitsu & Ito (1984, 1989) and Okitsu (1998) consider *Pinus pumila* to be a unique species growing well in habitats with sufficient snow cover during long winters. At lower elevations and in more protected places, *Pinus pumila* can be replaced by growth with isolated stunted *Betula ermanii* and open forest dominated by *Picea jezoensis*. *Betula ermanii* might have been the only competitor for the niche of *Pinus pumila* (Okitsu & Ito 1989), especially on substrates with a layer of fine soil. *Pinus pumila* strongly dominates on rocky substrates.
SE The stands are open and occupy windy, cold, dry habitats, typical of the highest mountain ridges and summits on the western and southwestern slopes with an inclination of 10–37° and on the tops of hills from 1750 to 1870(1890) m a.s.l. The soil is moderately acidic (pH 4.5–5.1) and apparently possesses a good buffering capacity, which is manifested in the small differences between the actual and exchangeable acidity. The upper soil horizon is

richer in nutrients of organic origin, especially potassium, phosphorus, nitrogen, and nitrates. The ratio of calcium to magnesium is favourable, even in the lower layers of the profile.
D In North Korea, the community was recorded only on Mt. Wonmanbong and Mt. Pirobong (Myohyangsan Mountains). According to personal communications with Korean colleagues from Pyongyang, similar stands have been found near the Chinese boundary.
MI Direct human impact was not observed.
C This association was described by Song & Nakanishi (1985) from similar ecological conditions on Mt. Sulak (= Sorak, Soelag) in South Korea. They characterised the dominant dwarf pine as a cold-resistant, cryophilic, but chionophobic taxon with very narrow ecological amplitude. A different association, Vaccinio-Pinetum pumilae Maeda & Shimazaki 1951, as well as higher syntaxa, are known from Japan (Miyawaki 1986, 1987). The rare endemic *Taxus caespitosa* does not occur in North Korea, but as a whole, the physiognomy of this community is very similar. Generally, *Pinus pumila* stands do not correspond in species composition to the krummholz belt of Europe, despite the physiognomic similarity and frequent occurrence at the tree line. In North Korea, Li & Li (1986) occur in the Myohyangsan Mountains at an altitude of 1600–1800 m; this community was characterised by the species composition but without phytocoenological relevés.
REF Saito (1979), Song (1991a, 1992a, 2001a), Grishin et al. (1996), Kong (2000), Kolbek et al. (2003a)

Thujo koraiensis-Piceetum jezoensis Kolbek, Jarolímek & Valachovič 2003
(Tab. 7: G)
NT Kolbek et al. (2003a): Table 8.6, relevé 5
SM Typical stands are characterised by a canopy of *Picea jezoensis*, sometimes also with *Abies nephrolepis* and with a maximum tree layer coverage of 50 %. The shrub layer covers 30–60 % (A43) and is constituted by spruce and *Betula ermanii*, with *Thuja koraiensis* common in the lower layer. The alliance species, such as *Acer ukurundense* and *Rhododendron schlippenbachii,* are present in higher quantities. The herb layer, with cover of 60–95 % (A75), is richer and more diverse, formed partly by heliophilic grasses and partly by elements of subalpine meadows, such as *Scabiosa *alpina*, *Ligularia fischeri*, *Anemone narcissiflora*, *Calamagrostis *hirsuta*, and *Clintonia udensis*. The number of vascular plants varies between 23 and 46 (A31). The cover of the moss layer varies from 0 to 85 % (A35).
V In some relevés, *Calamagrostis *hirsuta* and *Rhododendron schlippenbachii* are missing.
SE This association has been found at altitudes between 1630 and 1755 m, on slopes from 15 to 55° oriented from south to north-northwest on sites with shallow soil. The soil is acidic (pH 3.9–4.9) and relatively poor, with a distinct decrease in nitrogen, nitrates, calcium, and magnesium in the lower layer. The deeper part of the horizon is more alkaline; acidification of the upper soil results from decomposition of the acidic leaf litter.
D This community represents a transition zone between the *Pinus pumila* thickets and the forests below the main mountain ridge of the Myohyangsan Mountains. Characteristic stands occur above tree line or closely below it, where the tree layer is not closed but forms open stands with good light conditions for the lower layers. This is analogous to the stands of *Pinus pumila* at higher elevations.
MI This unit is distributed at higher altitudes and therefore human influence is insignificant.
C Song (1991a) published a similar association Thujo-Abietetum nephrolepidis on Mt. Sulak and Mt. Taebaek in central Korea. *Rhododendron *roseum*, *Alnus mandshurica*, and a high constancy of *Abies nephrolepis* differentiate this association, while *Picea jezoensis* is not present.
REF Li & Li (1986), Song (2001)

Artificial forest and shrub communities

CL Robinietea Jurko ex Hadač & Sofron 1980 (Tab. 8: A)
OR Chelidonio-Robinietalia Jurko ex Hadač & Sofron 1980
ALL Chelidonio-Robinion Hadač & Sofron 1980
Artificial forests are dominated by the alien tree species *Robinia pseudo-acacia* with numerous other alien herbs. In the Korean Peninsula, only one unit has been distinguished so far.

Commelino communis-Robinietum pseudoacaciae Cho & Kim 2005
(Tab. 8: A)
SM Stands of the community are species-rich with an open canopy. The number of species varies between 26 and 40 (A34). The cover of the tree layer, dominated by *Robinia pseudo-acacia*, varies from 65 to 80 % (A73), the shrub layer from 20 to 75 % (A52) and the herb layer from 20 to 80 % (A59). Among the aliens, *Erigeron annuus*, *E. canadensis*, *Chenopodium album*, and *Ambrosia artemisifolia* are the most frequent.
V Probably due to the low number of samples and localities, the community is relatively homogeneous. Twenty-one species attain a frequency 50 % or more. Relevés from North Korea contain most of the differential species of the subassociation Commelino-Robinietum pinetosum densiflorae Cho & Kim 2005, e.g. *Pinus densiflora*, *Spodiopogon sibiricus*, and *Erigeron annuus*.
SE Relevés were made at habitats of the original forests dominated by *Quercus mongolica*, *Q. acutissima*, and *Pi-*

nus densiflora on loamy soils, on the alluvia of small rivers, and calcareous slate outcrops visible on the surface. Stands of black locust grow on modest slopes of 15–25° inclination with various orientations, except toward the north. The age of stands is approximately 30–50 years.
D This community is scattered to rare in the capital city of Pyongyang and its surroundings (near the village Dzunghoa south of Hedju). Small stands were observed in the Kumgangsan Mountains and beside the Ponghari monument near the Taedonggang River.
MI North Korean black locust tree forests represent secondary forests alternating with the original oak or oak-pine forests.
C In South Korea, *Robinia pseudo-acacia* forests occur more often and they are more frequently described in the literature. Authors describing this association distinguished within the unit six subassociations from South Korea. The floristic composition of the Japanese stands is not compatible with this association or other similar stands with *Robinia pseudo-acacia* in the Korean Peninsula.
REF Yim & Jeon (1980), Miyawaki (1981), Song (1992b, 2001a), Song & Kim (1993), Song & Song (1996), Lee (1997), Cho et al. (1999), Cho & Kim (2005), Kolbek & Jarolímek (2008)

CL Rhamno-Prunetea Rivas-Goday & Borja Carbonell ex R. Tx. 1962 (Tab. 8: B)
OR Sambucetalia racemosae Oberdorfer ex Passarge in Scamoni 1963
ALL Arctio-Sambucion nigrae Doing 1962 (syn. Balloto-Sambucion nigrae Jurko 1963, Balloto-Sambucion Passarge 1978)
Communities of nitrophilous shrubs and herbs and artificial hedgerows in the cities.

Lycium chinense community sensu Kolbek & Jarolímek (2008)
(Tab. 8: B)
SM This shrub community is dominated by *Lycium chinense*. Another 12 shrubs with low abundance participate in forming stands. The total cover varies from 75 to 100 % (A89). The herb layer contains many different species, but with low cover of some species. The cover of the herb layer varies from 10 to 40 % (A24). The number of species attains 14–24 (A19). Most of them are weeds penetrating into shrubs from the surrounding ruderal and segetal vegetation. Only the species *Humulus japonica* and *Cocculus trilobus* occur in both natural and artificial stands.
V The *Lycium chinense* community includes both natural and artificial stands. Artificial shrub stands are rich in species. They are heterogeneous in species composition. On the other hand, the natural riverside stands are species-poor with a simple structure in the shrub layer and several herbs in the undergrowth.
SE Most of the species are helio- and nitrophilous and usually grow in disturbed habitats. The stands are not hoed or weeded and provide suitable space for the ecesis of synanthropic species and species of open habitats. The inclination of habitats does not exceed 10°.
D This community is common in settlements, e.g. in the villages of the Kumgangsan Mountains and in the city of Hedju. Similar stands are observed in the capital, Pyongyang. Natural stands with the occurrence of *Lycium chinense* are located on riversides in the Kumgangsan Mountains.
MI These stands are typical of the margins of some gardens and public parks in villages and cities. Artificial stands are regularly cut. More natural stands occur in complexes of riverside vegetation.
C The floristic composition of similar stands is weakly known only from South Korea from two relevés.
REF Song & Song (1996), Song (2001a)

Note: Forest edge communities of the class Rosetea multiflorae Ohba, Miyawaki & Tüxen 1973 may be found in North Korea, as they have been described in South Korea (e.g. Jung & Kim 1998).

Terrestrial ruderal vegetation

CL Stellarietea mediae R. Tüxen et al. in R. Tüxen 1950 ex von Rochow 1951 (Tab. 9: A–C)
OR Commelinetalia Miyawaki 1969
ALL Cosmo-Humulion japonicae Kolbek & Sádlo 1996
NT The name-giving species of this alliance are the relatively slender East Asian liana *Humulus japonica* and the physiognomically conspicuous neotropical neophyte *Cosmos bipinnata*, which grow very frequently in Korea and also frequently escape from cultures into the wild. This alliance includes three communities of dumps and similar non-trampled habitats (as well as one association and two communities of weeds in crop fields; see the following section "Weed field vegetation").

Beckmannio eruciformis-Potentilletum costatae Kolbek & Sádlo 1996
(Tab. 9: A)
NT Kolbek & Sádlo (1996): Table 1, relevé 3
SM The stands are small and often very patchy. The cover of the herb layer varies between 35 and 100 % (A70). Mosses cover 0–15 % (A4), but were missing in about half of the relevés. The number of species in each relevé varies in a broad range of 9–36 (A18). In the pre-monsoon phenophase, the stands are two-layered with dominating *Potentilla *costata* or *Rorippa palustris* in the lower herb layer reaching up to 20 cm. The gappy upper herb layer reaching up to 1 m consists of *Chenopodium* sp. div., *Erigeron canadensis*, and *Beckmannia erucaeformis*. Some

Table 8. Artificial forest and shrub communities.
A – Commelino communis-Robinietum pseudoacaciae; B – Lycium chinense community

	Community	A	B
	Number of relevés	6	6
	Average number of species	34	18
	Commelino communis-Robinietum pseudoacaciae, Chelidonio-Robinion, Robinietea		
T	*Robinia pseudo-acacia*	**100^{45}**	0$^{..}$
S	*Robinia pseudo-acacia*	**100^{a4}**	0$^{..}$
	Carex lanceolata	**100^{+a}**	0$^{..}$
	Persicaria mitis	**83ra**	0$^{..}$
	Rubus parvifolius	**83^{+1}**	17^{11}
	Lactuca raddeana	**67^{++}**	0$^{..}$
	Viola mandshurica	**67^{r1}**	0$^{..}$
	Robinia pseudo-acacia	**67^{+a}**	0$^{..}$
	Diarrhena japonica	**67^{a4}**	0$^{..}$
	Carduus crispus	**67^{r1}**	0$^{..}$
	Cleistogenes hackelii	**67^{1a}**	0$^{..}$
	Chrysanthemum indicum	**67^{1a}**	0$^{..}$
	Rubus crataegifolius	**50^{+a}**	0$^{..}$
	Calamagrostis arundinacea	**50^{r1}**	0$^{..}$
	Ambrosia artemisifolia	**50^{r+}**	0$^{..}$
	Agrimonia pilosa	**50^{++}**	0$^{..}$
	***Lycium chinense* community**		
S	*Lycium chinense*	0$^{..}$	**100^{45}**
	Erigeron canadensis	33^{rr}	**100^{+1}**
	Artemisia asiatica	17^{++}	**67^{+a}**
S	*Ailanthus altissima*	0$^{..}$	**50^{+a}**
	Other species		
	Commelina communis	**100^{+a}**	**83ra**
	Erigeron annuus	**100^{+a}**	50^{r1}
	*Agropyron *transiens*	**100ra**	50^{+a}
	Humulus japonica	**83^{+a}**	50^{aa}
	Chenopodium album	**67ra**	**100^{+a}**
	Chelidonium majus	**67^{+1}**	33^{aa}
	Capsella bursa-pastoris	50^{+1}	17^{rr}
	Leonurus sibiricus	50^{+1}	17^{rr}
	Melica turczaninowiana	33^{aa}	0$^{..}$
T	*Quercus acutissima*	33^{1a}	0$^{..}$
	Galium aparine	33^{1a}	0$^{..}$
	Torilis japonica	33ra	0$^{..}$
	Oenothera biennis	33^{+1}	17^{rr}
	Dontostemon dentatus	33^{+1}	0$^{..}$
	Potentilla fragarioides	33^{+1}	0$^{..}$
	Spiraea prunifolia	33^{+1}	0$^{..}$
	Oxalis stricta	33^{++}	0$^{..}$
S	*Quercus acutissima*	33^{++}	0$^{..}$
S	*Spiraea prunifolia*	33^{++}	0$^{..}$
	Lactuca bungeana	33^{++}	0$^{..}$
	Carpesium sp.	33^{++}	0$^{..}$
	Pinus koraiensis	33^{++}	0$^{..}$
S	*Euonymus alata*	33^{++}	0$^{..}$
	Ixeris polycephala	33^{++}	0$^{..}$
	Carex sp.	33^{++}	0$^{..}$
	Hemistepta lyrata	33^{++}	0$^{..}$
	Chylocalyx perfoliatus	33^{r+}	0$^{..}$
	Fagara schinifolia	33^{r+}	0$^{..}$
S	*Fagara schinifolia*	33^{r+}	0$^{..}$
	Euonymus alata	33^{r+}	0$^{..}$
S	*Quercus dentata*	33^{r+}	0$^{..}$
	Duchesnea indica	33^{r+}	0$^{..}$
	Lactuca indica	33^{r+}	0$^{..}$
	Poa compressa	33^{r+}	0$^{..}$
S	*Morus alba*	17^{11}	17^{11}
S	*Parthenocissus tricuspidata*	17^{++}	17^{++}
	Chylocalyx senticosus	17^{++}	17^{11}
	Myosoton aquaticum	17^{++}	17^{++}
	Orthodon punctatum	17^{rr}	50^{r+}
	Chenopodium ficifolium	17^{rr}	33^{rr}
	Artemisia capillaris	17^{rr}	17^{rr}
S	*Diospyros lotus*	0$^{..}$	33^{aa}
S	*Acer negundo*	0$^{..}$	33^{1a}
S	*Ligustrum ovalifolium*	0$^{..}$	33^{+1}
	Poa pratensis	0$^{..}$	33^{+1}
	Kochia scoparia	0$^{..}$	33^{+1}
	Xanthium strumarium	0$^{..}$	33^{+1}
	Setaria viridis	0$^{..}$	33^{++}
	Senecio vulgaris	0$^{..}$	33^{++}
	Plantago asiatica	0$^{..}$	33^{r+}
	Ricinus communis	0$^{..}$	33^{rr}
	Lepidium apetalum	0$^{..}$	33^{rr}
	Bidens tripartita	0$^{..}$	33^{rr}
	Number of accessoric species	39	29

hydrophilous species (mostly from the class Bidentetea) also occur regularly, with variable cover. *Potentilla supina* subsp. *costata* was only recently recognised as a separate taxon (Soják 1987, Dostálek et al. 1989). In Europe, the vicariant subspecies of *Potentilla supina* subsp. *supina* occurs in habitats with fluctuating soil moisture and slightly saline soils (e.g. Oberdorfer 1983).

V The variable cover of *Potentilla *costata*, *Rumex crispus*, *Persicaria lapathifolia*, *Bidens frondosa*, *Chenopodium glaucum*, and *Plantago asiatica* plays an important role in the synmorphology of stands.

SE The stands of the association are found on the fringes of water pools, in flat depressions on compacted soils such as at building sites, and on loamy and gravelly substrata. The stands often develop over a long period of time in the limose and littoral ecophases (for the definitions of ecophases, see Hejný 1960). Periodic disturbances caused by truck wheels and/or by temporary ex-

tensive trampling are a characteristic feature of this community. The community is found at an altitude of 40–50 m on plains or on slopes up to 29°.
D This community is found only in Pyongyang.
MI Occasional but extensive trampling maintains the structure of the stands and gaps in cover.
C This community is not yet known from other localities and countries. In Japan, Miyawaki & Okuda (1972) described three similar or related communities: Beckmannio-Veronicetum undulatae, Stellario-Ranunculetum cantoniensis, and Alopecuro-Ranunculetum scelerati.
REF Sádlo & Kolbek (1997)

Daturo tatulae-Siegesbeckietum pubescentis Kolbek & Sádlo 1996
(Tab. 9: B)
NT Kolbek & Sádlo (1996): Table 2, relevé 4
SM The ruderal community of quickly growing annual weeds achieves 60–100 % (A88) cover of the herb layer. Dense stands are relatively rich in species (10–32, A20). The lower herb layer with the species *Commelina communis*, *Siegesbeckia pubescens*, and *Xanthium strumarium* s.l. attains a height of about 25 cm. In the upper herb layer (reaching over 1 m), *Chenopodium album*, *Datura tatula*, and *Kochia scoparia* occur most frequently. The moss layer was missing in half of the relevés; in the rest, it attained maximally 15 % cover.
V In some relevés, the dominant species *Datura tatula* was missing, but the species composition was relatively stable.
SE During the pre-monsoon period, the stands form small dense patches. The community is found at an altitude of 10–100 m on plains or on slopes up to 20°. The community colonises dumps of household garbage kept as compost and/or as a substrate for vegetables. The garbage is refilled, trenched and dug over. The substrate contains rotting plant and animal remains, ash, and industrial waste. The stands are disturbed when the garbage is replenished or by weeding of the vegetables. The development of the stands is quite rapid.
D This community is found in the towns of Hedju, Pyongyang, and Wonsan, and in the village of Onjongri (Kumgangsan Mountains).
MI In some stands, crop plants, e.g. *Perilla frutescens*, *Oenanthe decumbens*, *Ricinus communis*, *Zea mays*, and *Spinacia oleracea* are cultivated in small weeded gaps or grow spontaneously.
C This is a newly described community without other references.
REF Sádlo & Kolbek (1997), Song (2001a)

