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A phytosociological survey of the deciduous temperate forests of mainland Northeast Asia

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with 3 figures and 6 tables

Abstract. This study represents the first survey of the temperate deciduous forests of mainland Northeast Asia on the territories of the Russian Far East, northeast China and Korea. A total of 1200 relevés are used, representing nemoral broadleaved (*Fraxinus mandshurica*, *Kalopanax septemlobus*, *Quercus mongolica*, *Tilia amurensis*)-coniferous (*Abies holophylla*, *Pinus koraiensis*) forests, and broadleaved *Quercus* spp. forests. The vegetation is classified into 4 orders, 12 alliances, 50 associations, 36 subassociations and 8 variants. One order, Lespedezo bicoloris-Quercetalia mongolicae, 4 alliances Rhododendro daurici-Pinion koraiensis, Phrymo asiaticae-Pinion koraiensis, Corylo heterophyllae-Quercion mongolicae and Dictamno dasycarpi-Quercion mongolicae, and 14 associations are described for the first time. The communities are placed into two classes. Quercetea mongolicae reflects monsoon humid maritime climate with the amount of summer precipitation higher than winter precipitation and the lack of a period of moisture deficit. They occur in Korea, montane regions of China east of the Lesser Hingan and the Sikhote-Alin. Querco mongolicae-Betuletea davuricae unites forests in conditions of semiarid subcontinental climate with summer precipitation considerably higher than winter precipitation and with the period of moisture deficit in spring and early summer. They occupy mostly the regions of northeast China and eastern Russia west of the Lesser Hingan and in the low elevation belts of the southern Sikhote-Alin.

Keywords: China, Far East, Korea, Russia, syntaxonomy, Quercetea mongolicae, Querco mongolicae-Betuletea davuricae, temperate forest.

Nomenclature: Kharkevich (1985–1996) and Lee (1989).

Electronic appendix (http://www.geopacifica.org/proj/eApp.pdf): Tables 1–18.

1. Introduction

Forest vegetation in the cool and cold subzones of the temperate zone of Asia is characterized by the dominance of summergreen deciduous trees and by a prevalence of species restricted in distribution to East Asia (Sino-

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Japanese floristic nucleus). The modern state of knowledge about this vegetation is based on numerous studies in China, Korea, Japan and Russia conducted in the 20th century. However, the different methodologies used in vegetation classification make the results of studies obtained in different countries hardly compatible. Approaches used in Russia and China up to now remain exotic for international audiences, while Japan and Korea widely use the Braun-Blanquet methodology in vegetation studies. Meanwhile, the similar ecology, history of formation and zonal position of the temperate deciduous forests in the East Asian mainland demand unified methods of classification.

The current state of syntaxonomical studies within the scope of the Braun-Blanquet approach (Braun-Blanquet 1964, Westhoff & van der Maarel 1978) for all these forest types remains very uneven in different countries. The most comprehensive studies were undertaken in Japan (see Miyawaki 1980–1989, Miyawaki et al. 1994) and in South Korea (see Kim 1992). Recently, a valuable accomplishment on syntaxonomy of North Korea was made by Kolbek et al. (2003a).

In Russia, the principles of vegetation classification based on dominance criteria (Sukachev 1957, Sukachev & Dylis 1964) were generally used for distinguishing and ordering community types (Kolesnikov 1938, 1956a, Smagin 1965, Manko 1967; see also Krestov 2003). Russian reaction to the Braun-Blanquet methodology, after a century of prevalence of Sukachev's dominance paradigm, was so strong that the main Russian-language vegetation-ecology journals repeatedly rejected phytosociological papers based on Braun-Blanquet until the 1980s. With the information exchange between Russian and foreign phytosociologists largely blocked, syntaxonomical schemes developed by Russian authors are hardly commensurate with the well-developed syntaxonomies of adjacent regions (Japan and Korea) or regions in the same vegetation zones (boreal and temperate Europe and North America). A strong impulse to the syntaxonomical studies based on Braun-Blanquet approach was given by Mirkin's syntaxonomical school (Mirkin & Naumova 1998). A 10-year history of the application of Braun-Blanquet methodology in Russia may be known to international audience from "Prodromus of Vegetation of the USSR" by Korotkov et al. (1991). At that period, in the Prodromus, the forest vegetation of southern Russian Far East had not been mentioned (with an exception of some references to the manuscript of Galkina & Petelin (1990)). Then, a number of systems by Akhtiamov (1995, 2001), related mainly to meadow and steppe vegetation, Gumarova (1993) and Gumarova et al. (1994) related mainly to broadleaved-Korean pine forests appeared. Closely related vegetation was classified by Ermakov (1997, 2003) and Ermakov et al. (2000), who introduced a new class Querco-Betuletea davuricae Ermakov et Petelin in Ermakov 1997 within hemiboreal forest zone, and Krestov & Nakamura (2002), who classified *Picea jezoensis* forests in their entire range.