Humulo japonicae-Chenopodietum albi Kolbek & Sádlo 1996
(Tab. 9: C)
NT Kolbek & Sádlo (1996): Table 3, relevé 5
SM Among the described ruderal communities, this syntaxon is the most widely delimited. Various dominant species and structural heterogeneity of analysed stands is an apparent feature of the community. The stands, medium-rich in species (6–33, A16), cover large abandoned areas. They are mostly closed, high, and two-layered. The lower herb layer (below 20 cm) is usually sparse, excepting stands with dominating *Humulus japonica* creeping over the soil surface. The higher herb layer reaches to 150 cm. The cover of the herb layer varies between 35 and 100 % (A86). The moss layer is missing. The species *Chenopodium* sp. div., *Cosmos bipinnata*, *Humulus japonica*, and *Chylocalyx perfoliatus* frequently play the role of dominant species and they alternate in particular stands. The changing pattern of dominance is responsible for the heterogeneity in the species composition. No evident influence of the habitat conditions was found on this heterogeneity. As the most typical stands of the association, we consider the stands dominated by the name-giving species.
V The species *Myosoton aquaticum*, *Erigeron canadensis*, *E. annuus*, *Persicaria cochinchinensis* etc. are frequent subdominants and co-influence the synmorphology of the stands.
SE The community is found at an altitude of 30–110 m on plains or on slopes up to 35°. The habitats are on loamy and loam-sandy ground piled up in the vicinity of building sites, heaps of earth along excavations or trenches, banks and gravelly alluvium of brooks, road edges, bare ground emerging due to levelling, abandoned ruderal sites along a field, and rarely also rubbish dumps.
D This community is found in the towns of Pyongyang, Wonsan, and Hyangsan (at the foot of the Myohyangsan Mountains), and in the village of Onjongri (Kumgangsan Mountains).
MI The habitats are affected by disturbances due to building activity, by mowing or large-scale weeding of whole stands, by local trampling, and by fertilisation with excrement. The additional sowing of *Cosmos bipinnata*, *Pharbitis nil*, or *Consolida orientalis* into the stands occurs specifically in the spring and the subsequent weeding out of other species possibly occurs as well. In other places, paradoxically, all dicotyledons are weeded from the stands, whereas the annual weed grasses (*Echinochloa crusgalli* and *Setaria* sp. div.) are left.
C Even though this is a rather frequent community in cities and villages, it has probably been neglected.
REF Sádlo & Kolbek (1997), Song (2001a)

CL Plantaginetea majoris R. Tüxen & Preising in R. Tüxen 1950 (Tab. 9: D–J)
OR Plantaginetalia asiaticae Miyawaki 1964
ALL Plantaginion asiaticae Miyawaki et al. 1971
This alliance comprises communities of trampled habitats with considerable disturbance. They are mostly sunny or slightly shaded and stands are tolerant to variable content of the soil water. The communities are analogous units of

Table 9. Terrestrial ruderal vegetation.
A – Beckmannio eruciformis-Potentilletum costatae; B – Daturo tatulae-Siegesbeckietum pubescentis; C – Humulo japonicae-Chenopodietum albi; D – Artemisio asiaticae-Plantaginetum asiaticae; E – Bryo-Saginetum japonicae; F – Plantagini depressae-Polygonetum avicularis; G – Euphorbio maculatae-Centipedetum minimae; H – Digitario pectiniformis-Eleusinetum indicae; I – Setario viridis-Chlorisetum virgatae; J – Plantagini asiaticae-Poetum pratensis; K – Digitario ciliaris-Zoysietum japonicae; L – Eragrostietum ferrugineae

Community	A	B	C	D	E	F	G	H	I	J	K	L
Number of relevés	12	16	30	10	3	21	19	18	10	14	44	1
Average number of species	18	20	16	10	20	13	14	12	14	9	15	14
Beckmannio eruciformis-Potentilletum costatae												
*Potentilla *costata*	**100**$^{+3}$	0$^{..}$	20^{r1}	10^{++}	*0*$^{..}$	**57**^{r5}	32^{++}	44^{+1}	20^{r+}	0$^{..}$	0$^{..}$	*0*$^{..}$
Rorippa palustris	**100**$^{+a}$	0$^{..}$	13^{r+}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Rumex crispus	**92**^{ra}	0$^{..}$	20^{r+}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Beckmannia erucaeformis	**75**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Alopecurus geniculatus	**58**$^{+a}$	0$^{..}$	3^{++}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{++}	*0*$^{..}$
Carex neurocarpa	**33**$^{+1}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Rumex maritimus	**33**^{r1}	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Agropyron ciliare	**25**$^{++}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Rorippa cantoniensis	**25**$^{++}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	11^{11}	0$^{..}$	10^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$
Ranunculus sceleratus	**25**$^{r+}$	0$^{..}$	3^{rr}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Ranunculus chinensis	**17**$^{r+}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Mentha arvensis	**17**$^{r+}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Daturo tatulae-Siegesbeckietum pubescentis												
Solanum nigrum	0$^{..}$	**94**^{ra}	3^{rr}	0$^{..}$	*1*$^{++}$	14^{++}	21^{r+}	11^{r+}	10^{rr}	14^{rr}	0$^{..}$	*0*$^{..}$
Persicaria mitis	8^{rr}	**69**^{ra}	37^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	7^{++}	0$^{..}$	*0*$^{..}$
Orthodon punctatum	0$^{..}$	**63**$^{+a}$	10^{r+}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
Datura tatula	0$^{..}$	**38**^{r4}	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Lycium chinense	0$^{..}$	**25**^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Abutilon theophrastii	0$^{..}$	**19**^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Oxalis stricta	0$^{..}$	**19**$^{r+}$	0$^{..}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
Humulo japonicae-Chenopodietum albi												
Ambrosia artemisifolia	0$^{..}$	0$^{..}$	**57**^{r3}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	10^{++}	0$^{..}$	0$^{..}$	*0*$^{..}$
Lactuca bungeana	8^{rr}	0$^{..}$	**43**^{ra}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
Chylocalyx perfoliatus	0$^{..}$	0$^{..}$	**27**^{r3}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Chrysanthemum indicum	0$^{..}$	0$^{..}$	**27**^{ra}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Cosmo-Humulion japonicae, Commelinetalia communis, Stellarietea mediae												
Bidens frondosa	**50**$^{+4}$	**44**^{r1}	**13**$^{r+}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Myosoton aquaticum	**42**^{ra}	**6**^{aa}	**30**$^{+a}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	7^{++}	0$^{..}$	*0*$^{..}$
Hemistepta lyrata	**42**^{r1}	**0**$^{..}$	**20**^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	5^{rr}	*0*$^{..}$
Persicaria lapathifolia	**33**^{r3}	**13**$^{+a}$	**7**$^{r+}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Humulus japonica	**33**^{r1}	**56**$^{+3}$	**80**$^{+5}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
Artemisia annua	**25**$^{r+}$	**0**$^{..}$	**7**^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Xanthium strumarium	**25**$^{r+}$	**44**$^{+3}$	**3**$^{++}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	11^{rr}	0$^{..}$	14^{r1}	0$^{..}$	*0*$^{..}$
Commelina communis	**25**$^{r+}$	**94**$^{+3}$	**37**$^{+a}$	10^{rr}	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	5^{rr}	*0*$^{..}$
Artemisia feddei	**17**$^{+1}$	**6**$^{++}$	**10**^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	2^{rr}	*0*$^{..}$
Rorippa atrovirens	**17**^{r1}	**19**$^{+1}$	**10**$^{r+}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	21ra	0$^{..}$	*0*$^{..}$
Cannabis sativa	**17**$^{++}$	**19**^{1a}	**17**$^{+a}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	6^{++}	0$^{..}$	0$^{..}$	2^{++}	*0*$^{..}$
Cosmos bipinnata	**17**$^{r+}$	**19**$^{r+}$	**27**^{r5}	0$^{..}$	*0*$^{..}$	0$^{..}$	11^{++}	6^{rr}	0$^{..}$	0$^{..}$	2^{++}	*0*$^{..}$
Trigonotis peduncularis	**17**$^{r+}$	**19**^{r1}	**33**^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	5^{++}	0$^{..}$	0$^{..}$	7^{++}	9^{r+}	*0*$^{..}$
Artemisia capillaris	**17**^{rr}	**31**$^{r+}$	**7**^{ra}	0$^{..}$	*0*$^{..}$	0$^{..}$	11^{++}	0$^{..}$	0$^{..}$	0$^{..}$	23^{r1}	*0*$^{..}$
Pharbitis nil	**8**$^{++}$	**19**$^{r+}$	**10**^{r1}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Bidens bipinnata	**8**$^{++}$	**25**^{ra}	**7**$^{+1}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Galium aparine	**0**$^{..}$	**25**$^{r+}$	**10**$^{r+}$	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Chelidonium majus	**0**$^{..}$	**6**^{rr}	**20**^{ra}	0$^{..}$	*0*$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$
Artemisio asiaticae-Plantaginetum asiaticae												
Persicaria hydropiper	8^{aa}	0$^{..}$	0$^{..}$	**60**^{r1}	*0*$^{..}$	0$^{..}$	5$^{+.}$	0$^{..}$	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$

Table 9. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L
Number of relevés	12	16	30	10	3	21	19	18	10	14	44	1
Equisetum arvense	8^{rr}	13^{rr}	$0^{\cdot\cdot}$	**30^{+1}**	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	6^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	11^{r+}	*$0^{\cdot\cdot}$*
Juncus decipiens	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**20^{11}**	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Bryo-Saginetum japonicae												
Sagina japonica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	10^{++}	*3^{12}*	$0^{\cdot\cdot}$	21^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	2^{aa}	*$0^{\cdot\cdot}$*
Mazus japonicus	8^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*3^{+2}*	$0^{\cdot\cdot}$	**63^{+1}**	11^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	7^{rm}	*$0^{\cdot\cdot}$*
Acalypha australis	$0^{\cdot\cdot}$	19^{r+}	7^{r+}	$0^{\cdot\cdot}$	*3^{11}*	5^{++}	21^{r1}	6^{++}	10^{rr}	7^{rr}	14^{r1}	*$0^{\cdot\cdot}$*
Viola mandshurica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	10^{++}	*3^{+1}*	5^{++}	26^{r+}	22^{r+}	20^{+1}	21^{r1}	**66^{+a}**	*$0^{\cdot\cdot}$*
Oxalis corniculata	8^{ra}	$0^{\cdot\cdot}$	3^{++}	40^{++}	*3^{+1}*	5^{++}	42^{+1}	11^{++}	$0^{\cdot\cdot}$	29^{+1}	9^{ra}	*$0^{\cdot\cdot}$*
Cardamine scutata	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	10^{++}	*2^{22}*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Duchesnea indica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*1^{11}*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	2^{rr}	*$0^{\cdot\cdot}$*
Persicaria nepalensis	$0^{\cdot\cdot}$	6^{++}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*1^{++}*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Plantagini depressae-Polygonetum avicularis												
Matricaria matricarioides	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	**24^{r+}**	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Euphorbio maculatae-Centipedetum minimae												
Centipeda minima	$0^{\cdot\cdot}$	6^{rr}	3^{11}	10^{++}	*2^{++}*	$0^{\cdot\cdot}$	**84^{+3}**	17^{+1}	20^{+1}	*7^{++}*	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Portulaca oleracea	8^{rr}	13^{+1}	3^{++}	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	33^{r1}	**79^{r2}**	50^{r1}	20^{+1}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Digitario pectiniformis-Eleusinetum indicae												
Eleusine indica	$0^{\cdot\cdot}$	6^{++}	$0^{\cdot\cdot}$	10^{rr}	*1^{++}*	$0^{\cdot\cdot}$	42^{r2}	**100^{24}**	**60^{+1}**	$0^{\cdot\cdot}$	2^{++}	*$0^{\cdot\cdot}$*
Setario viridis-Chlorisetum virgatae												
Chloris virgata	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	22^{++}	**100^{24}**	$0^{\cdot\cdot}$	5^{++}	*$0^{\cdot\cdot}$*
Chenopodium strictum	$0^{\cdot\cdot}$	19^{r1}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**30^{+1}**	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Cynodon dactylon	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	5^{++}	$0^{\cdot\cdot}$	**30^{++}**	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Plantagini asiaticae-Poetum pratensis												
Poa pratensis	8^{++}	25^{+1}	17^{r1}	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**79^{15}**	36^{ra}	*$0^{\cdot\cdot}$*
Poa annua	$0^{\cdot\cdot}$	25^{r1}	3^{rr}	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	19^{+2}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**79^{+4}**	2^{++}	*$0^{\cdot\cdot}$*
Paspalum thunbergii	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**21^{r1}**	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Digitaria ischaemum	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**14^{ra}**	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Plantaginion asiaticae, Plantaginetalia asiaticae, Plantaginetea majoris												
Plantago asiatica	**75^{ra}**	19^{++}	3^{++}	**100^{35}**	*3^{13}*	**$0^{\cdot\cdot}$**	**11^{+1}**	**22^{+1}**	**10^{rr}**	**64^{r3}**	32^{r+}	*1^{1}*
Digitaria sanguinalis agg.	8^{++}	25^{+a}	10^{r1}	**70^{r1}**	*3^{+2}*	**24^{+2}**	**95^{+2}**	**83^{+2}**	**83^{+3}**	**$0^{\cdot\cdot}$**	2^{++}	*$0^{\cdot\cdot}$*
Eragrostis multicaulis	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**10^{rr}**	*1^{11}*	**29^{+2}**	**100^{+4}**	**72^{+2}**	**70^{+2}**	**$0^{\cdot\cdot}$**	20^{+1}	*$0^{\cdot\cdot}$*
Cyperus microiria	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**10^{rr}**	*1^{++}*	**$0^{\cdot\cdot}$**	**63^{r+}**	**39^{++}**	**30^{r+}**	**$0^{\cdot\cdot}$**	20^{+1}	*$0^{\cdot\cdot}$*
Taraxacum officinalis	8^{rr}	$0^{\cdot\cdot}$	7^{r+}	**$0^{\cdot\cdot}$**	*1^{++}*	**62^{r1}**	**11^{++}**	**17^{r+}**	**50^{r+}**	**$0^{\cdot\cdot}$**	23^{r1}	*$0^{\cdot\cdot}$*
Euphorbia maculata	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	7^{+1}	**$0^{\cdot\cdot}$**	*$0^{\cdot\cdot}$*	**24^{+1}**	**79^{r3}**	**6^{rr}**	**60^{r1}**	**$0^{\cdot\cdot}$**	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*
Digitario ciliaris-Zoysietum japonicae												
Zoysia japonica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	**52^{+3}**	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	10^{11}	*7^{++}*	**98^{a5}**	*$0^{\cdot\cdot}$*
Kummerowia stipulacea	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	7^{r+}	10^{++}	*$0^{\cdot\cdot}$*	10^{+2}	$0^{\cdot\cdot}$	6^{rr}	20^{++}	$0^{\cdot\cdot}$	**77^{r3}**	*1^{1}*
Ixeris dentata	8^{rr}	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*1^{rr}*	14^{r+}	5^{++}	$0^{\cdot\cdot}$	20^{r1}	$0^{\cdot\cdot}$	**52^{ra}**	*$0^{\cdot\cdot}$*
Festuca ovina	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**30^{+3}**	*$0^{\cdot\cdot}$*
Carex botrychostigma	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**27^{+a}**	*$0^{\cdot\cdot}$*
Lespedeza daurica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**25^{ra}**	*$0^{\cdot\cdot}$*
Cassia nomame	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	3^{rr}	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	10^{11}	$0^{\cdot\cdot}$	**25^{r1}**	*$0^{\cdot\cdot}$*
Gentiana squarrosa	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**14^{+a}**	*$0^{\cdot\cdot}$*
Artemisia japonica	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**14^{r+}**	*$0^{\cdot\cdot}$*
Eragrostietum ferrugineae												
Eragrostis ferruginea	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	20^{+1}	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	33^{+1}	$0^{\cdot\cdot}$	**29^{+3}**	30^{+a}	*1^{4}*
Zoysion japonicae, Caricetalia nervatae, Miscanthetea sinensis												
Digitaria ciliaris	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	*$0^{\cdot\cdot}$*	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	$0^{\cdot\cdot}$	**36^{+3}**	**45^{+3}**	*$0^{\cdot\cdot}$*

Table 9. cont.

Community	A	B	C	D	E	F	G	H	I	J	K	L
Number of relevés	12	16	30	10	3	21	19	18	10	14	44	1
Potentilla chinensis	0··	0··	0··	0··	*0*··	5^{rr}	0··	0··	0··	0··	**34^{r1}**	***1^{+}***
Lespedeza hedysaroides	0··	0··	0··	0··	*0*··	0··	0··	0··	0··	0··	**14^{++}**	***1^{+}***
Rumex acetosella	0··	0··	0··	0··	*0*··	0··	0··	0··	0··	0··	**11ra**	*0*··
Digitaria violascens	0··	0··	0··	0··	*0*··	0··	0··	0··	0··	0··	**9^{+a}**	***1^{+}***
Other species												
Chenopodium album	**75ra**	**94^{+3}**	**97^{r5}**	10^{++}	***1^{rr}***	**81^{r2}**	26^{r+}	50^{r1}	40^{++}	14^{++}	14^{r+}	*0*··
Polygonum aviculare	**67ra**	38ra	30^{r+}	40^{+1}	*0*··	**86^{+5}**	26^{+1}	**72^{r3}**	**70^{r3}**	**64^{r3}**	2^{rr}	*0*··
Erigeron canadensis	**58^{+a}**	**81ra**	**83^{r3}**	20^{r+}	*2*$^{+1}$	**76^{r1}**	**58^{r1}**	44^{r1}	50^{r1}	36^{+a}	**61ra**	***1^{+}***
Erigeron annuus	42^{r+}	19^{++}	43ra	20^{++}	*0*··	10^{rr}	0··	6^{++}	0··	0··	32^{r1}	*0*··
Lepidium apetalum	33^{r+}	19^{+a}	30ra	10^{rr}	*0*··	38^{+1}	5^{rr}	0··	1^{++}	14^{r+}	20^{r1}	***1^{+}***
Chenopodium ficifolium	25^{+a}	25^{r+}	**30^{r4}**	0··	*0*··	43^{r1}	0··	0··	0··	0··	0··	*0*··
Trifolium repens	25^{++}	6^{11}	3^{rr}	**40^{+3}**	*0*··	33^{r2}	16^{+2}	39^{+2}	40^{++}	**50^{14}**	**66^{+3}**	***1^{a}***
Kochia scoparia	25^{r+}	**75^{r4}**	**40^{r3}**	0··	*0*··	48^{r2}	5^{rr}	0··	20^{rr}	14^{rr}	0··	*0*··
Sonchus asper	25^{r+}	6^{++}	20^{r1}	0··	*0*··	19^{r+}	16^{r+}	0··	10^{++}	0··	0··	*0*··
Plantago depressa	25^{rr}	0··	7^{++}	0··	***1^{rr}***	**86^{r3}**	**63^{r5}**	**72^{+3}**	50^{r2}	21^{1a}	18^{r1}	***1^{+}***
Chenopodium glaucum	**17^{44}**	6^{11}	20^{r1}	0··	*0*··	38^{r1}	16^{+1}	17^{r+}	10^{++}	0··	0··	*0*··
Echinochloa crusgalli	17^{1a}	**50^{+3}**	37ra	10^{++}	*1*$^{++}$	24^{+2}	16^{+1}	**39^{+3}**	50^{+2}	0··	2^{++}	*0*··
Capsella bursa-pastoris	17^{r+}	19^{r+}	**53^{r+}**	0··	*0*··	**57^{+1}**	26^{+1}	33^{+1}	0··	14^{++}	5^{rr}	*0*··
Setaria viridis	17^{rr}	31^{+a}	23ra	20^{r+}	*1*$^{++}$	43^{+1}	**58^{r1}**	33^{++}	**80^{+2}**	7^{rr}	23^{+1}	***1^{+}***
Arenaria serpyllifolia	8^{++}	0··	7^{r+}	0··	*0*··	0··	0··	0··	0··	0··	14^{+1}	*0*··
Siegesbeckia pubescens	0··	**88^{r3}**	7^{r+}	10^{rr}	*2*^{rr}	5^{rr}	0··	17^{rr}	0··	0··	0··	*0*··
Artemisia asiatica	0··	**56ra**	27ra	**70^{+1}**	*2*$^{++}$	24^{r+}	16^{++}	11^{+1}	0··	21^{r1}	48ra	***1^{a}***
Setaria glauca	0··	**50^{r3}**	23^{+1}	20^{+2}	*0*··	5^{22}	5^{rr}	22^{+1}	10^{22}	7^{aa}	11^{+a}	*0*··
Amaranthus retroflexus	0··	38^{r1}	30^{r1}	0··	*1*$^{++}$	5^{rr}	16^{++}	39^{+1}	20^{++}	0··	0··	*0*··
*Agropyron *transiens*	0··	31^{+1}	**53^{r1}**	0··	*0*··	0··	0··	0··	0··	7^{++}	41ra	*0*··
Senecio vulgaris	0··	31^{r+}	10^{r+}	0··	*2*$^{+1}$	14^{r+}	11^{++}	6^{++}	20^{++}	29^{r+}	0··	*0*··
Robinia pseudo-acacia	0··	25^{r+}	7^{++}	0··	*1*$^{++}$	0··	0··	0··	0··	0··	5^{r+}	*0*··
Amaranthus lividus	0··	13^{r1}	0··	0··	*1*^{11}	10^{++}	0··	0··	0··	0··	0··	*0*··
Stellaria media	0··	13^{++}	3^{++}	50^{+1}	*2*$^{+1}$	10^{r+}	26^{+1}	0··	0··	0··	0··	*0*··
Oenothera biennis	0··	13^{rr}	**13^{+3}**	0··	*0*··	0··	0··	0··	0··	0··	18^{r+}	*0*··
Taraxacum sp.	0··	0··	0··	0··	*0*··	0··	0··	0··	0··	36^{+1}	11^{+1}	*0*··
Cyperus nipponicus	0··	0··	0··	0··	*0*··	0··	42^{+2}	50^{+1}	30^{++}	0··	0··	*0*··
Pilea mongolica	0··	0··	0··	40^{+1}	*1*^{11}	0··	0··	0··	0··	0··	0··	*0*··
Elscholzia patrini	0··	0··	0··	30^{r+}	*1*^{11}	0··	5^{rr}	0··	0··	0··	0··	*0*··
Kummerowia striata	0··	0··	0··	20^{11}	*0*··	5^{rr}	0··	0··	0··	0··	14^{r1}	*0*··
Pennisetum alopecuroides	0··	0··	0··	20^{+1}	*0*··	0··	0··	11^{++}	10^{++}	0··	16^{++}	*0*··
Number of accessoric species	**15**	**26**	**41**	**7**	**0**	**3**	**3**	**5**	**3**	**8**	**65**	**2**

those of the European alliance Matricario matricarioidis-Polygonion arenastri Rivas-Martínez 1975 corr. Rivas-Martínez et al. 1991.

Artemisio asiaticae-Plantaginetum asiaticae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991 (Tab. 9: D)

NT Mucina et al. (1991): Table 1, relevé 7

SM The appearance of the community is determined by the dominant *Plantago asiatica*, and by the frequent *Artemisia asiatica*, *Persicaria hydropiper*, and *Trifolium repens*. The stands are loose and species-poor. The cover of the herb layer varies between 60 and 85 % (A73); the moss layer cover varies from 0–5 % (A1), but in the most of relevés it was missing. The number of species in a relevé varies in a broad range from 6 to 19 (A10). The sparse higher herb layer reaches to ca. 90 cm (*Agropyron*, *Artemisia*, and *Erigeron* species); the dense lower herb layer is only a few centimetres high.

V Variable cover of *Digitaria sanguinalis*, *Artemisia asiatica*, and *Plantago asiatica* plays an important role in the synmorphology of stands.

SE The soils are sandy or loamy-sandy and skeletal. This community inhabits slightly moist and half-sheltered habitats in close proximity to human settlements and on forest roads. *Pinus densiflora*, *Quercus mongolica*, rarely *Salix babylonica*, *Pinus koraiensis*, and *Castanea crenata* were recorded as the most frequent shade-casting trees.

D This community is found in the Myohyangsan Mountains below the Paekuntae view.
MI Trampling is a typical feature of the community.
C It can be seen as a vicariant unit (sensu Mucina 1990) to the Japanese Junco-Plantaginetum asiaticae, Taraxaco-Plantaginetum asiaticae, Eragrostio ferruginae-Plantaginetum asiaticae and others (Tüxen 1977, Miyawaki 1964, 1985–1988).
REF Kim et al. (1996)

Bryo-Saginetum japonicae Ohba 1971
(Tab. 9: E)
SM Unlike the Artemisio-Plantaginetum, the moss layer dominated by *Bryum argenteum* is well-developed (20–80 % cover). *Sagina japonica* and *Cardamine scutata* are the character species. *Viola mandshurica*, *Mazus japonicus*, *Acalypha australis*, and *Senecio vulgaris* indicate moister habitats. The cover of the herb layer varies between 50 and 70 % (A62), while the moss layer covers 20–80 % (A43). The number of species varies between 15 and 28 (A20). The stands are mostly just a few centimetres high; exceptionally, some herbs attain 80 cm (*Artemisia* and *Erigeron* species).
V In a small number of relevés, variability was not obvious.
SE The habitats are shaded and exposed to slight trampling. The soils contain more loam than the preceding community; they are also generally less disturbed.
D Bryo-Saginetum forms small patches which fill fissures between paving stones. The community is typical of old shrines and monasteries (in the surroundings of the town of Kaesong), where it is found around old trees or at the base of buildings.
MI Trampling is a necessary condition for the preservation of the floristic composition of the community.
C The community is broadly distributed in Japan (e.g. Miyawaki 1984, 1985). In comparison with the Japanese community, species such as *Digitaria adscendens*, *Hydrocotyle maritima*, *Rorippa indica*, etc. are not present in the community analysed in North Korea. It is a geographic vicariant of the European Bryo-Saginetum procumbentis Diemont et al. 1940 nom. inv. (e.g. Oberdorfer 1971) and the Sagino-Rehmannietum glutinosae described in Beijing (China) by Borza (1960).
REF Tüxen (1957), Mucina et al. (1991), Sádlo & Kolbek (1997)

Plantagini depressae-Polygonetum avicularis Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991 emend. Sádlo & Kolbek 1997
(Tab. 9: F)
NT Mucina et al. (1991): Table 2, relevé 2
SM The dominant species is *Polygonum aviculare* s.s. which is characterised by heterophylly and fruits equally as long as the perigone. *Polygonum arenastrum*, a character species of an analogous community in Europe, was not found in the stands, although Miyawaki (1964, 1988) reported other trampled communities, including Plantagini depressae-Polygonetum avicularis with this species in Japan. The cover of the herb layer varies between 30 and 90 % (A70). The mosses cover 0–5 % (A2), although they were missing in most relevés. The number of species in a relevé varies in the range of 7–17 (A13). The higher herb layer reaches to 100 cm (*Agropyron*, *Chenopodium* species, and some others); lower herb layer attains 10–20 cm.
V The association is divided into four subassociations:
1. polygonetosum avicularis (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
2. potentilletosum costatae (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
3. trifolietosum repentis (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997 comb.
4. inops (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997 comb.

Some trampled stands, dominated by *Chenopodium glaucum*, were recorded in habitats close to those of Plantagini-Potentilletum. They might be classified as a facies of the association.
SE The community occurs frequently in dry, sunny, and heavily trampled habitats along roads and paths in both urban and rural environments. The soils are loamy-sandy or loamy and frequently disturbed by man. The stands are adjacent to pavement built of flat concrete blocks.
D The community forms small dwarf carpet-like patches on the slightly trampled edges of flowerbeds in cities to the higher altitudes of the mountains, e.g. on gravel roadsides near the village of Naegok at the foot of Changbaishan Mountains.
MI Intensive trampling is necessary for the preservation of the community, including its floristic composition and rich variability.
C This community forms a geographical vicariant to the European Polygonetum arenastri Gams 1927 (syn. Plantagini-Polygonetum avicularis Passarge 1964) (e.g. Oberdorfer 1971, Hejný et al. 1979, Jarolímek et al. 1997). Plantagini depressae-Polygonetum differs from the European vicariant community by the presence of *Plantago depressa*, *Zoysia japonica*, *Potentilla *costata*, *Kochia scoparia*, *Setaria viridis*, *Agropyron hackelianum*, *Carex tenuifolia*, *Ranunculus chinensis*, and *Kummerowia stipulacea*, and the occurrence of *Polygonum aviculare* s.s.
REF Sádlo & Kolbek (1997)

Euphorbio maculatae-Centipedetum minimae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991 emend. Sádlo & Kolbek 1997
(Tab. 9: G)

NT Mucina et al. (1991): Table 4, relevé 7
SM This community, due to severe trampling, becomes gapped and is built by prostrate plants, such as *Euphorbia maculata*, *Portulaca oleracea*, *Eragrostis multicaulis*, and *Centipeda minima*. A few other species (e.g. *Chenopodium glaucum*, *Kochia scoparia*, and *Erigeron canadensis*) are represented by dwarf individuals tolerant to extreme trampling. *Bryum argenteum* is a frequent moss occurring in the majority of the studied stands. The cover of the herb layer varies between (5)20 and 85 % (A47). The mosses cover 0–5 % (A2), but they were missing in some relevés. The number of species in a relevé varies in a broad range from 7–25 (A14). The lower herb layer reaches 10–30 cm; the scarce higher herb layer attains a maximum height of 90 cm (*Chenopodium* and *Amaranthus* species).
V The association is divided into four subassociations:
1. cyperetosum microiriae (Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991) Sádlo & Kolbek 1997
2. plantaginetosum depressae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
3. typicum Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
4. amaranthetosum retroflexi Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
SE This community forms open stands in the city near trampled and slightly shaded pavements, and in the cracks separating paving stones. They are also exposed to high levels of sunshine and to desiccation that supports the development of this type of vegetation. The soils are dry, loamy-sandy and compressed by trampling. They are neutral and rich in nitrogen and phosphorus. The analysis of acidity shows pH 7.2–7.7.
D This community is found at the foot of the Myohyangsan Mountains, in the towns of Hyangsan and Pyongyang.
MI Trampling intensity and soil moisture are the major factors determining variability and floristic richness.
C Oberdorfer (1983) classified similar communities with *Euphorbia maculata* in North America, Hawaii and central Japan within the Polygonion avicularis.
REF Sádlo & Kolbek (1997), Song (2001a)

Digitario pectiniformis-Eleusinetum indicae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
(Tab. 9: H)
NT Mucina et al. (1991): Table 6, relevé 2
SM These phytocoenoses show low coverage and are dominated by *Eleusine indica*. Their height depends on the intensity of trampling and varies from 10 to 40(60) cm. The cover of the herb layer varies between 35 and 85 % (A64). The mosses are mostly missing or cover up to 5 % (A<1). The number of species in a relevé varies between 7 and 22 (A12).
V The association is divided into two subassociations:
1. digitarietosum sanguinei Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
2. chlorisetosum virgatae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
SE The stands are found on clay as well as sandy soils. The community occupies typical trampled ruderal habitats along roads and pathways in fields and orchards, on the margins of sport grounds and on earth dumps. A chemical analysis of a sample showed a rather low organic matter content. The analysis of acidity gave a pH value of 7.2.
D This association is found in Pyongyang along the Taedonggang River, in the town of Hedju, and at the foot of the Sujangsan Mountains.
MI Trampling and disturbance intensity are the most important factors determining the floristic composition, stand height, and cover of the herb layer.
C The association belongs to the group of other *Eleusine*-dominated communities described in East Asia (see Miyawaki 1985, 1986).
REF Song (1992b, 2001a), Sádlo & Kolbek (1997)

Setario viridis-Chlorisetum virgatae Mucina, Dostálek, Jarolímek, Kolbek & Ostrý 1991
(Tab. 9: I)
NT Mucina et al. (1991): Table 6, relevé 20
SM This unit is dominated by *Chloris virgata*. Other species such as *Polygonum aviculare*, *Digitaria sanguinalis*, and *Setaria viridis* possess a subdominant status. The presence of *Chenopodium strictum* is significant (differential species). The cover of the herb layer varies between 60 and 80 % (A67), and the moss layer covers 0–5 % (A3). The number of species in a relevé varies from 7 to 25 (A14). The height of the lower herb layer varies between 30 and 50 cm; some herbs reach 0.8 m (*Chenopodium* sp. div., *Echinochloa crusgalli*).
V The community is rather homogeneous with small differences in the cover of dominants.
SE This trampled community occurs in sunny and dry habitats such as roadsides, dykes, and field tracks. The soils are sandy, skeletal and very permeable. The analysed soil profiles revealed the presence of two subhorizons; the upper one (0–2 cm) was brown or light brown, while the deeper horizon (below 2 cm) was dark grey in colour. The analysis of acidity showed pH 7.6 and 7.7.
D The community is found, for example, in the city of Pyongyang and in the surroundings of the airport.
MI The community colonises relatively newly arising places with fresh soil without intensive trampling and soil cultivation.
C Similar species-poor stands dominated by *Digitaria sanguinalis* or rarely also by *Chloris virgata* were observed, e.g. on the banks of rice fields and water ports.
REF Song & Song (1996), Sádlo & Kolbek (1997), Song (2001a)

Plantagini asiaticae-Poetum pratensis Blažková 1993
(Tab. 9: J)
NT Blažková (1993): Table 1, relevé 28
SM In harmony with the description of this syntaxon, *Poa pratensis*, *P. annua*, and *Polygonum aviculare* are the dominant species of this lawn vegetation; *Plantago asiatica* attains higher constancy. The number of species in each relevé is 5–9 (A8); the cover of the herb layer is 70–95% (A89); the moss layer was not found. The height of stands reaches 10–15 cm in the lower herb layer and 80 cm in the higher layer.
V In strongly shaded areas, we can see the decline of the species *Poa pratensis* and *Polygonum aviculare* and an increase in *Poa annua* and *Plantago asiatica*. In some relevés, *Poa pratensis* was absent. This can be regarded as a younger succession phase of the same community. The high dominance of *Liriope platyphylla* is supported by deliberate cultivation of this species in city parks and lawns.
SE A mesic water regime and moderate summer temperatures are the typical ecological conditions determining the development of this community. Such conditions can be met in several different habitats: (a) on soils with a sufficient water supply formed on suitable land types (depressions) in extremely oceanic parts of the country (Wonsan) and (b) in areas shaded by a sparse cover of trees in parks.
D This community was registered in the towns of Hedju, Pyongyang, Kaesong, Kumgang Spa, and Wonsan. It is not frequent in more continental regions of North Korea (e.g. Myohyangsan Mts).
MI Itow (1963) lists the species *Poa annua* and *Plantago asiatica* as indicators of heavy disturbances in pastures, but it is possible that, under different environmental conditions (shading, water, and nutrient supply), the competitive relationships are different from those in open pastures. On trampled places, the cover of *Plantago depressa* and *Eragrostis ferruginea* increases (Blažková 1993).
C The synthetic table of this community was published by Sádlo & Kolbek (1997) together with other terrestrial ruderal communities. Plantagini-Poetum is probably an ecological vicariant of the Japanese community *Taraxacum officinale-Plantago major* (*asiatica*?) Tüxen 1977.
REF Song & An (1999), Kolbek & Jarolímek (2008)

CL Miscanthetea sinensis Miyawaki & Ohba 1970
(Tab. 9: K–L)
OR Caricetalia nervatae Suganuma 1966
ALL Zoysion japonicae Suzuki & Abe ex Suganuma 1966
In North Korea, *Zoysia japonica* mostly forms stands on artificial lawns with relative strong management, which also depends on (besides planting *Zoysia japonica*) regular weeding and removal of some unsuitable species (Šrůtek & Kolbek 1992). Such lawns in cities and villages are of relatively homogenous structure and their species composition is minimised to a low number of species. In addition to these artificial stands, it is possible to find semi-natural stands recalling pastures or less mowed meadows. Similar stands are described in the literature very scarcely and their syntaxonomical classification is problematic.
Zoysia japonica also occurs in other trampled communities in North Korea (see Mucina et al. 1991). Sádlo & Kolbek (1997) registered the occurrence of *Z. japonica* in several communities with variable frequency.

Digitario ciliaris-Zoysietum japonicae Blažková 1993
(Tab. 9: K)
NT Blažková (1993): Table 1, relevé 2
SM Lawns of this association have *Zoysia japonica* as a dominant species, and *Digitaria ciliaris* as a constant species. The number of species varies between (4)10 and 31 (A20). The characteristic species with the optimum in this association is *Viola mandshurica*. The cover of the herb layer reaches 50–100 % (A87) and the moss layer covers 0–40 % (A4). Some species, such as *Kummerowia striata*, *Eragrostis ferruginea*, *Cassia nomame*, and *Erigeron canadensis*, are mechanically eliminated from regularly weeded lawns. In intensively weeded lawns, only *Erigeron canadensis* persists thanks to its rapid growth and the early flowering of very young plants. The biological properties of *Zoysia japonica* clones determine the life-form structure of the stands. Especially common are annuals that can use the favourable conditions of the summer monsoon climate and are able to survive dry and cold periods in the diaspore stage (*Digitaria* sp. div., *Setaria* sp. div., *Erigeron canadensis*, *Cassia nomame*, *Cyperus microiria*). The second important group are perennial species with deep roots which use the deeper parts of the soil profile beneath the *Zoysia japonica* rhizosphere, such as *Viola mandshurica*, *Pennisetum alopecuroides*, *Lespedeza cytisoides*, *Artemisia asiatica*, and *Potentilla chinensis*.
V The association is divided into three subassociations:
1. cyperetosum microiriae Blažková 1993
2. eragrostietosum ferrugineae Blažková 1993
3. ixeridetosum dentatae Blažková 1993
SE *Zoysia japonica* lawns are established in sunny places, usually on sandy-silty soils. Their physiognomy and floristic composition reflects differences in the management of the stands.
D This community is found in many settlements, e.g. Pyongyang, Dzaeryong north of Pyongyang, Mangende, Hyangsan, Wonsan, Kaesong, Kumgang Spa, in the Myohyangsan Mountains and Kumgangsan Mountains (in the village of Onjongri), etc.
MI Intensive and regular cultivation and weeding is necessary.

C Similar stands were previously described from the same localities as a "community with *Zoysia japonica*". The community is known in various types throughout the Korean Peninsula, China, and Japan, e.g. Itow (1974).
REF Okuda (1975), Nakanishi (1982), Šrůtek & Kolbek (1992), Kolbek & Jarolímek (2008)

Eragrostietum ferrugineae Yoshioka 1955
(Tab. 9: L)
SM *Eragrostis ferruginea* is only one dominant and character species of this community. In one known relevé from North Korea, the number of species was 14, the cover of the herb layer was 70 % and the moss layer was not found. The stands are very low, i.e. not more than 15 cm in height.
V Succession to the more developed community Plantagini-Polygonetum is probable.
SE This community is found on dry, sunny, and sandy or scoria substrates.
D This community was observed in Kumgang Spa.
MI Stands are less trampled than the previously described communities.
C More species-rich stands were described at first as Eragrostio multicaulis-Plantaginetum depressae and later classified as Plantagini-Polygonetum and Euphorbio-Centipedetum (Sádlo & Kolbek 1997).
REF Song (1992b), Blažková (1993)

Weed vegetation

CL Stellarietea mediae R. Tüxen et al. in R. Tüxen 1950 ex von Rochow 1951 (Tab. 10: A–E)
OR Commelinetalia Miyawaki 1969
ALL Cassio nomame-Phyllanthion ussuriensis Sádlo & Kolbek 1997
NT Acalypho australis-Digitarietum pectiniformis Dostálek, Kolbek & Jarolímek 1990
This alliance groups the segetal communities of soya bean fields. Their species composition differs distinctly from all other types of vegetation under study. However, the delimitation of the alliance has been hitherto rather uncertain because of limited data. The most related communities of the segetal vegetation were described in Japan by Miyawaki (1969) within the alliance Cypero-Mollugion. The Korean alliance differs by numerous species which were not reported in the Japanese segetal vegetation (Sádlo & Kolbek 1997: Tab. 2). The evaluation of the relationships between these alliances needs more extensive study.