In northeast China, vegetation classification started its history in the late 1940s under the influence of the Russian school of phytocoenology

(SUKACHEV 1957) and biogeocoenology (SUKACHEV & DYLIS 1964). Best known are the descriptions of WANG (1961), WU (1980) and QIAN et al. (2003b). Recently, several local works following the Braun-Blanquet methodology have been published in English (YOU et al. 2001).

The purpose of this paper is to observe the existing studies of the temperate deciduous forests in the mainland Asia, on the territories of Korea, northeast China and southeastern Russia, and, on the basis of the extensive relevé database for this entire region, propose a syntaxonomical system of main vegetation types.

2. Material and methods

2.1. Study area and temperate deciduous forests of Asian mainland

According to published vegetation maps (KOLESNIKOV 1956b, SOCHAVA 1969, ANONYMOUS 1982, KIM 1992), the deciduous temperate forests occupy an extensive space in northeast China, Korea (with an exception of southern regions) and Russia (southern part of Amur basin) (Fig. 1). Temperature gradient in the area causes delineation of at least two subzones in the region covered with deciduous forests (NAKAMURA & KRESTOV, 2005). The northern subzone is characterized by mixed (nemoral coniferous and broadleaf trees) forests and by annual temperatures from −2 ° to +6 °C. Kira's warmth (WI) index defined as WI = Σ max{0,(Ti −5)} (where Ti is the mean temperature in °C of the i'th month) showing a strong correlation with vegetation distribution in maritime regions of Asia (KIRA 1949, 1977) ranges in the subzone from 55 to 65 °C. The middle subzone is characterized by the domination of several deciduous oak species with prevalence of *Quercus mongolica* and by annual temperatures from +6 to +12 °C and Kira's warmth indices ranging from 65 to 95 °C. The southern boundary of the middle temperate zone somewhat coincides with the northern distribution of evergreen species and with the isotherm 0 °C for the absolute minimum temperatures. The major climatic characteristics are given in Table 1.

2.2. Database

We used a set of 1200 relevés including our original data collected in the Russian Far East (407 relevés), in Korea (65 relevés), and in northeast China (44 relevés). The rest of the database was formed by relevés extracted from the literature and relevés kept in the phytocoenarium of the laboratory of geobotany of the Institute of Biology and Soil Science in Vladivostok, Russia. All data used in this paper were collected during the 1970–2003 period. The distribution of relevés in the range of deciduous temperate forests as well as authorship and a year of collection are shown in the Table 2.