Acalypho australis-Digitarietum pectiniformis Dostálek, Kolbek & Jarolímek 1990
(Tab. 10: A)
NT Dostálek et al. (1990): Table 1, relevé 12
SM This weed community with a low number of species 7–16 (A10) is dominated by *Digitaria *pectiniformis*. Here and there, the thick stands of this dominant grass overgrow cultivated crops. *Acalypha australis*, *Cyperus microiria*, and *Echinochloa crusgalli* occur with high constancy. Before harvesting, the maximum height of stands achieves from 70 to 180 cm and the total coverage ranges between 20 and 85 %. The cover of weeds attains 20 to 85 % (A52), and the cover of crops 15 to 75 % (A45).
V In the part evaluated in relevés, the group of species including *Centipeda minima*, *Euphorbia humifusa*, *Setaria glauca*, and *Phyllanthus ussuriensis* was present, whereas *Chenopodium album* agg. and *Siegesbeckia pubescens* were absent.
SE This association includes slightly nitrophilous to nitrophilous, relatively thermophilous stands of weeds growing in soya bean fields. It thrives mostly on light, sandy-loamy to sandy soils with a high content of gravel. The stands were observed on the plains or on north- and west-oriented slopes up to 32° at a low altitude of 15–115 m.
D The community occurs in the lowlands and hills of North Korea (in the surroundings of the Taesong dam and the towns of Hyangsan and Anju).
MI This community was studied just before harvesting of the crop. It strongly depends on the style of farming.
C From a syntaxonomical point of view, Acalypho-Digitarietum belongs to the nitrophilous communities of therophytes growing on disturbed habitats and among root crops. These communities were formerly classified within the class Chenopodietea (Miyawaki 1969).
REF Sádlo & Kolbek (1997), Song (1997)

ALL Cosmo-Humulion japonicae Kolbek & Sádlo 1996
NT Humulo japonicae-Chenopodietum albi Kolbek & Sádlo 1996
The characteristics of the alliance were previously described in the section "Terrestrial ruderal vegetation". This alliance consists of one association in soya bean fields and two weed communities in crop cultures.

Cephalonoploso segeti-Geranietum eriostemoni Dostálek, Kolbek & Jarolímek 1990
(Tab. 10: B)
NT Dostálek et al. (1990): Table 1, relevé 17
SM The average height of the stands attains 20 cm and the total coverage ranges from 20 to 45 %; the cover of crops achieves 10–15 % (A14) and the cover of weeds is 20–45 % (A32). The number of species in a relevé varies from 12 to 24 (A19). This community is dominated by *Cephalonoplos segetus*, *Geranium eriostemon*, and *Equisetum arvense*. In comparison with Acalypho-Digitarietum, it is more abundant in species, due to the presence of the species remaining in the fields from the former forest.

V Our data come from a small area, so the community seems to be relatively homogeneous.
SE This association is a slightly nitrophilous community of weeds, occurring in soya bean fields. It mostly grows on loamy-sandy soils with a high content of gravel. The community was observed mostly on the plains or on slopes up to 18°, exposed mostly to the north or west at an altitude of 800–890 m.
D This community was observed on the slopes of the Changbaishan Mountains in the surroundings of the village of Naegok.
MI It was studied in the spring at the juvenile phenological stage of crops in a brook alluvium or on cultivated terraces. The floristic composition reflects the intensity and style of field farming.
C No thermophilous species, such as *Echinochloa crus-galli*, *Setaria glauca*, *S. macrocarpa*, *Amaranthus retroflexus*, *Portulaca oleracea*, or *Xanthium* cf. *strumarium* were observed in the studied community. On the other hand, species of Plantaginetea majoris units were present, especially *Plantago asiatica* and *Potentilla *costata* (Mucina et al. 1991). According to the floristic composition, this community could be related to some weed communities of the Kamchatka Peninsula (Ul'yanova 1982).
REF Miyawaki (1964), Kolbek & Sádlo (1996)

Aeschynomeno indicae-Kummerowietum striatae Jarolímek, Kolbek & Dostálek 1991
(Tab. 10: C)
NT Jarolímek et al. (1991): Table 4, relevé 54
SM The height of the stands ranges between 15–50 cm and the cover between 85–95 % (A87). Each relevé contained 7–13 (A10) species. They are exceptional for the common occurrence of the species *Aeschynomene indica*, *Kummerowia striata*, *Digitaria *pectiniformis*, *D. sanguinalis*, *Setaria glauca*, *Xanthium strumarium*, *Kyllinga brevifolia*, *Fimbristylis complanata*, and *Echinochloa crusgalli*.
V Two subassociations are distinguished, depending on the soil moisture:
1. pycreetosum sanguinolenti Jarolímek, Kolbek & Dostálek 1991
2. ambrosietosum artemisiifoliae Jarolímek, Kolbek & Dostálek 1991
SE The community is found on sand-and-clay skeletonless alluvia on the banks of dam at an altitude of 10–50 m.
D The relevés were obtained on the banks of the Taesong dam.
MI The community is influenced by agricultural activities in rice and soya bean fields.

Platycodon grandiflorus culture
(Tab. 10: D)
SM Two relevés documented the floristic composition of the weed vegetation of fields with the cultivated crop *Platycodon grandiflorus*. Both stands contained numerous common species (*Oxalis corniculata, Chenopodium album, Erigeron annuus, Siegesbeckia pubescens, Artemisia asiatica, Myosoton aquaticum, Portulaca oleracea, Viola mandshurica*). The cover of both herb layers (crop and weeds) was 75–80 %. The cover of the moss layer was 10 % in one relevé; in the second, there were no mosses. The number of species in the relevés was 29 and 30, respectively.
V Though the relevés come from remote areas, the similarity of both stands in terms of floristic composition is eminently evident.
SE The crop is cultivated on moderately shadow, moist to drippy, stony or gravelly soils in areas with the occurrence of pine and oak forests at an altitude of 110 to 280 m.
D Stands were recorded in fields in the Myohyangsan Mountains (near the city of Hyangsan) and the Kumgangsan Mountains (near the village of Onjongri).
MI The tuber roots of *Platycodon grandiflorus* are used for preparing a tasty salad.
C Related data from South Korea and Japan are not known.
REF Kolbek & Jarolímek (2008)

Secale cereale culture
(Tab. 10: E)
SM The species composition of this community (according to only one relevé in a rye field) is very similar to previous field cultures with numerous common species. We expect that, in this region, the floristic composition of the weed vegetation of terrestrial field cultures is not seriously influenced by the cultivated crop, but more by management. The herb layer covers 60 %, and the moss layer absent. The relevé contains 16 mostly acidophilous species. *Rumex acetosella* attains the same cover as cultivated rye.
V This community does not exhibit any known variability.
SE The field was based on sandy soil in the location of former pine and oak forests at an altitude of 150 m.
D Only one stand was analysed in the Kumgangsan Mountains, in the valley of the Kuryongtschon River. Similar fields were registered at the foot of the Changbaishan Mountains.
MI In North Korea, the cultivation of grain is rare and grain fields at higher elevations occur rather exceptionally.
C Related data from South Korea and Japan are not known.
REF Kolbek & Jarolímek (2008)

Table 10. Weed vegetation.
A – Acalypho australis-Digitarietum pectiniformis; B – Cephalonoploso segeti-Geranietum eriostemoni; C – Aeschynomeno indicae-Kummerowietum striatae; D – *Platycodon grandiflorus* culture; E – *Secale cereale* culture

Community	A	B	C	D	E
Number of relevés	14	7	9	2	1
Average number of species	11	20	10	30	16
Crops (FC)					
Glycine max	100^{a5}	100^{aa}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Zea mays	21^{r3}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Platycodon grandiflorus	0$^{..}$	0$^{..}$	0$^{..}$	*2*^{34}	*0*$^{.}$
Phaseolus vulgaris	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{aa}	*1*$^{+}$
Secale cereale	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*1*^{3}
Acalypho australis-Digitarietum pectiniformis					
Acalypha australis	**86**$^{+1}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Cyperus microiria	**86**$^{+1}$	0$^{..}$	11^{++}	*0*$^{..}$	*0*$^{.}$
Cephalonoploso segeti-Geranietum eriostemoni					
Geranium eriostemon	0$^{..}$	100^{+a}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Equisetum arvense	0$^{..}$	100^{+a}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Myosoton aquaticum	0$^{..}$	**86**^{ra}	0$^{..}$	*2*$^{r+}$	*0*$^{.}$
Cosmos bipinnata	0$^{..}$	**86**^{r1}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Cephalonoplos segetus	0$^{..}$	**71**$^{+a}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Plantago asiatica	0$^{..}$	**71**^{r1}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Alopecurus amurensis	0$^{..}$	**57**$^{+a}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Draba nemorosa	0$^{..}$	**57**$^{+1}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Ixeris chinensis	0$^{..}$	**57**$^{r+}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Aeschynomeno indicae-Kummerowietum striatae					
Kummerowia striata	7^{++}	0$^{..}$	100^{a4}	*0*$^{..}$	*1*$^{+}$
Aeschinomene indica	0$^{..}$	0$^{..}$	100^{+a}	*0*$^{..}$	*0*$^{.}$
Setaria glauca	29^{+a}	0$^{..}$	100^{13}	*0*$^{..}$	*1*^{a}
Digitaria sanguinalis	7^{aa}	0$^{..}$	**89**^{14}	*1*$^{++}$	*0*$^{.}$
Fimbristilis complanata	0$^{..}$	0$^{..}$	**67**$^{+a}$	*0*$^{..}$	*0*$^{.}$
Ambrosia artemisiifolia	0$^{..}$	0$^{..}$	**56**^{r1}	*0*$^{..}$	*0*$^{.}$
Pycreus sanguinolentus	0$^{..}$	0$^{..}$	**44**$^{+1}$	*0*$^{..}$	*0*$^{.}$
Kyllinga brevifolia	0$^{..}$	0$^{..}$	**67**$^{+1}$	*0*$^{..}$	*0*$^{.}$
Bidens frondosa	0$^{..}$	0$^{..}$	**33**$^{+1}$	*0*$^{..}$	*0*$^{.}$
***Platycodon grandiflorus* culture**					
Setaria viridis	0$^{..}$	0$^{..}$	0$^{..}$	*2*^{13}	*0*$^{.}$
Oxalis corniculata	0$^{..}$	0$^{..}$	0$^{..}$	*2*$^{+a}$	*0*$^{.}$
***Secale cereale* culture**					
Rumex acetosella	0$^{..}$	0$^{..}$	0$^{..}$	*0*$^{..}$	*1*^{3}
Stellarietea mediae					
*Digitaria *pectiniformis*	**100**^{a5}	**57**^{11}	100^{13}	*0*$^{..}$	*0*$^{.}$
Echinochloa crusgalli	**64**$^{+1}$	0$^{..}$	**78**$^{+a}$	*0*$^{..}$	*0*$^{.}$
Commelina communis	50^{r1}	**71**$^{+a}$	0$^{..}$	*1*$^{++}$	*1*^{1}
Chenopodium album agg.	36^{11}	**86**$^{r+}$	0$^{..}$	*2*^{11}	*0*$^{.}$
Siegesbeckia pubescens	36^{+m}	**57**$^{+a}$	0$^{..}$	*2*$^{+1}$	*0*$^{.}$
Amaranthus retroflexus	36^{r1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Setaria macrocarpa	21^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Erigeron canadensis	14^{++}	0$^{..}$	11^{++}	*2*$^{+1}$	*1*$^{+}$
Capsella bursa-pastoris	0$^{..}$	43^{+1}	0$^{..}$	*1*^{rr}	*0*$^{.}$
Stellaria media	0$^{..}$	43^{+1}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Erigeron annuus	0$^{..}$	29^{r+}	0$^{..}$	*2*$^{+1}$	*0*$^{.}$
Other species					
Xanthium strumarium	50^{r1}	0$^{..}$	**78**$^{r+}$	*0*$^{..}$	*0*$^{.}$
Cassia nomame	50^{+1}	0$^{..}$	0$^{..}$	*2*$^{r+}$	*1*^{1}
Portulaca oleracea	43^{++}	0$^{..}$	0$^{..}$	*2*^{r1}	*0*$^{.}$
Centipeda minima	36^{+1}	0$^{..}$	22^{++}	*1*^{11}	*0*$^{.}$
Viola mandshurica	29^{+1}	0$^{..}$	0$^{..}$	*2*$^{r+}$	*0*$^{.}$
Euphorbia humifusa	29^{++}	0$^{..}$	11^{++}	*0*$^{..}$	*0*$^{.}$
Persicaria lapathifolia	21^{11}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Phyllanthus ussuriensis	21^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Persicaria cochinchinensis	21^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Persicaria nodosa	21^{+1}	0$^{..}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Persicaria hydropiper	21^{++}	14^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Mazus japonicus	7^{11}	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Arthraxon hispidus	7^{++}	0$^{..}$	0$^{..}$	*1*$^{++}$	*1*$^{+}$
Trifolium repens	0$^{..}$	**71**$^{+a}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Agropyron sp.	0$^{..}$	**71**$^{+a}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Artemisia asiatica	0$^{..}$	**57**$^{+1}$	0$^{..}$	*2*$^{r+}$	*1*$^{+}$
Taraxacum sp.	0$^{..}$	**57**$^{+1}$	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Poa pratensis	0$^{..}$	43^{+a}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Chylocalyx perfoliatus	0$^{..}$	43^{++}	0$^{..}$	*1*$^{++}$	*0*$^{.}$
*Ranunculus *elatus*	0$^{..}$	43^{r+}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Arctium lappa	0$^{..}$	29ra	0$^{..}$	*0*$^{..}$	*0*$^{.}$
*Potentilla *costata*	0$^{..}$	29^{11}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Rumex crispus	0$^{..}$	29^{+1}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Persicaria amphibia	0$^{..}$	29^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Oenanthe decumbens	0$^{..}$	29^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Brassica juncea	0$^{..}$	29^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Chenopodium strictum	0$^{..}$	29^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Rorippa atrovirens	0$^{..}$	29^{++}	0$^{..}$	*0*$^{..}$	*0*$^{.}$
Plantago depressa	0$^{..}$	14^{rr}	0$^{..}$	*0*$^{..}$	*1*^{r}
Arenaria serpyllifolia	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{11}	*1*$^{+}$
Convolvulus arvensis	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{11}	*0*$^{.}$
Senecio vulgaris	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{11}	*0*$^{.}$
Persicaria mitis	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*1*^{1}
Veronica arvensis	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Rorippa palustris	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Euphorbia maculata	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Chenopodium glaucum	0$^{..}$	0$^{..}$	0$^{..}$	*1*$^{++}$	*0*$^{.}$
Artemisia capillaris	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{rr}	*1*$^{+}$
Lepidium apetalum	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{rr}	*0*$^{.}$
Paraixeris denticulata	0$^{..}$	0$^{..}$	0$^{..}$	*1*^{rr}	*0*$^{.}$
Number of accessoric species	10	15	5	14	2

Rice field vegetation

CL Oryzetea sativae Miyawaki 1960 (Tab. 11)
OR Cypero-Echinochloetalia oryzoidis Bolós & Masclans 1955
ALL Cypero-Echinochloion oryzoidis Bolós & Masclans 1955
The plant communities of stagnant shallow waters in rice fields.

Sagittario-Monochorietum Miyawaki 1960 (Tab. 11)
SM The weed community of rice fields mostly consists of open stands which can be roughly divided into three layers. The highest layer (65–100 cm, A75) is principally formed by rice with variable cover, depending on the density of planting and on the development stage of the stand. Rice is accompanied by a few species such as *Echinochloa crusgalli*, *Sagittaria trifolia*, and *S. aginashi*. The weed components are found in the two lower layers, (a) 10–50 cm above the water level containing e.g. *Monochoria *plantaginea*, *Oenanthe decumbens*, and *Persicaria* sp. div. and (b) at the water level and partly below it (e.g. *Potamogeton distinctus*, *Lemna paucicostata*, *Ottelia alismoides*, *Najas graminea*). The cover of the vegetation above the water level reaches 15–95 % (A54); the cover of the vegetation at the water level has the same parameters. The number of species in each relevé varies between 5 and 18 (A10). From the viewpoint of the representation of life forms, the community in North Korea consists of: a) annual species, primarily *Ottelia alismoides*, *Bidens frondosa*, *B. tripartita*, and *Monochoria *plantaginea* and b) perennial species that survive due to their subterranean organs, especially *Potamogeton distinctus*, *Rotala indica*, *Juncellus serotinus*, *Sagittaria trifolia*, and *Eriocaulon robustius*.
V The association is divided into three subassociations:
1. limnophiletosum sessiliflorae Kolbek, Dostálek & Jarolímek 1996
2. najadetosum gramineae Kolbek, Dostálek & Jarolímek 1996
3. sagittarietosum aginashi Kolbek, Dostálek & Jarolímek 1996
The development of weed vegetation begins along with the flooding of fields and achieves its optimum and simultaneously its maximum cover toward the end of the summer. After draining the water from the fields, the weed cover decreases. Some species survive the unfavourable period of drought and cold in the form of seeds, others in the form of rootstocks hidden in the soil. Some originally floating species, like *Monochoria *plantaginea*, are firmly rooted in the soil.
SE This community is found at an altitude of 2–150 m. The synecology of the community depends on the management. The acidity of the water varies between pH 5.9 and 6.1.
D The rice field weed stands were studied in the province of South Pyongyang in the surroundings of Thaesong dam and Anju (in fields near the city), in the northern outskirts of Pyongyang, in the province of Kaesong in the surroundings of the city of Kaesong near the king's tomb, in the Kumgangsan Mountains, near Samilpo Lake, and near the villages of Onjongri and Samilpori.
MI Strictly artificial plant community determined by rice cultivation technology.
C The presence of the diagnostic association species *Monochoria *plantaginea*, *Sagittaria pygmaea*, and *Alisma orientale* enables the classification of all of the North Korean material into the association *Sagittario-Monochorietum*. The distribution of this community apparently includes suitable habitats throughout the entire Korean Peninsula and Japan.
REF Japan (Miyawaki 1960, 1981–1987, Miyawaki et al. 1972), South Korea (Song 1991b, 1997; Kim & Nam 1998), North Korea (Kolbek et al. 1996)

Discussion

From the point of view of the vegetation research, Japan has the best analysed vegetation cover within the East Asia. Besides the numerous vegetation studies, ten volumes monograph, containing comprehensive surveys of vegetation units (documented by phytocoenological relevés) of all main islands, was published (Miyawaki et al. 1980–1989). In the other regions similar works were not yet done. Vegetation survey is available also for Russia (Mirkin & Naumova 2012), but without synthesis of phytocoenological relevés. Therefore, for the purposes of comparison it is necessary to use local vegetation surveys, which were recently published especially for the north-eastern Siberia. However, the comparison of some less frequent vegetation units from the North Korea is problematic, since many works from Korea and China are hardly linguistically accessible or the authors used different methods of vegetation study. From this point of view the presented vegetation survey of North Korea represents useful pioneering act.

After the study of numerous literature sources from the East Asia we are convinced, that many units (also in the higher levels of syntaxonomical hierarchy) with identical content have different names. In several cases the new syntaxa were described without comparison with already described syntaxa from the same or adjacent region and this approach lead to arising of many synonyms. It would be useful to collate common database from all available published phytocoenological relevés and to try to process large-scale classification by vegetation experts from the East Asia, to revise and clearly delimit syntaxa at all levels and eliminate numerous synonyms.

From the Northeast Asia numerous syntaxa were described at various levels of syntaxonomical hierarchy,

frequently only as "communities" – units without rank, or in terms of vegetation typology. However, recent typological surveys introduced more comprehensive view on the vegetation of larger regions, such as Russian Far East (Krestov 2003), Russia (Ermakov in Mirkin & Naumova 2012), Northeast China (Qian et al. 2003), Northern Japan and Southern Kuril Islands (Okitsu 2003). Use of the different methodology limits more detailed comparisons and formation of uniform consistent syntaxonomical system (Ermakov 2010). Major part of that works was prepared using Zürich-Motpelliér school methods and their proportion increases (Ohba et al. 1973, Ohba 1974, Miyawaki 1981–1988, Kim 1992, Ermakov 1994, Song et al. 1995, Ermakov et al. 2000, Achtyamov 2001, Krestov 2002, Krestov & Nakamura 2002, Kolbek et al. 2003a, c, Krestov et al. 2006, etc.). Authors who used typological approach in past are the most capable to do such comparison. The comparison and revision of vegetation data needs extensive database of phytocoenological relevés from all available sources. Some of them are relatively hard to acquire (local publications, manuscripts, etc.) and their use is consequently limited. We have faced similar situation during the synthesis of the North Korean vegetation. The situation was complicated by the impossibility to obtain both published and unpublished vegetation data of North Korean phytocoenologists for comparison.

Therefore, for the first survey of North Korean vegetation we used available publications mainly from the southern part of the Korean Peninsula and the nearest neighbours (Japan, Eastern Russia, occasionally also from China), which use the same methods of vegetation research and description of vegetation units. The majority of literature sources is cited in descriptions of relevant vegetation units. In the following text we comment only units with clear relationship or on the contrary, if they are different due to geographical and/or floristically differences.

Some types of vegetation in Korea are well known (e.g. forests), on the other hand some were studied only marginally (anthropogeneous vegetation of the classes Stellarietea, Bidentetea, a.o.), and some were so far relatively overlooked (communities on rocks, fissures and walls). Therefore a wider comparison of the last group is rather difficult. In addition to that, in the North Korea we found some plant communities, which were not documented by phytocoenological relevés (for various reasons), but we can confirm their occurrence there, for example fringe communities of the order Dioscoreo-Puerarietalia lobatae dominated by species *Pueraria lobata*, *Dioscorea japonica*, and *Smilax china*. We frequently observed these communities also in the South Korea and they are documented by published phytocoenological relevés (Song & Song 1996, Jung & Kim 1998, Song 2001a). However, relevés from the North Korea are absent; therefore these communities are not mentioned in the inventory of units.

We did not find some types of vegetation during our research (wetlands, swamps, bogs, springs, and swamp forests), even though they occur there and their typical taxa are mentioned in the Korean floras, some we found only rarely (meadows, communities on calcareous rocks).

Table 11. Rice field vegetation.
Sagittario-Monochorietum

Number of relevés	44
Average number of species	10
Crops:	
Oryza sativa	98^{+5}
Sagittario-Monochorietum	
Potamogeton distinctus	$\mathbf{84}^{+4}$
Echinochloa crusgalli	$\mathbf{64}^{+a}$
*Monochoria *plantaginea*	$\mathbf{57}^{+4}$
Rotala indica	$\mathbf{50}^{+a}$
Eleocharis acicularis agg.	$\mathbf{41}^{r3}$
Spirodela polyrhiza	$\mathbf{32}^{r3}$
Limnophila sessiliflora	$\mathbf{23}^{+m}$
Sagittaria pygmaea	$\mathbf{20}^{+a}$
Najas graminea	$\mathbf{20}^{+a}$
Oenanthe decumbens	$\mathbf{20}^{ra}$
Sagittaria trifolia	$\mathbf{20}^{rm}$
Sagittaria aginashi	$\mathbf{16}^{r1}$
Ottelia alismoides	$\mathbf{11}^{a4}$
Cypero-Echinochloion oryzoidis, Cypero-Echinochloetalia oryzoidis, Oryzetea sativae	
Aneilema japonica	20^{r1}
Eriocaulon robustius	14^{+a}
Ludwigia prostrata	14^{r+}
Rotala littorea	11^{+1}
Scirpus preslii	11^{+a}
Scirpus juncoides	11^{+1}
Scirpus triqueter	9^{+a}
Cyperus glomeratus	9^{+a}
Other species	
Lemna paucicostata	$\mathbf{52}^{r3}$
Persicaria thunbergii	$\mathbf{30}^{+3}$
Bidens frondosa	23^{r1}
Number of accessoric species	52

Following notes on groups of vegetation units are ordered according to their order in the above text.

Riverside communities: Ohba (1973a), Minamikawa (1979), Ohba & Sugawara (1979), Miyawaki (1979), Song & Song (1996), Song (2001a) published descriptions of willows communities from the class Salicetea sachalinensis Ohba 1973 from the South Korea and Japan, namely Salicetum serrissaefoliae Ohba 1973, Salicetum jessoensis Ohba 1973, Salicetum gracilistylae Minamikawa 1963, Salicetum subfragilis

Okuda 1978, Salicetum graciliglandis Song & Song 1996, Salicetum koreensis Song & Ohno 2000, and Salicetum koreensio-chaenomeloides Song & Ohno 2000. They did not mention any community described by Achtyamov (2001) from the catchment area of the Amur River in Siberia. Apart from *Salix rorida*, species composition of the related vegetation types in Mongolia is quite different (Mirkin et al. 1980). Chytrý et al. (1995) published description of the association Calamagrostio langsdorffii-Salicetum roridae Chytrý, Anenchonov & Danihelka 1995 from the East Siberia. These communities were not registered so far in the North Korea. Communities of shrub willows have mostly local distribution and they are usually defined by one dominant willow species. On the contrary Song (2001a) suggested that the endemic units in the Korean riverside vegetation (including willows) are very rare, because most of them are common with those of Japan.

Whereas in the South Korea and Japan the communities found at riversides and willow stands are dominated by *Artemisia princes* (Ishikawa 1991, Kim et al. 1996, Song & Song 1996, Song 2001a), in the North Korea replaced with *A. capillaris*. Also Minamikawa (1979) has found this species in the community *Kummerovia striata-Artemisia capillaris* from Japan.

Aquatic communities: From the East Asia groundless amount of aquatic floating stands dominated by *Lemna paucicostata, Spirodela polyrhiza, Hydrilla verticillata, Myriophyllum verticillatum, M. spicatum, Nymphaea tetragona, Ceratophyllum demersum, Najas marina, Trapa japonica, Potamogeton* spec. div., etc. and their combinations were described at the community level (e.g. Miyawaki & Fujiwara 1974, Miyawaki 1981–1985, Song 1991b, 2001a). So far, these communities were not sufficiently analysed and synthesised. Difficulty of their syntaxonomical evaluation, in comparison with other communities, lies in the low number of present species and big seasonal variability of the stands. Determination of some species is also complicated (*Potamogeton* spec. div.). Other species (e.g. *Lemna paucicostata*) are hard to distinguish from the relative Euro-Asian species (*L. minor* agg.), which could be easily introduced there.

Seaside vegetation: Habitats of seaside communities in the temperate zone are unified by sea water, providing similar temperature, moisture and chemical conditions. Saline communities are very similar in all sea sides of the North Korea and Japan. The associations Suaedetum japonicae, Artemisietum fukudo, Caricetum kobomugi and similar units of the alliances Rosion rugosae and Salsolion komarovii occur in both countries (Miyawaki & Ohba 1969, Nakanishi 1982, Kolbek et al. 1989). Several communities of the alliance Caricion kobomugi from the South Korea were reported also by Jung (2000), but with partially different species composition. Some communities are similar in their ecology, but syntaxonomically quite different, e.g. *Stephanandra incisa* community and *Lycium chinense* community are ordered in the South Korea within the class Rosetea multiflorae (Song 2001a), whereas in the North Korea and Japan they are classified in other classes. However, South Korean Ulleung Island has considerably different seaside vegetation (Song & Ohno 2005).

Communities of rocky and wall habitats: In the European, Central Siberian and also in the East Siberian part of distribution area the more xerophilous rock communities are classified within the class Asplenietea trichomanis (cf. Valachovič et al. 2002, Ermakov et al. 2006). These communities overlap to the territory of Central Mongolia (1977 Kolbek in litt.). Communities of rock fissures are in the Eastern Siberia represented by stands with *Woodsia ilvensis* or *Dryopteris fragrans* (Valachovič et al. 2002). They are related to the Korean communities of the association Woodsio polystichoidis-Orostachyetum erubescentis. Mongolian communities with *Orostachys malacophylla* and *O. spinosa* (Mirkin et al. 1980) were not recorded in rock fissures in the North Korea, even though both species occur in that region.

Mesophilous and hygrophilous communities on rocks in Korea and Japan are ordered to the class Selaginello tamariscini-Potentilletea dickinsii (also in this survey), with regard to very different habitat conditions and species composition. Several communities of the order Potentilletalia dickinsii and the alliance Potentillion dickinsii which were described from Japan (Ohba 1973b) were found in the North Korea. Several other communities, so far not reported from the surrounding countries, were described as new.

Alpine tundra vegetation: The class Carici rupestris-Kobresietea bellardii consists of five orders and one of them (Caricetalia tenuiformis) occurs also in Japan, North Korea, Sakhalin, Kuril Islands and South Kamchatka. Two orders are reported from Europe, and one in Europe, Canada and Arctic Siberia (Ohba 1974). In Japan, 12 units on community level were reported within this class and the order Caricetalia tenuiformis (Ohba 1974), but with relatively different species composition from the related North Korean vegetation, known from the Changbaishan Mts. The association Artemisio-Oxytropidetum yezoensis Ohba (1967)1974 seems to be most similar, especially the subassociation with *Dryas tschonoskii*. This community is floristically and physiognomically related to the Korean association Dryado tschonoskii-Rhododendretum aurei. However, work comparing alpine tundra floras from the Changbaishan Mts and North America does not contain phytocoenological relevés (Zhu & Rowe 1987).

The community with *Dryas punctata* Juz., from the alliance Dryadion oxydontae Zhitlukhina & Onishchenko ex Chytrý et al. 1993, was described in the Eastern Siberia (Chytrý et al. 1993, Valachovič et al.

2002). Floristic composition of alpine tundra vegetation from central Kamchatka (Okitsu 1996a) also indicates some similarity to that community.

Broad-leaved and mixed forests: The class Quercetea mongolicae Song ex Krestov et al. 2006, published in some recent surveys of forest communities from North-East Asia, represents syntaxonomical synonym of the already described subclass Quercenea mongolicae Kim J.W. 1992, hence we used the older valid name in this work. The future shows the practical applicability of both units.

From units, described by us from North Korea (Kolbek et al. 2003a, Kolbek & Jarolímek 2011) Krestov et al. (2006) accepted units such as Parthenocisso tricuspidati-Fraxinetum rhynchophyllae, Festuco ovinae-Pinetum densiflorae, Syneilesio palmatae-Carpinetum laxiflorae, Vaccinio-Quercetum mongolicae and new subassociations within the association Artemisio-Quercetum mongoliacae in the Survey of deciduous temperate forests of Northeast Asia. Study from the Far East (Krestov 1993a, b) also shows certain similarities with some Korean forests. However, forests with *Quercus mongolica* from warmer regions of Japan have different floristically composition (Ohno 1991).

In Japan scree and alluvial forests dominated by *Zelkova serrata* (suballiance Zelkovenion serratae Miyawaki et al. 1977 emend. Ohno 1983) are occurring relatively frequently (Miyawaki 1979, Ohno 1983, 1991, 2008). In North Korea, they are found on scree slopes altered by the associations Saso-Quercetum mongolicae and Parthenocisso tricuspidati-Fraxinetum rhynchophyllae. Rare community *Prunus padus-Zelkova serrata* or *Zelkova serrata* community was reported from the South Korea (Kim & Kim 1988, Kim et al. 1996, Song & Song 1996, Song 2001c). Floodplain forests in Japan are mostly changed by human activities or cut down and converted to paddy fields.

Most of the natural forests in the whole Korean Peninsula are also degraded due to human influence (collection of firewood and timber) (Kim 1990). As a result, they are not suitable for syntaxonomical evaluation. In the North Korea, mainly forests dominated by *Quercus mongolica* are in lower altitudes replaced by culticoenoses of *Pinus densiflora*. In Japan the natural forests dominated by *Pinus densiflora* are represented by several associations differentiated by different species of the genus *Rhododendron*. They are concentrated in the alliance Pinion densiflorae (Nakagoshi 1995: Tab. 2). Li & Li (1986) published brief description of *Pinus densiflora* and *Quercus mongolica* dominated forests from the Myohyangsan Mts in the North Korea. Comparison of forest communities with *Pinus densiflora* in South Korea was published e.g. by Choung & Hong (2006) and Song et al. (2009). Pine forests in the northwest of the European part of the Russia have quite different floristic composition and they are dominated by the species *Pinus sylvestris* (e.g. Sambuk 1986).

In the South Korea forests of the association Corylo-Quercetum mongolicae Song 1988, Ainsliaeo-Quercetum mongolicae Song, Roh, Chung, Song, Ohno & Mochida 1999 and Lespedezo-Quercetum serratae Takeda, Nakanishi & Choe 1994 are ordered to the alliances Rhododendro-Quercion mongolicae Song 1988 and Lespedezo-Quercion serratae Takeda, Nakanishi & Choe 1994, respectively. Both alliances are included to the order Aceri-Quercetalia mongolicae Song 1988 (Kim 1989, Takeda et al. 1994, Song et al. 1999, 2009, Song 2001b). Units, corresponding to that forests, are in the North Korea mainly classified in the alliance Rhododendro mucronulati-Pinion densiflorae (see also Kim & Yim 1988).

Sensu Wang (1961) the temperate deciduous broad-leaved forest of China are characterised mostly by *Quercus* species, known also from North Korea, e.g. *Q. mongolica*, *Q. dentata*, *Q. aliena*, *Q. acutissima*, *Q. variabilis*, and *Q. serrata*. The most similar composition of trees to the Korean forests occurs in North-East Provinces, where very relative species of *Quercus* grow. High similarity to broad-leaved forests with dominant species *Tilia amurensis*, *Pinus koraiensis*, *Quercus mongolica* etc., show forests of neighbouring North-East China – e.g. in Jilin Province, Changbaisan Preserve (Barnes et al. 1992).

Coniferous forests: Gumarova (1993) described new units of broad-leaved and coniferous forests from the South Sichote-Alin: order Schisandro-Pinetalia koraiensis and alliances Lathyro humilis-Quercion mongolicae and Pino koraiensis-Abietion nephrolepidis. The species composition of these units is very similar to the forests of the subclass Quercenea mongolicae and class Vaccinio-Piceetea in the North Korea. The above-mentioned study contains phytocoenological relevés and synoptic tables and therefore it could be used for comparison with the Korean data. Unfortunately, the descriptions of new units are not in accordance with the ICPN (Weber et al. 2000) and the names are published invalidly.

Several orders and alliances of the class Vaccinio-Piceetea, different from the European ones, were described by Krestov et al. (2008) for Kamchatka Peninsula and East Siberia (Ledo palustris-Laricetalia cajanderi, Abieti-Piceetalia jezoensis, Vaccinio-Pinetalia pumilae), by Ermakov & Makhatkov (2011) for the northern boreal dark coniferous forests (Aconito rubicundi-Abietion sibiricae Anenkhonov & Chytrý 1998, Pino sibiricae-Abietion sibiricae all. prov.) or by Ermakov & Morozova (2011) for pine forests of the Northern Europe and western Siberia. The abovementioned units have no analogues in Europe except for the alliance Pinion mughi (cf. also Krestov 2003). The alliance Vaccinio-Pinion pumilae Suzuki 1964 from

the order Vaccinio-Pinetalia pumilae Suzuki 1964 and the class Vaccinio-Piceetea (Valachovič et al. 2002) are probably East Siberian analogues of the alliance Abieti nephrolepidis-Piceion jezoensis, described by various authors from the Korean Peninsula. Pinion mughi Pawłowski in Pawłowski, Sokołowski & Wallisch 1928 represents analogous alliance in Europe.

Various units were reported within the class Vaccinio-Piceetea and the order Abieti nephrolepidis-Piceetalia jezoensis, e.g. from Hokkaido (Miyawaki 1979), Kuril Islands and Sakhalin forests of the alliance Piceion jezoensis Suz.-Tok. ex Jinno & Suzuki 1973, in North China, Russia and Korea forests of the alliance Abieti nephrolepidis-Piceion jezoensis Song 1991 and in the border mountains of North Korea and North East China forests of the alliance Laricion olgensis (Kolbek et al. 2003a, c). Stands with *Pinus pumila* from Korean Peninsula were included within the alliance Abieti nephrolepidis-Piceion jezoensis (Song & Nakanishi 1985, Song 1991a, 1992a, Kolbek et al. 2003a, c). On the other hand, subalpine krumholz communities from Japan (Suzuki 1973, Miyawaki 1979, Saito 1979, Okitsu & Ito 1989) and East Siberia (Chytrý et al. 1995) were classified into the alliance Vaccinio-Pinion pumilae Suz.-Tok. 1964 and from Kamchatka to the alliance Empetro sibiricae-Pinion pumilae Neshataeva 1990. Li & Li (1986) gave a brief description of the forests with *Pinus pumila*, *Thuja koraiensis*, and *Picea jezoensis* from the Myohyangsan Mts in the North Korea.

Subalpine deciduous shrub and tall-herb vegetation of the class Betulo ermanii-Ranunculetea japonici Ohba 1998 or only Betuletum ermanii or *Betula ermanii*-forest (see e.g. Suzuki et al. 1963, Watanabe 1979, Suzuki 1973) were published mostly from Japan (Hokkaido) and partly also from East Siberia and China. Betulion ermanii is the most frequent alliance of the subarctic zone in Japan (Nakano sec. Watanabe 1979). Stands with *Betula ermanii* sporadically occur in mountains of North Korea and were classified within the alliances Rhododendro dahurici-Acerion barbinervi and Abieti nephrolepidis-Piceion jezoensis (Kolbek et al. 2003a, c).

The association Dryopterido fragranti-Rhododendretum dahurici belongs definitely to the class Vaccinio-Piceetea, as it contains many species of the alliance, order and class. The association Taxo-Pinetum pumilae was in original description (Song & Nakanishi 1985) also classified to the class Vaccinio-Piceetea, therefore we leave it in this class. The association Thujo koraiensis-Piceetum jezoensis is analogous to the South Korean association Thujo-Abietetum nephrolepidis Song 1991, classified also into the class Vaccinio-Piceetea (Song 1991a, 1992a). However, the low number of relevés (only three) does not enable wider comparisons.

Whereas in Korea the light taiga forests with *Larix olgensis* are included in the alliance Laricion olgensis, analogous forests in Siberia with *L. sibirica* are included in the alliance Pino sibiricae-Laricion sibiricae Guinocet ex Dostálek et al. 1988 (Valachovič et al. 2002), and in the Central Kamchatka within the forests with *L. gmelinii* (Okitsu 1997). Light taiga forests of East Siberia (Calamagrostio obtusae-Laricetum sibiricae Chytrý, Anenkhonov, Danihelka, Ünal & Valachovič 1998) in North Korea are supplied by associations Rhododendro aurei-Laricetum olgensis, Carici peiktusani-Abietetum nephrolepidis, and Ledo decumbentis-Laricetum olgensis.

Dark taiga forests (Valachovič et al. 2002) in East Siberia were classified to the association Cardamino macrophyllae-Abietetum sibiricae Chytrý, Anenkhonov & Valachovič 1998, which is analogous to the North Korean association Goodyero repentis-Piceetum jezoensis. Prevailing forests *Picea jezoensis-Abies sachalinensis* from South Sakhalin (Okitsu 1996b) are floristically similar with forests of the order Abieti nephrolepidis-Piceetalia jezoensis from North Korea.

Following Wang (1961), all main types of natural forests, mapped in the Korean Peninsula, are present also in China, namely forests with *Picea jezoensis* and *Abies nephrolepis* occur in North East Province and in Korea. Similarly forests dominated by infraspecific species of *Larix sibirica* group, incl. *L. olgensis* are presented. Floristic composition of the forests with *L. olgensis*, published from China, is very similar to those in Korea. Yet the book Forests of China (Wang 1961) provides very good introductory survey of this type of vegetation. However, it is based on typological conception without phytocoenological relevés. Therefore, it does not permit full-value comparison with similar vegetation in North Korea.

Artificial forest and shrub communities: The communities of artificial forests and shrubs, namely stands with *Robinia pseudo-acacia* and *Lycium chinense* were reported in several sources from Korea and Japan (Yim & Jeon 1980, Miyawaki 1981, Song 1992b, 2001a, Song & Kim 1993, Song & Song 1996, Lee 1997, Cho et al. 1999, Lee et al. 2004, Cho & Kim 2005, Kolbek & Jarolímek 2008), but their survey and distribution was not published neither for South Korea nor for neighbouring Japan. Even though these communities form stable types of vegetation, they have been overlooked in the vegetation surveys of Korea and adjacent countries till now.

Ruderal communities: In the evaluation of trampled communities we follow the original conception of the class Plantaginetea majoris Tüxen 1950, which comprises both therophyte and hemicryptophyte communities.

The class Miscanthetea sinensis and the alliance Zoysion japonicae represent frequent communities in

Japan islands (Itow 1974, Minamikawa 1979, Miyawaki 1979, Nakanishi 1982). Similar communities of this alliance occur also in Korea, but with different species composition and form the association Digitario ciliaris-Zoysietum japonicae, which has not been reported so far from Japan. The association Eragrostietum ferrugineae was found in both countries. Song & Song (1996) and Song (2001a) recorded in South Korea *Eragrostis multicaulis-Plantago asiatica* community and Kim et al. (1996) *Polygonum aviculare-Plantago asiatica* community with *Eragrostis ferruginea*. *Zoysia japonica* frequently forms monodominant stands with various species composition, and therefore its stands are classified else in one alliance, but in different associations in the studied territory of Korea and Japan. An example is difference of units described from North Korea also in this survey (Digitario ciliaris-Zoysietum japonicae), and units published from western Japan by Itow (1974): Centello-Zoysietum japonicae Itow 1970, Geranio-Zoysietum japonicae Suganuma 1966 emend. Itow 1974, and *Angelica longeradiata-Zoysia japonica* community sensu Itow (1974), or Miyawaki & Suzuki (1976) as Zyosietum sinicae Ohba, Miyawaki & Tx. 1973.

Segetal weed vegetation: In comparison with Europe, in the North Korea and in Japan there are few "dry" cultivated fields. In plain lowlands and also in fields with narrow slopes mainly the rice is cultivated at special hydrocultures. Vegetable cultures are intensively managed by herbicides, which inhibit development of segetal weed vegetation. As a result, the number of relevés from this type of vegetation is low.

In Japan Miyawaki (1969) published comprehensive study, based on 1500 phytocoenological relevés, selected from 5000 (!) relevés. He classified all relevés within the class Chenopodietea Br.-Bl. 1951 (syn. Stellarietea mediae p.p.) and orders Siegesbeckietalia orientalis Miyawaki 1969 and Commelinetalia communis Miyawaki 1969. Within the last-mentioned order we classified also two associations described from North Korea. Segetal vegetation in South Korea was studied only marginally up to now (e.g. Song 1991b, 1997).

Rice field vegetation: Rice is one of the most important crops of the word, feeding billions of people. Cultivation of rice has gradually spread to several continents. As a result, species composition of weed vegetation in paddy fields is very heterogenous. One part is classified within the specific class of weed vegetation of paddy fields – Oryzetea sativae, however other parts are ordered to the classes Lemnetea, Potametea and Bidentetea, and vegetation on paddy field dams also to the class Stellarietea mediae.

Process of rice cultivation in the northern part of the peninsula usually starts at the beginning of April, when rice is sown into nurseries. At the beginning of May, the fields are flooded and the nursery-grown seedlings are planted into the muddy soil. During the vegetation season, the water depth fluctuates between 5 and 30 cm. The fields are fertilised twice in the course of the growing season: (1) before the planting of the field and (2) in June. Herbicides are frequently applied (especially to large areas) (1) before seedlings are planted in the field and (2) towards the end of June or at the beginning of July, depending on the number of weeds. If there are few weeds, the second dose of herbicides is not applied. Fields treated with herbicides are practically denuded of the accompanying flora, and phytocoenological research becomes pointless. About one week before the harvest, at the end of September or at the beginning of October, water is drained from the fields by cutting the dams, and fields are made ready for harvest. After the stands have been mown, rice in sheaves is left for one to two weeks in stocks to become dry and fully ripe. In the autumn and winter, the fields are dry. All vegetation is therefore adapted to this type of management, i.e. to markedly different alternating ecological conditions.

Paddy field weed vegetation was studied also in Europe (e.g. Koch 1954, Ubrizsy 1961, Dzjuba 1989). From the East Asia, where it grows frequently, it was described in many works, e.g. from Japan (Miyawaki 1960, 1981–1987), South Korea (e.g. Kim & Nam 1998, Song 1991b, 1997) and from North Korea only in our publication (Kolbek et al. 1996).

Most of the higher syntaxa, described from the European and West-South Siberian territory, have analogous (vicariant) units, due to the big geographical distance and different florogenesis (e.g. Asplenietea trichomanis vs. Selaginello tamariscini-Potentilletea dickinsii, Querco-Fagetea sensu auct. medioeurop. vs. Querco-Fagetea crenatae).

In coniferous forests of the class Vaccinio-Piceetea in Siberia (Ermakov & Makhatkov 2011, Ermakov & Morozova 2011) still *Pinus sylvestris* or *Pinus sibirica* prevail (e.g. Chytrý et al. 2008), but in Korea already *P. densiflora* and *P. koraiensis* occur. In the Far East species *Picea jezoensis*, *P. glehnii*, *Abies nephrolepis*, *A. sachalinensis*, *Larix sibirica* spec. agg., in Korea represented by local species *L. olgensis*, penetrate into the coniferous forests. It is reflected by classification into different alliances in the class Vaccinio-Picetea. European and the West Siberian alliances, e.g. Dicrano-Pinion, Piceion excelsae, Pinion mughi, Betulion pubescentis, and Athyrio alpestris-Piceion are in the East Siberia supplemented by alliances Vaccinio-Piceion jezoensis, Abieti nephrolepidis-Piceion jezoensis, Pino pumilae-Piceion jezoensis and Abietion koreanae (Krestov & Nakamura 2002, 2007). In Korea the alliances Laricion olgensis and Rhododendro dahurici-Acerion are added.

The west-east gradient is represented by the European class Querco-Fagetea in the broad-leaved forests, with

alliances e.g. Alnion incanae, Carpinion, Tilio-Acerion, Fagion, Luzulo-Fagion, Quercion pubescenti-petraeae, Aceri tatarici-Quercion, Quercion petraeae, and by the class Fagetea crenatae (incl. Quercenea mongoliacae, syn. Quercetea mongolicae) in Korea with alliances Pino koraiensis-Quercion mongolicae (syn. Rhododendro-Quercion mongolicae), Rhododendro mucronulati-Pinion densiflorae, Lindero-Quercion mongolicae, Weigelo floridae-Fagarion schinifoliae a.o.

Communities of the classes Querco mongolicae-Betuletea davuricae, Vaccinio-Piceetea and Quercetea mongolicae are typical for the north-eastern Siberia (Krestov et al. 2010). European class Betulo-Alnetea viridis is replaced by the class Betulo ermanii-Ranunculetea acris in the Siberia and Japan. The class Brachypodio-Betuletea (Ermakov 1994, 1997) was described from the southern Siberia, but it does not occur in the North Korea. The most similar in this region is vegetation of the class Betulo-Ranunculetea.

Conclusion

Presented preliminary survey of all vegetation units found in North Korea is based on the evaluation of field phytocoenological material from the Czech-Slovak expeditions. The survey is geographically limited by the accessibility of the territories selected for the field work. With only one exception, there are no phytocoenological publications available from this country, and no published vegetation classification based on the synthesis of vegetation relevés from North Korea is available. The botanical knowledge of other authors from the boundary zone, e.g. the Paektusan and Kumgangsan Mountains, are based on investigations beyond the borders of the North Korea. Thus, for this classification, we used only our own phytocoenological relevés, and for comparison, we used only data from South Korea and Japan, where the same methods of vegetation research were applied. North Korean botanists probably have data on the vegetation units or on the vegetation cover of selected regions (possibly acquired by other methods), but these data are inaccessible to the global scientific community for now. The abovementioned facts explain why this survey is preliminary, but in spite of this fact, it is offered for publication. This aspect represents both a deficiency and the high informational value of this article, and it should be understood from this perspective. The authors are aware that the presented vegetation units comprise only a part of the real vegetation units of the North Korean vegetation, and the synthesis of a greater amount of phytocoenological material may lead to different classification of this vegetation in the future.

The geomorphologically, geologically, and climatically unique country of North Korea possesses a number of habitats, biotopes and vegetation types unknown to science until now. Rich flora and heterogenous habitat conditions underlie the great variability of the plant communities and the diversity of the entire vegetation. In the largely populated regions, this relation is suppressed and the habitats are partially unified. On the contrary, the natural vegetation variability in the high mountain regions with low or only local human influence (according to our observations) is high and the plant species and communities develop there under their own rules. Some groups of vegetation types, such as synanthropic vegetation, the vegetation of rock fissures and rock walls, or the partial macrophyte vegetation in water bodies have been almost completely neglected throughout the entire Korean Peninsula. We decided to study the vegetation of rock habitats. Recently, we collected a representative number of relevés for the evaluation and classification of the entire Peninsula on a larger scale (in preparation).

Knowledge of the vegetation of North Korea is still very poor and belongs to the least known vegetation in the world. The authors of this article hope that this survey will be preliminary only for a short time and that it will be supplemented by more detailed research in the near future. The rich nature of North Korea, including its vegetation, is worth knowing.

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References

Achtyamov, N.Ch. (2001): Coenotaxonomy of the valley willow, willow-poplar and riparian forests of the Amur River floodplain. – Dalnauka, Vladivostok. 138 pp. [in Russian]

Anonymous (1972–1976): Flora Coreana. Vols. **1–7**. – Pedagogical Publishing House, Pyongyang. 2849 pp. [in Korean]

Anonymous (1976): Geographical atlas of Korea. – Pedagogical Publishing House, Pyongyang. [in Korean] n. v.

Anonymous (1979): Flora Coreana. Appendix. – Ed. Scient. R.P.D.C., Pyongyang. 685 pp. [in Korean]

Anonymous (2005): Ferns and fern allies of Korea. – Korean Fern Soc., Geobook. 399 pp.

Baik, M.-C., Hoang, H.-D. & Hammer, K. (1986): A check-list of the Korean cultivated plants. – Kulturpflanze **34**: 69–144.

Barkman, J.J., Doing, H. & Segal, S. (1964): Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse. – Acta Bot. Neerl. **13**: 394–419.

Barnes, B.V., Xü, Z. & Zhao, S. (1992): Forest ecosystems in an old-growth pine – mixed hardwood forest of the Changbai Shan Preserve in northeastern China. – Can. J. For. Res. **22**: 144–160.

Blažková, D. (1993): Phytosociological study of grassland vegetation in North Korea. – Folia Geobot. Phytotax. **28**: 247–260.

Boratyński, A. (1984): Herbarium materials of trees and shrubs from the Democratic People's Republic of Korea collected in the years 1978 and 1980. – Fragm. Flor. Geobot. **28**: 555–589.

Borza, A. (1960): Phytosociological notes from People's Republic of China. – Acta Bot. Horti Bucurest, (**1960**): 311–316.

Box, E.O. & Choi, J. (2003): Climate of Northeast Asia. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 5–31. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.

Box, E.O., & Fujiwara, K. (2012): A comparative look at biolimatic zonation, vegetation types, tree taxa and species richness in Northeast Asia. – Bot. Pacifica **1**: 5–20.

Box, E.O., Peet, R.K., Masuzawa, T., Yamada, I., Fujiwara, K. & Maycock, P.F. (eds.) (1995): Vegetation science in forestry. Global perspective based on forest ecosystems of East and Southeast Asia. – Kluwer Academic Publishers, Dordrecht, 663 pp.

Braun-Blanquet, J. (1964): Pflanzensoziologie. Grundzüge der Vegetationskunde. 3. Aufl. – Springer, Wien & New York. 865 pp.

Chang, N.-K. (1990): Wave character of the timber line on Paektusan. – Korean J. Ecol. **13**: 321–329.

Chang, N.-K., Shim, K.-Ch., Lee, H.-U., Kang, K.-M. & So, K.-H. (1998): The theory of boundary distribution of the plant and wave character of the timber line on Mt. Paektu. – Korean J. Ecol. **21**: 491–499.

Chang, N.-K., Yeau, S.-H. & Lee, S.-K. (1992): A study on distribution of plant communities around Chunji in crater on Mt. Paektu. – Korean J. Ecol. **15**: 209–220.

Chang, N.-K., Yeau, S.-H., Lee, S.-K. & Kwon, H.-R. (1991): Vertical distribution of forest types on the north-western slope of Mt. Paektu. – Korean J. Ecol. **14**: 435–448.

Chang, N.-K., Yoo, H.-M. & Eo, E.-J. (1990): A comparison of the alpine tundra floras of the alpine tundra zone on Paektusan with the alpine and subalpine zone in Korea. – Korean J. Ecol. **13**: 237–245.

Charkewicz, S.S. [ed.] (1985–1989): Plantae vasculares orientalis extremi Sovietici. Tomus **1–4**. – Nauka, Leningrad. [in Russian]

Cho, H.-J., Cho, J.-H. & Lee, Ch.-S. (1999): Forest vegetation units and landscape structures of Mt. Inwang in Seoul, Korea. – J. Korean. For. Soc. **88**: 342–351.

Cho, K.-J. & Kim, J.-W. (2005): Syntaxonomy and synecology of the Robinia pseudoacacia forests. – Korean J. Ecol. **28**: 15–23.

Choe, D.-M. (1980): Musci-Hepaticae. Illustrated flora and fauna of Korea **24**. – Ministry of Educ. Korea. Seoul.

Choung, H.-L. & Hong, S.-K. (2006): Distribution patterns, floristic differentiation and seccession of Pinus densiflora forest in South Korea: A perspective at nation-wide scale. – Phytocoenologia **36**: 213–229.

Choung, H.-L. & Lee, H.-J. (2001): Syntaxonomy and distribution characteristics of the herbaceous vegetation on running waterside in the main stream of Geumho River, Daegu and Gyeongsanbuk-do, Korea. – Korean J. Environ. Ecol. **19**: 239–247. [in Korean]

Choung, Y. (1998): Characteristic species distribution of the Baekdoo Great Mountain Chain at Kangwon Province, Korea. – Korean J. Ecol. **21**: 105–112.

Chytrý, M., Anenchonov, O.A. & Danihelka, J. (1995): Plant communities of the Boľšoj Čivyrkuj river valley, Barguzinskij range, East Siberia. – Phytocoenologia **25**: 399–434.

Chytrý, M., Danihelka, J., Kubešová, S., Lustyk, P., Ermakov, N., Hájek, M., Hájková, P., Kočí, M., Otýpková, Z., Roleček, J., Řezníčková, M., Šmarda, P., Valachovič, M., Popov, D. & Pišút, I. (2008): Diversity of forest vegetation across a strong gradient of climatic continentality: Western Sayan Mountains, southern Siberia. – Plant Ecol. **196**: 61–83.

Chytrý, M., Pešout, P. & Anenchonov, O.A. (1993): Syntaxonomy of vegetation of Svyatoi Nos Peninsula, Lake Baikal. 1. Non forest communities. – Folia Geobot. Phytotax. **28**: 337–383.

Do, Ph.-S. & Im, R.-Z. (1976): Choson Sikmul Dogam [Plants of Korea]. – Guahak Publ. House, Pyongyang. 1023 + 25 pp.

Dostálek, J. (1995): The Rhododendrons of North Korea. – Amer. Rhododendron Soc. **49**: 127–133.

Dostálek, J. sen., Dostálek, J. jr., Mucina, L. & Hoang, H.D. (1988): On taxonomy, phytosociology, and ecology of some Korean Rhododendron species. – Flora **181**: 29–44.

Dostálek, J., Kolbek, J. & Jarolímek, I. (1989): A few taxa new to the flora of North Korea. – Preslia **61**: 323–327.

Dostálek, J., Kolbek, J. & Jarolímek, I. (1990): A note on the weed vegetation of soya bean fields in North Korea. – Folia Geobot. Phytotax. **15**: 71–78.

Dzjuba, T.P. (1989): Classification of weed vegetation of rice fields of the Black Sea area. – Ukraj. Bot. Zhurn. **46/6**: 26–30. [in Ukrainian]

Ermakov, N. (1994): Grass forest classification of southern Siberia and Mongolia. – Colloq. Phytosoc. **13**: 259–276.

Ermakov, N. (1997): Hemiboreal forests of Siberia: Biodiversity and Red data book status. – Darwin fellow, Unit of Veget. Sci. Lancaster Univ., p. 1–45 + 15 pp. App.

Ermakov, N. (2010): Corresponding geographical types of hemiboreal forests in North Asia: pecullarities of ecology and genesis. – Phytocoenologia **40**: 29–40.

Ermakov, N., Chytrý, M. & Valachovič, M. (2006): Vegetation of the rock outcrops and screes in the forest-steppe and steppe belts of the Altai and Western Sayan Mts., southern Siberia. – Phytocoenologia **36**: 509–545.

Ermakov, N., Dring, J. & Rodwell, J. (2000): Classification of continental hemiboreal forests of North Asia. – Braun-Blanquetia **28**: 1–131.

Ermakov, N. & Makhatkov, I. (2011): Classification of northern boreal dark coniferous forests of the West Siberian Plain. – Annali di Bot. **1**: 29–36.

Ermakov, N. & Morozova, O. (2011): Syntaxonomical survey of boreal oligotrophic pine forests in northern Europe and western Siberia. – Applied Veget. Sci. **14**: 524–536.

Grishin, S.Yu., Krestov, P. & Okitsu, S. (1996): The subalpine vegetation of Mt. Vysokaya, central Sikhote-Alin. – Vegetatio **127**: 155–172.

Gumarova, R.R. (1993): Sintaksonomija gornych kedrovo-schirokolistvennych lesov juznogo Sichote-Alin. (Syntaxonomy of montane pine-broadleaved forests of the southern Sikhote-Alin). – In: Vserosijskij Inst. naucnoj i techniceskej informacii, Msc. N 502-V93, Biol.-Pocvennyj Inst., Rosijskaja Akad. Nauk, Dalnevostocnoje otdelenie, Vladivostok. pp. 1–62. [in Russian]

Hammer, K., Han, U.-X. & Hoang, H.-D. (1987): Additional notes to the check-list of the Korean cultivated plants (1). – Kulturpflanze **35**: 323–333.

Hämet-Ahti, L., Ahti, T. & Koponen, T. (1974): A scheme of vegetation yones for Japan and adjacent regions. – Ann. Bot. Fennici **11**: 59–88.

Hejný, S. (1960): Ökologische Charakteristik der Wasser- und Sumpfpflanzen in den Slowakischen Tiefebenen. – Vydavateľstvo SAV, Bratislava. 489 pp.

Hejný, S., Kopecký, K., Jehlík, V. & Krippelová, T. (1979): Survey of ruderal communities of Czechoslovakia. – Rozpr. Čs. Akad. Věd, Ř. Mat.-Přír. Věd. **89/2**: 1–100.

Hoang, H.-D. & Hammer, K. (1988): Additional notes to the check-list of the Korean cultivated plants (2). – Kulturpflanze **36**: 291–313.

Hong, S.-K. (1998): Changes in landscape patterns and vegetation process in the Far-Eastern cultural landscapes: Human activity on pine-dominated secondary vegetation in Korea and Japan. – Phytocoenologia **28**: 45–66.

Ihm, B.-S., Lee, J.-S. & Kim, J.-W. (2001): Coastal vegetation on the western, southern, and eastern coasts of South Korea. – J. Plant Biol. **44**: 163–167.

Ishikawa, S. (1991): Floodplain vegetation of the Ibi river in Central Japan II. Vegetation dynamics on the bars in the river course of the alluvial fan. – Jap. J. Ecol. **41**: 31–43. [in Japanese]

Itow, S. (1963): Grassland vegetation in uplands of western Honshu, Japan. Part II. Succession and grazing indicators. – Jap. J. Bot. **18:** 133–167.

Itow, S. (1974): Phytosociological studies on grassland vegetation in western Japan. – Phytocoenologia **1**: 306–338.

Jarolímek, I. & Kolbek, J. (2006): Plant communities dominated by Salix gracilistyla in Korean Peninsula and Japan. – Biologia **61**: 63–70.

Jarolímek, I., Kolbek, J. & Dostálek, J. (1991): Annual nitrophilous pond and river bank communities in North part of Korean Peninsula. – Folia Geobot. Phytotax. **26**: 113–140.

Jarolímek, I. & Schlosser, G. (1997): FYTOPACK – a system of programs to process phytosociological tables. – Biologia **52/1**: 53–59.

Jarolímek, I., Zaliberová, M., Mucina, L. & Mochnacký, S. (1997): Rastlinné spoločenstvá Slovenska. 2. Synantropná vegetácia. – Veda, Bratislava. 416 pp.

Jung, Y.-K. (2000): Glehnietea littoralis in South Korea. – Phytocoenologia **30**: 131–142.

Jung, Y.-K. & Kim, J.-W. (1998): Syntaxonomy of mantle communities in South Korea. – Korean J. Ecol. **21**: 739–750.

Kil, B.-S., Kim, Y.-S., Kim, Ch.-H. & Yoo, H.-G. (1998): The vegetation characteristics of the upper area of timber line in Mt. Paektu. – Korean J. Ecol. **21**: 519–529.

Kim, H.-S., Ri, S.-D., Pak, H.-S. & Kim, M.-G. (1988): Sikmulwonsakdogam [Plant illustrated Flora]. – Goahakbaekgoasadzon-Tschulpansa, Pyongyang. 880 pp.

Kim, J.-H. & Yun, K.W. (1998): Evergreen broad-leaved trees in Mt. Paektu and North Korea. – Korean J. Ecol. **21**: 531–539.

Kim, J.-U. & Yim, Y.-J. (1988): Phytosociological classification of plant communities in Mt. Naejang, Southwestern Korea. – Korean J. Bot. **31:** 1–31.

Kim, J.-W. (1989): Phytosociology and phytogeography of summer green broad-leaved forests in South Korea. – In: E. Sjögren (ed.): Forests of the world diversity and dynamics, pp. 141–143. – Studies in Plant Ecol. **18**, Svenska Växtgeogr. Sllskapet, Uppsala.

Kim, J.-W. (1990): A syntaxonomic scheme for the deciduous oak forests in South Korea. –Abstracta Bot. **14**: 51–81.

Kim, J.-W. (1992): Vegetation of Northeast Asia. On the syntaxonomy and syngeography of the oak and beech forests. – Ph.D. Dissertation, University of Vienna. 314 pp.

Kim, J.-W. (1996): Floristic characterization of the temperate oak forests in the Korean Peninsula using high-rank taxa. – J. Plant Biol. **39**: 149–159.

Kim, J.-W. & Kim, J.-H. (1988): Phytosociological study on montane forest vegetation at periphery of Seoul, Korea. – Korean J. Ecol. **11**: 97–107.

Kim, J.-W., Lee, D.-I. & Kim, W. (1995): Minimal areas and community structure of Pinus densiflora forests and Quercus mongolica forests. – Korean J. Ecol. **18**: 451–462.

Kim, J.-W. & Nam, H.-K. (1996): On the southernmost distribution of the Rosa rugosa community. – J. Inst. Nat. Sci. Keimyung Univ. **15**: 149–156. [in Korean]

Kim, J.-W. & Nam, H.-K. (1998): Syntaxonomical and synecological characteristics of rice fields vegetation. – Korean J. Ecol. **21**: 203–215. [in Korean]

Kim, J.-W., Song, S.-D. & Kim, S.-J. (1996): A syntaxonomical study on the vegetation of Ulreung-do and Tok-do, Korea. – Rep. Surv. Nat. Environ. Korea **10**: 137–202. [in Korean]

Koch, W. (1954): Pflanzensoziologische Skizzen aus den Reisfeldgebieten des Piemont (PO- Ebene). – Vegetatio **2**: 487–493.

Kolbek, J. & Dostálek, J. (1996): Vegetation of water basins in the northern part of the Korean Peninsula. – Thaiszia J. Bot. **5(1995)**: 121–130.

Kolbek, J., Dostálek, J. & Jarolímek, I. (1996): The vegetation of rice fields in North Korea and its relation to South Korea and Japan. – Fragm. Flor. Geobot. **41/2**: 621–637.

Kolbek, J., Dostálek, J., Jarolímek, I., Ostrý, I. & Li, S.-H. (1989): On salt marsh vegetation in North Korea. – Folia Geobot. Phytotax. **24**: 225–251.

Kolbek, J. & Jarolímek, I. (2007): Vegetation of Paektu Mt. alpine tundra and changes of species composition in its ecotone. – Linzer Biol. Beitr. **39/2**: 707–725.

Kolbek, J. & Jarolímek, I. (2008): Man-influenced vegetation of North Korea. – Linzer. Biol. Beitr. **40/1**: 381–404.

Kolbek, J. & Jarolímek, I. (2010): Phragmitetum japonicae in Korean Peninsula and Japan. – Biologia **65/3**: 479–488.

Kolbek, J. & Jarolímek, I. (2011): Forests of the Northern Korean Peninsula. – In: Z.H. Bernal, C.H. Sierra, M.O. Olalde & T.A. González Vega (eds.): Bosques del Mundo, Cambio climático y Amazonía, pp. 125–140. – Ed. ASOCOLVAS (Asociación de Colombianos en al País Vasco), UNESCO Katedra, Bilbao.

Kolbek, J., Jarolímek, I. & Valachovič, M. (1997): Plant communities of rock habitats in North Korea: 1. Communities of semi-dry rocks. – Biologia **52/4**: 503–522.

Kolbek, J., Jarolímek, I. & Valachovič, M. (2003a): Forest vegetation of the northern Korean Peninsula. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 263–361. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.

Kolbek, J. & Kučera, M. (1989): A brief survey of selected woody species of North Korea (D.P.R.K.). – Inst. Bot., Acad. Sci. Czech Rep., Průhonice. 67 pp. + 125 figs.

Kolbek, J. & Kučera, M. (1999): A brief survey of selected woody species of North Korea (D.P.R.K.). II. – Inst. Bot., Acad. Sci. Czech Rep., Průhonice. 93 pp.

Kolbek, J., Kučera, M., Jarolímek, I. & Valachovič, M. (2001): Distribution and phytocoenology of selected woody species of North Korea (D.P.R.K.). – Inst. Bot., Acad. Sci. Czech Rep., Průhonice. 340 pp.

Kolbek, J. & Sádlo, J. (1996): Some short-lived ruderal plant communities of non-trampled habitats in North Korea. – Folia Geobot. Phytotax. **31**: 207–217.

Kolbek, J., Šrůtek, M. & Box, E.O. (eds.) (2003b): Forest vegetation of Northeast Asia. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London. 462 pp.

Kolbek, J. & Valachovič, M. (1996): Plant communities on walls in North Korea: a preliminary report. – Thaiszia-J. Bot. **6**: 67–75.

Kolbek, J., Valachovič, M., Ermakov, N. & Neuhäuslová, Z. (2003c): Comparison of forest syntaxa and types in Northeast Asia. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 409–423. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.

Kolbek, J., Valachovič, M. & Jarolímek, I. (1998): Plant communities of rock habitats in North Korea: 2. Communities of moist rocks. – Biologia **53/1**: 37–51.

Kong, W.-S. (1998): The alpine and subalpine geoecology of the Korean Peninsula. – Korean J. Ecol. **21**: 383–387.

Kong, W.-S. (2000): Geoecology on the subalpine vegetation and landscape of Mt. Sorak. – Journ. Korean Geogr. Soc. **35**: 177–187. [in Korean]

Kong, W.-S. & Watts, D. (1993): The plant geography of Korea with an emphasis on the alpine zones. – Kluwer Academic Publishers, Dordrecht. 229 pp.

Kong, W.-S. & Watts, D. (1999): Distribution of arboreal arctic-alpine plants and environments in NE Asia and Korea. – Geograph. Rev. Japan **72**: 122–134.

Košťák, M., Krestov, P.V. & Okitsu, S. (2003): Basic geomorphological and geological characteristics of Northeast Asia. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 33–49. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.

Krestov, P.V. (1993a): Ecological and phytocoenotical characteristics of the broad-leaved-coniferous forest belt in the basin of Bolshaya Ussurka river (Primorsky region). – Bot. Zhurn. **78**: 116–122. [in Russian]

Krestov, P.V. (1993b): Rare plant communities in the broad-leaved-coniferous belt of the Bolshaya Ussurka river basin (Middle Sykhote-Alin Mountains). – Bot. Zhurn. **78**: 107–115. [in Russian]

Krestov, P.V. (2003): Forest vegetation of Easternmost Russia (Russian Far East). – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 93–180. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.

Krestov, P.V. & Nakamura, Y. (2002): Phytosociological study of the Picea jezoensis forests of the Far East. – Folia Geobot. **37**: 441–473.

Krestov, P.V. & Nakamura, Y. (2007): Climatic controls of forest vegetation distribution in Northeast Asia. – Ber. d. Reinh.-Tüxen-Ges. **19**: 131–145.

Krestov, P.V., Omelko, A.M. & Nakamura, Y. (2008): Vegetation and natural habitats of Kamchatka. – Ber. d. Reinh.-Tüxen-Ges. **20**: 195–218.

Krestov, P.V., Omelko, A.M. & Nakamura, Y. (2010): Phytogeography of higher units of forests and krummholz in North Asia and formation of vegetation complex in the Holocene. – Phytocoenologia **40**: 41–56.

Krestov, P.V., Song, J.-S., Nakamura, Y. & Verkholat, V.P. (2006): A phytosociological survey of the deciduous temperate forests of mainland Northeast Asia. – Phytocoenologia **36**: 77–150.

Lee, Ch.-S., Cho, H.-J. & Yi, H. (2004): Stand dynamics of introduced black locust (Robinia pseudoacacia L.) plantation under different disturbance regimes in Korea. – Forest Ecol. Manag. **189**: 281–293.

Lee, D.-S. (ed.) (1987): Geology of Korea. – Geolog. Soc. Korea, Kyohak-sa Publ., Seoul. 514 pp.

Lee, E.-B. (1997): Actual vegetation and potential natural vegetation of Pukhansan National Park, Mid-western Korea. – Korean J. Ecol. **20**: 439–450.

Lee, H.-S., Park, H.-W., Rim, Y.-D. & Lee, S.-K. (1998): Flora and vegetation of alpine grassland at Dalmon on Mt. Paektu. – Korean J. Ecol. **21**: 541–547.

Lee, T.-B. (1999): Illustrated flora of Korea. – HMS Publ., Seoul. 990 pp. [in Korean]

Lee, T.-B. (2003): Coloured flora of Korea. – HMS Publ., Seoul. 910 pp. [in Korean]

Lee, Y.-J. (1988): Spore plants (Cryptogams) of Korea. Vol. 7. Lichens. – Goahakbaekgoasadzon-Tschulpansa, Pyongyang. 276 pp. [in Korean]

Lee, Y.-N. (2006): New Flora of Korea. Vol. I, II. – Kyo-Hak Publ. Co. Ltd., Seoul, 975 + 885 pp. [in Korean]

Li, S.-H. & Li, K.-Ch. (1986): Some characteristics of Myohyangsan Mts.-forests. – J. Bot. **3**: 8–16. [in Korean]

Lohmeyer W. & Miyawaki A. (1962): Zur Kenntnis der ephemeren nitrophilen Meeresstrand- und Flussufer-Vegetation in Japan. – Mitt. Florist.-Soziol. Arbeitsgem. **9**: 78–84.

Maarel, E. van der (1979): Transformation of cover abundance values in phytosociology and its effects on community similarity. – Vegetatio **39**: 97–114.

Min, B.M. & Kim, J.-H. (1999): Plant community structure in reclaimed lands on the west coast of Korea. – J. Plant Biol. **42**: 287–293.

Min, B.M., Kim, J.H., Kimura, M., Kikuchi, E., Suzuki, T., Takeda, S. & Kurihara, Y. (1989): Soil and plant community of reclaimed lands on the west coast of Korea. – Ecol. Rev. **21**: 245–257.

Minamikawa, M. (1963): Phytosociological studies of the plant communities on the river-bach of the river Yahagi and its tributaries. – In: M. Hiro (ed.): Nature in Yahagi Riwer, pp. 287. – College of Nagoya Women's University, Nagoya.

Minamikawa, M. (1979): Phytosociological studies of the vegetation on the dry beds of the River Nagara and its tributaries. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc., Vol. **16**: 281–288.

Mirkin, B.M., Manibazar, N., Gareeva, L.M., Kashapov, R.Sh., Maksimovicz, S.V., Muchametshina, V.S. & Naumova, L.G. (1980): Rastitel'nost recnych pojm Mongolskoj narodnoj respubliky. – Nauka, Leningrad. 284 pp. [in Russian]

Mirkin, B.M. & Naumova, L.G. (2012): The current state of the main concepts of vegetation science. – Gilgem, Ufa. 488 pp. [in Russian]

Miyawaki, A. (1960): Pflanzensoziologische Untersuchungen über Reisfeld-Vegetation auf dem Japanischen Inseln mit vergleichender Betrachtung Mitteleuropas. – Vegetatio **2**: 345–402.

Miyawaki, A. (1964): Trittgesellschaften auf den Japanischen Inseln. – Bot. Mag. **77**: 365–374.

Miyawaki, A. (1969): Systematik der Ackerunkrautgesellschaften Japans. – Vegetatio **19**: 47–59.

Miyawaki, A. (1979): Vegetation und Vegetationskarten auf den Japanischen Inseln. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc., Vol. **16**: 49–70.

Miyawaki, A. et al. (1972): Vegetation der Stadt Yokohama. – Yokohama. 143 pp.

Miyawaki, A. et al. (1973): Vegetation der Stadt Kamakura. – Kamakura, 114 pp.

Miyawaki, A. et al. (1981): Vegetation der Stadt Kawasaki und ihrer Umgebung. – Yokohama.

Miyawaki, A. (ed.) (1980): Vegetation of Japan. Vol. **1.** Yakushima. – Shibundo Publishers, Tokyo. 378 pp.

Miyawaki, A. (ed.) (1981): Vegetation of Japan. Vol. **2.** Kyushu. – Shibundo Publishers, Tokyo. 486 pp.
Miyawaki, A. (ed.) (1982): Vegetation of Japan. Vol. **3.** Shikoku. – Shibundo Publishers, Tokyo. 542 pp.
Miyawaki, A. (ed.) (1983): Vegetation of Japan. Vol. **4.** Chugoku. – Shibundo Publishers, Tokyo. 542 pp.
Miyawaki, A. (ed.) (1984): Vegetation of Japan. Vol. **5.** Kinki. – Shibundo Publishers, Tokyo. 598 pp.
Miyawaki, A. (ed.) (1985): Vegetation of Japan. Vol. **6.** Chubu. – Shibundo Publishers, Tokyo. 606 pp.
Miyawaki, A. (ed.) (1986): Vegetation of Japan. Vol. **7.** Kanto. – Shibundo Publishers, Tokyo. 644.
Miyawaki, A. (ed.) (1987): Vegetation of Japan. Vol. **8.** Tohoku. – Shibundo Publishers Tokyo. 608 pp.
Miyawaki, A. (ed.) (1988): Vegetation of Japan. Vol. **9.** Hokkaido. – Shibundo Publishers, Tokyo. 563 pp.
Miyawaki, A. & Fujiwara, K. (1974): Vegetation der Stadt Itami (Präfektur Hyogo). – Itami.
Miyawaki, A. & Ohba, T. (1969): Studien über die Strandsalzwiesen-Gesellschaften auf Honshu, Shikoku und Kyushu (Japan). – Sci. Rep. Yokohama Nat. Univ., Sect. II, **15**: 1–23.
Miyawaki, A., Ohba, T. & Okuda, S. (1969): Phytocoenological study of alpine and subalpine zones of the Norikura-dake Mts in Central Japan. – Cons. Soc. Jap. **36**: 50–103. [in Japanese]
Miyawaki, A. & Okuda, S. (1972): Pflanzensoziologische Untersuchungen über die Auen-vegetation des Flusses Tama bei Tokyo, mit einer vergleichenden Betrachtung über die Vegetation des Flusses Tone. – Vegetatio **24**: 229–311.
Miyawaki, A. & Suzuki, K. (1976): Vegetation der Dünen und der Korallenbauten auf den Ryukyu-Inseln, Japan. – Bull. Inst. Envir. Sci. Techn. **2**: 115–152.
Mucina, L. (1990): Vicariance and clinal variation in synanthropic vegetation. – In: P.L. Nimis & T. Crovella (eds.): Approaches to quantitative phytogeography, pp. 263–276. – Kluwer, Dordrecht.
Mucina, L. & Dostálek, J. (1985): A short note on the coastal dune vegetation south of Wonsan, the North Korea. – Tuexenia **5**: 331–334.
Mucina, L., Dostálek, J., Jarolímek, I., Kolbek, J. & Ostrý, I. (1991): Plant communities of trampled habitats in North Korea. – J. Veg. Sci. **2**: 667–678.
Nakagoshi, N. (1995): Pine forests in East Asia. – In: E.O. Box, R.K. Peet, I. Masuzawa, I. Yamada, K. Fujiwara & P.F. Maycock (eds.): Vegetation science in forestry. Global perspective based on forest ecosystems of east and southeast Asia, pp. 85–104. – Kluwer Academic Publishers, Dordrecht.
Nakamura, Y., Krestov, P.V. & Omelko, A.M. (2007): Bioclimate and zonal vegetation in Northeast Asia: first approximation to an integrated study. – Phytocoenologia **37**: 443–470.
Nakanishi, H. (1982): Coastal vegetation on the shingle spits of southwestern Japan. – Phytocoenologia **10**: 57–71.
Neuhäusl, R. & Neuhäuslová, Z. (1994): Vegetation belts and community patterns in Central Korean mountain ranges. – Phytocoenologia **24**: 155–165.
Nobuhara, H. (1979): Variation of density of Suaeda maritima in Reed Marsh. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc., Vol. **16**: 369–377.
Oberdorfer, E. (1971): Zur Syntaxonomie der Trittpflanzen-Gesellschaften. – Beitr. Naturkdl. Forsch. Südw.-Dtschl. **30**: 95–111.
Oberdorfer, E. (1983): Einige Bemerkungen zu Vegetationsstrukturen im östlichen Nordamerika, in Oahu Hawaii und Mitteljapan. – Andrias **2**: 53–63.
Oh, S.-Y. & Pak, J.-H. (2001): Distribution maps of vascular plants in Korea. – Academy Book Publ., Seoul. 997 pp.
Ohba, T. (1973a): Die Vegetation des oberen Kiyotsu-Tales, Mittel-Japan. Vegetationskarte 1:500 000. – Rep. Jap. Assoc. Natur. Conserv. **43**: 57–128.
Ohba, T. (1973b): Über die Vegetation des Kiyotsu-Tales, Zentral-Japan. – In: Scientific report of the conservation in Kiyotsu river dam planning. – Natur. Conserv. Soc. Japan, pp. 57–102. – Tokyo [in Japanese]
Ohba, T. (1974): Vergleichende Studien über die alpine Vegetation Japans. 1. Carici rupestris-Kobresietea bellardii. – Phytocoenologia **1**: 339–401.
Ohba, T., Miyawaki, A. & Tüxen, R. (1973): Pflanzengesellschaften der japanischen Dünen-Küsten. – Vegetatio **26**: 1–143.
Ohba, T. & Sugawara, H. (1979): Bemerkung über die japanischen Vorwald-Gesellschaften. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc., Vol. **16**: 267–279.
Ohno, K. (1983): Pflanzensoziologische Untersuchungen über Japanische Flußufer- und Schluchtwälder der montanen Stufe. – J. Sci. Hiroshima Univ., Ser. B, Div. 2, **18/2**: 235–286 & Tabs 1–11.
Ohno, K. (1991): A vegetation-ecological approach to the classification and evaluation of potential natural vegetation of the Fagetea crenatae region in Tohoku (northern Honshu), Japan. – Ecol. Res. **6**: 29–49.
Ohno, K. (2008): Vegetation-geographic evaluation of the syntaxonomic system of valley-bottom forests occurring in the cool-temperate zone of the Japanese Archipelago. – In: H. Sakio & T. Tamura (eds.): Ecology of riparian forests in Japan. Disturbance, life history, and regeneration, pp. 49–72. – Springer, Tokyo.
Ohwi, J. (1965): Flora of Japan. – Smithsonian Inst., Washington, D.C. 1067 pp.
Okitsu, S. (1996a): Alpine tundra vegetation around the timberline ecotone of Mt. Daľnyaya Ploskaya, Central Kamchatka. – J. Phytogeogr. Taxon. **44**: 53–62. [in Japanese]
Okitsu, S. (1996b): Forest geography and establishment processes of the Picea jezoensis-Abies sachalinensis forest of southern Sakhalin. – Veget. Sci. **13**: 25–35. [in Japanese]
Okitsu, S. (1997): Distribution, growth and regeneration of Larix gmelinii (Rupr.) Rupr. along the timberline ecotone of Mt. Daľnyaya Ploskaya, Central Kamchatka. – Proc. NIPR Symp. Polar Biol. **10**: 179–187.
Okitsu, S. (1998): Distribution and growth of Pinus pumila Regel along the Larix gmelinii (Rupr.) Rupr. timberline ecotone of Mt. Dal´nyaya Ploskaya, Central Kamchatka. – Proc. NIPR Symp. Polar Biol. **11**: 159–168.
Okitsu, S. (2003): Forest vegetation of Northern Japan and Southern Kurils. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 231–261. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.
Okitsu, S. & Ito, K. (1984): Vegetation dynamics of the Siberian dwarf pine (Pinus pumila Regel) in the Taisetsu mountain range, Hokkaido, Japan. – Vegetatio **58**: 105–113.
Okitsu, S. & Ito, K. (1989): Conditions for the development of the Pinus pumila zone of Hokkaido, northern Japan. – Vegetatio **84**: 127–132.
Okuda, S. (1975): Classification of weed communities in sown-grassland. – In: M. Numata: JIBP synthesis 13. Ecological

studies in Japanese grasslands with special reference to IBP area – Productivity of terrestrial communities, pp. 51–58. – Tokyo.
Pak, J.-H. (2005): The coloured flora for practical use in Korea. I. – Seoul, 711 pp. [in Korean]
Park, Ch.-W. (2007): The genera of vascular plants of Korea. – Academic Publ., Seoul. 1482 pp.
Podani, J. (1993): SYN-TAX-pc. Computer programs for multivariate data analysis in ecology and systematics. Version 5. – Scientia Publ., Budapest. 104 pp.
Podani, J. (2001): SYN-TAX 2000. Computer Program for Multivariate Data Analysis in Ecology and Systematics for Windows 95, 98 & NT. User's Manual. – Scientia Publ., Budapest. 104 pp.
Qian, H. (1992): Alpine tundra vegetation of Changbai Mountains. – Bot. Res. **3**: 97–118. [in Chinese]
Qian, H., Yuan, X.-Y. & Chou, Y.-L. (2003): Forest vegetation of Northeast China. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 181–230. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.
Rehder, A. (1962): Manual of cultivated trees and shrubs. – Dioscorides Press, Portland, Oregon. 996 pp.
Ri, J.-D. & Hoang, H.-D. (1984): List of plant names. – Goahakbaekgoasadzon-Tschulpansa, Pyongyang. 544 pp. [in Korean]
Sádlo, J. & Kolbek, J. (1997): The terrestrial ruderal and segetal vegetation of North Korea: A synthesis. – Folia Geobot. Phytotax. **32**: 25–40.
Saito, K. (1979): A note on subalpine coniferous forests in North Honshu, Japan. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc. Vol. **16**: 177–188.
Sambuk, S.G. (1986): The classification of the lichen and green-moss pine forests of the nort-west of the European part of the USSR. – Bot. Zhurn. **71**: 1468–1479.
Simoda, M. & Suzuki, H. (1979): Wetland vegetation of the Saijo Basin, Hiroshima Prefecture. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc. Vol. **16**: 315–323. [in Japanese]
Soják, J. (1987): Notes on Potentilla paradoxa and P. supina. – Preslia **59**: 271–272.
Son, K.-N., Kang, Ch.-G., Pak, G.-J. & Kim, Y.-B. (eds.) (2005): Red Data Book of DPR Korea (Plant). – MAB Nat. Comm. DPRK, Bot. Inst., Pyongyang. 177 pp.
Song, J.-S. (1988): Phytosociological study of the mixed coniferous and deciduous broad-leaf forests in South Korea. – Hikobia **10**: 145–156. [in Japanese]
Song, J.-S. (1991a): Phytosociology of subalpine coniferous forests in Korea I. Syntaxonomical interpretation. – Ecol. Res. **6**: 1–19.
Song, J.-S. (1991b): Preliminary survey of the summer weed communities in cultivated fields and abandoned fields of Cheju Island. – Res. Rev. Andong Nat. Univ. **13(1989)**: 307–319. [in Japanese]
Song, J.-S. (1992a): A comparative phytosociological study of the subalpine coniferous forests in northeastern Asia. – Vegetatio **98**: 175–186.
Song, J.-S. (1992b): Vegetation changes and their causes in Andong Dam areas. – Korean J. Ecol. **15**: 411–431. [in Korean]
Song, J.-S. (1997): A phytosociological study on the weed communities in the cultivated and abandoned fields of Korea. – Korean J. Ecol. **20**: 191–200.
Song, J.-S. (2001a): A phytosociological study of the shrubby and herbaceous vegetation of the riverside in the upper stream of Nak-dong River, Korea. – Korean J. Envir. Ecol. **15**: 104–117. [in Korean]
Song, J.-S. (2001b): Phytosociological study of the oak (Quercus spp.) forests on Mts. Kaya, Bisul, Unmun and Kaji in southern Kyongpook Province. – Korean J. Ecol. **24**: 9–18. [in Korean]
Song, J.-S. (2001c): A phytosociological study on the forest vegetation in the northern part of Kyongbuk Province, Korea. – J. Envir. Res. **1**: 101–114. [in Korean]
Song, J.-S. & An, S.-H. (1999): Synecological study of the naturalized plant communities in Old-Andong city. – Korean J. Ecol. **22**: 169–179. [in Korean]
Song, J.-S. & Kim, H.-K. (1993): Synecological study on the forest vegetation of Imha-dam area, Andong. – Korean J. Ecol. **16**: 439–457. [in Korean]
Song, J.-S. & Nakanishi, S. (1985): On the Pinus pumila scrub of Mt. Sulak, Korea. – Jap. J. Ecol. **35**: 537–541.
Song, J.-S. & Ohno, K. (2005): A phytosociological study on the coastal vegetation of Ulleung Island, South Korea. – Hikobia **14**: 305–314. [in Japanese]
Song, J.-S., Roh, K.-S., Chung, H.-S., Song, D.-S., Ohno, K. & Mochida, Y. (1999): Phytosociology of the Quercus ssp. forests on Mts. Palgong, Kumo and Hwangak in the city areas of Taegu, Kumi and Kimchon, Kyungpook Province, Korea. – Korean J. Envir. Ecol. **13**: 220–233. [in Korean]
Song, J.-S., Sin, D.-G., Lee, J.-S., Kim, H.-K. & Eom, G.-H. (2009): Synecological study of the forest vegetation on Mt. Boryeonsan, Chungcheonbuk Province. – Korean J. Envir. Ecol. **23**: 65–76. [in Korean]
Song, J.-S. & Song, S.-D. (1996): A phytosociological study on the riverside vegetation around Hanchon, an upper stream of Nak-tong River. – Korean J. Ecol. **19**: 431–451. [in Korean]
Song, J.-S., Song, S.-D., Park, J.-H., Seo, B.-B., Chung, H.-S., Roh, K.-S. & Kim, I.-S. (1995): A phytosociological study of Quercus mongolica forest on Mt. Sobaek by ordination and classification techniques. – Korean J. Ecol. **18**: 63–87.
Staszkiewicz, J. (1992a): Variability of the cones of Picea jezoensis and P. koraiensis (Pinaceae) in North Korea. – Fragm. Geobot. **37**: 241–249.
Staszkiewicz, J. (1992b): Variability of the cones of Larix olgensis (Pinaceae) in the massif of Paekdu-san in North Korea. – Fragm. Geobot. **37**: 487–497.
Suzuki, T. (1973): Die dorsiventrale Verteilung der Pflanzengesellschaften des Tateyama-Gebirges. – Rep. Ebino Biol. Lab., Kyushu Univ. **1**: 1–18.
Suzuki, T., Okamoto, S. & Honda, K. (1963): Über die Waldvegetation der subalpinen Stufe im inneren Kurobe-Gebiet, Japan. – Jap. J. Ecol. **13**: 216–226. [in Japanese]
Šrůtek, M. & Kolbek, J. (1992): Species structure of artificial grasslands with Zoysia japonica Steud. in Pyongyang, North Korea. – Feddes Repert. **103/3–4**: 215–234.
Šrůtek, M. & Kolbek, J. (1994): Vegetation structure along the altitudinal gradient at the treeline of Mount Paektu, North Korea. – Ecol. Res., Tsukuba, **9**: 303–310.
Šrůtek, M., Kolbek, J., Jarolímek, I. & Valachovič, M. (2003a): Vegetation-environment relationships within and among selected natural forests in North Korea. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 363–381. – Geobotany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.
Šrůtek, M., Kolbek, J. & Lepš, J. (2003b): Species and spatial structure of forests on the southeastern slope of Paektu-san, North Korea. – In: J. Kolbek, M. Šrůtek & E.O. Box (eds.): Forest vegetation of Northeast Asia, pp. 383–407. – Geo-

botany **28**, Kluwer Academic Publishers, Dordrecht, Boston & London.
Šrůtek, M. & Lepš, J. (1994): Variation in structure of Larix olgensis stands along the altitudinal gradient on Paektu-san, Changbai-shan, North Korea. – Arctic Alpine Res. **26**: 166–173.
Šrůtek, M., Lepš, J. & Kolbek, J. (1994): Vegetational structure along the altitudinal gradient on the southeastern slope of Paektu-san, North Korea. – Abstracts, Symp. Community Ecology and Conservation Biology, section 5–22, Bern (Switzerland) August 14–18.
Takeda, Y., Nakanishi, S. & Choe, D. (1994): Phytosociological study on natural summer-green forests in Korea. – Ecol. Res. **9**: 21–32.
Tatewaki, M. & Ro, T. (1960): Dune- and meadow-communities along the Ochotsk Sea near Abashiri, Hokkaido, Japan. – Japan Biol. J. Nara Women's Univ. **10**: 84–90.
Tüxen, R. (1957): Zur systematischen Stellung des Sagino-Bryetum argentei. – Mitt. Florist.-Soziol. Arbeitsgem. N.F. **5/6**: 170–171.
Tüxen, R. (1977): Unsere Reise durch Japan. – In: A. Miyawaki & R. Tüxen (eds.): Vegetation science and environmental protection, pp. 559–576. – Maruzen, Tokyo.
Tüxen, R. (1979): Zur soziologischen Bearbeitung anthropogener Weide- und Zierrasen europaischer Herkenft in der Holoarktis. – In: A. Miyawaki & S. Okuda (eds.): Vegetation und Landschaft Japans, pp. 45–48. – Yokohama.
Ubrizsy, G. (1961): Unkrautvegetation der Reiskulturen in Ungarn. – Acta Bot. Acad. Sci. Hung. **7**: 175–220.
Uh, D. (1991): Climatic change of the Korean Peninsula at the quaternary era. – J. Geogr. **100**: 762–775.
Ul'yanova, T.N. (1982): Kamchatka Peninsula. – In: W. Holzner & M. Numata (eds.): Biology and ecology of weeds, Geobotany 2, pp. 281–284. – The Hague, Boston & London.
Valachovič, M., Anenkhonov, O.A. & Hodálová, I. (2002): Vegetation along an altitudinal gradient in the Gremyachaya Valley, Barguzinskii Range, Eastern Siberia. – Biologia **57/1**: 83–100.
Voroshilov, V.N. (1982): Determination key of plants of the Soviet Far East. [Opredelitel rastenij Sovetskogo Dalnego Vostoka]. – Nauka, Moscow. [in Russian]
Wang, C.-W. (1961): The forests of China with a survey of grassland and desert vegetation. – Maria Moors Cabot Found., Publ. Ser. No. **5**, Harvard Univ., Cambridge. 313 pp.
Watanabe, S. (1979): The subarctic summer green forest zone in the Northeastern Asia. – In: A. Miyawaki & S. Okuda: Vegetation und Landschaft Japans. – Yokohama Phytosoc. Soc., Vol. **16**: 101–111.
Weber, H.E., Moravec, J. & Theurillat, J.P. (2000): International code of phytosociological nomenclature. Ed. 3. – J. Veget. Sci. **11**: 739–768.
Westhoff, V. & Maarel, E. van der (1978): The Braun-Blanquet approach. – In: R.H. Whittaker: Classification of plant communities, pp. 287–399. – Dr W. Junk, The Hague, Boston.
Wiegleb, G. & Kaplan, Z. (1998): An account of the species of Potamogeton L. (Potamogetonaceae). – Folia Geobot. **33**: 241–316.
Yim, Y.-J. (1977a): Distribution of forest vegetation and climate in the Korean Peninsula. III. Distribution of tree species along the thermal gradient. – Jap. J. Ecol. **27**: 177–189.
Yim, Y.-J. (1977b): Distribution of forest vegetation and climate in the Korean Peninsula. IV. Zonal distribution of forest vegetation in relation to thermal climate. – Jap. J. Ecol. **27**: 269–278.
Yim, Y.-J. (1995): Composition and distribution of deciduous broad-leaved forests in Korea. – In: E.O. Box, R.K. Peet, T. Masuzawa, I. Yamada, K. Fujiwara & P.F. Maycock (eds.): Vegetation science in forestry. Global perspective based on forest ecosystems of East and Southeast Asia, pp. 273–298. – Kluwer Academic Publishers, Dordrecht.
Yim, Y.-J. & Jeon, E.-S. (1980): Distribution of naturalized plants in the Korean Peninsula. –Korean J. Bot. **23**: 69–83.
Yim, Y.-J. & Kim, S.-D. (1983): Climate-Diagram map of Korea. – Korean J. Ecol. **6**: 261–272.
Yim, Y.-J. & Kira, T. (1975): Distribution of forest vegetation and climate in the Korean Peninsula. I. Distribution of some indices of thermal climate. – Jap. J. Ecol. **25**: 77–88.
Yim, Y.-J. & Shim, J.-K. (1998): On the vegetation zone of Mt. Paektu. – Korean J. Ecol. **21**: 501–518.
Yoshimura, I. (1994): Lichen flora of Japan in colour. 6th ed. – Hoikusha, Osaka. [in Japanese]
Zhu, T.-Ch. & Rowe, J.S. (1987): A comparison of alpine tundra floras: N.E. China and N.W. North America. – Linzer Biol. Beitr. **19/1**: 29–41.

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Appendix

Full names of the infra-specific taxa given in the nomenclatural sources:
Agropyron tsukushiense var. *transiens*
Asarum heterotropoides var. *mandshuricum*
Atrichum pallidum var. *gracile*
Calamagrostis arundinacea var. *hirsuta*
Cladonia rangiferina subsp. *grisea*
Corylus heterophylla var. *thunbergii*
Erigeron thunbergii var. *glabratus*
Festuca ovina var. *koreano-alpina*
Frullania tamarisci subsp. *obscura*
Galium verum var. *asiaticum*
Geranium koreanum var. *hirsutum*
Ledum palustre var. *maximum*
Lilium concolor var. *partheneion*
Monochoria vaginalis var. *plantaginea*
Polygonatum odoratum var. *pluriflorum*
Ranunculus acris var. *elatus*
Rhododendron fauriei var. *roseum*
Rubia cordifolia var. *pratensis*
Sasamorpha purpurascens var. *borealis*
Scabiosa japonica var. *alpina*
Tripogon chinensis var. *coreensis*

Names of taxa absent from the generally used nomenclatural sources, with the author abbreviations (see Ohwi 1965, Rehder 1962):
Amaranthus chlorostachys Willd.
Amaranthus lividus L.
Chenopodium strictum Roth
Dennstaedtia hirsuta (Sw.) Mett.
Digitaria sanguinalis subsp. *pectiniformis* Henrard
Diplachne fusca (L.) Beauv.
Gymnocarpium jessoense (Koidz.) Koidz.
Luzula multiflora subsp. *sibirica* V. I. Krecz
Luzula nipponica (Satake) Kirschner et Miyam
Lycopodium clavatum var. *nipponicum* Nakai
Potentilla coreana Soják
Potentilla supina subsp. *costata* Soják
Salix arctica Pall.
Schistidium apocarpum (Hedw.) B. et S.
Scirpus iseensis Schimizu
Setaria macrocarpa Lucznik
Spiraea japonica L. fil.