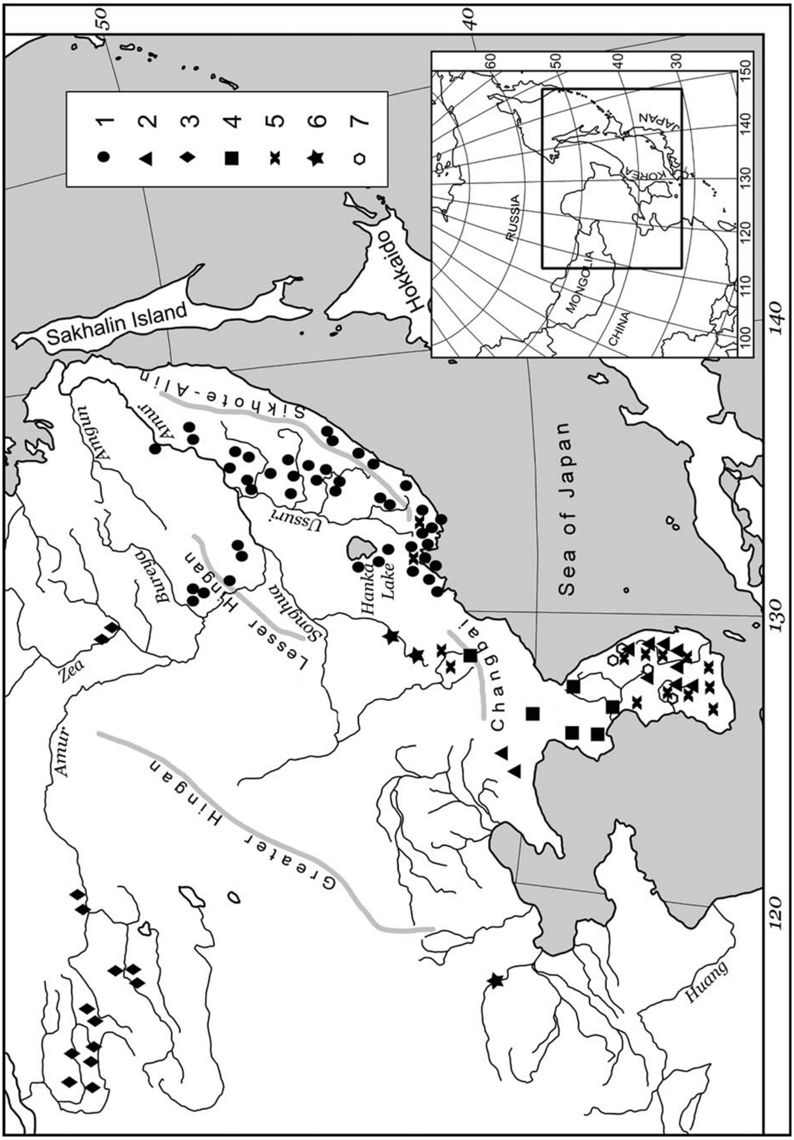

Fig. 1. Major geographical names of the Asian mainland and deciduous temperate forests sampling points referred in this paper. 1 – original data of Krestov & Verkholat (unpubl.); 2 – Song (1988, 1992b), Song et al. (1995, 1999); 3 – Ermakov (1997, 2003); 4 – Kolbek et al. (2003a); 5 – Kim (1990, 1992); 6 – You et al. (2001); 7 – Takeda et al. (1994).

Table 1. Climatic data for the selected stations in Russia (RU) (Anonymous 1966–1971), China (CH) (Zhang & Lin 1983), South (SK) (Anonymous 1992) and North Korea (NK) (Kim 1982) according to phytogeographical regions.

Latitude	Longitude	Region and climatic station	Mean temperature (° C)			Annual precipitation (mm)	Kira's warmth index (°C)
			annual	coldest month	warmest month		
		Tilio-Pinetalia koraiensis region					
48.8 °N	132.9 °E	Birobidzhan (RU)	–0.1	–24.6	20.3	761	53.6
48.5 °N	135.1 °E	Khabarovsk (RU)	1.4	–22.3	21.1	569	58.5
45.9 °N	134.9 °E	Roshchino (RU)	0.3	–24.4	20.4	789	54.2
45.1 °N	136.6 °E	Terney (RU)	2.3	–14.0	17.4	813	38.0
45.1 °N	133.5 °E	Kirovskiy (RU)	1.9	–21.8	21.0	646	59.8
43.1 °N	131.9 °E	Vladivostok (RU)	4.8	–13.5	21.0	831	58.9
43.3 °N	128.5 °E	Dunhua (CH)	5.5	–11.0	21.0	668	–
		Aceri-Quercetalia mongolicae region					
36.6 °N	128.7 °E	Andong (SK)	11.5	–3.0	25.3	1064	93.9
37.3 °N	127.0 °E	Suwon (SK)	11.1	–3.9	25.1	1307	96.8
35.8 °N	127.2 °E	Chonju (SK)	12.9	–1.2	26.3	1296	91.6
38.2 °N	128.6 °E	Sogcho (SK)	11.9	–0.5	23.8	1330	103.2
39.0 °N	125.5 °E	Pyongyang (NK)	9.4	–8.1	24.4	925	90.0
39.1 °N	127.3 °E	Wonsan (NK)	10.2	–3.8	23.4	1308	87.4
38.0 °N	125.4 °E	Haeju (NK)	10.6	–5.0	24.9	1090	93.5
		Lespedezo-Quercetalia mongolicae region					
45.2 °N	132.0 °E	Turiy Rog (RU)	2.4	–20.0	20.8	510	58.9
43.8 °N	132.0 °E	Ussuriysk (RU)	3.2	–19.1	21.2	599	60.6
43.7 °N	135.3 °E	Olga (RU)	3.6	–12.4	18.9	831	47.2
42.7 °N	131.0 °E	Kraskino (RU)	5.2	–11.8	20.9	751	60.0
44.2 °N	129.4 °E	Jingbohu (CH)	3.0	–20.0	24.0	586	–
41.8 °N	123.4 °E	Shenyang (CH)	7.8	–12.0	24.6	366	87.4
43.9 °N	125.3 °E	Changchung (CH)	4.9	–16.4	23.0	394	72.9
		Querco-Betuletalia davuricae region					
50.4 °N	116.5 °E	Borzya (RU)	–2.7	–28.0	20.0	278	36.0
50.3 °N	106.9 °E	Chikoi (RU)	–3.2	–27.0	17.2	317	47.0
50.9 °N	128.5 °E	Belogorsk (RU)	–1.2	–27.0	21.0	480	52.9
45.8 °N	126.6 °E	Harbin (CH)	3.6	–19.4	25.0	422	74.2

2.3. Vegetation classification

Classification was made at categorical levels of subvariant, variant, subassociation, association, suballiance, alliance, order and class using the Braun-Blanquet approach (Braun-Blanquet 1964, Mueller-Dombois & Ellenberg 1974, Westhoff & van der Maarel 1978). The major software tools used to achieve this objective were Turboveg (Hennekens 2002), Juice (Tichý 2002) and VTAB – Ecosystem Reporter, Revision 199907a (Ema-

Table 2. Sources and numbers (N) of relevés included in analysis for each association.

Association Code	Name	N	Region	Relevé source
1	Carici callitrichoi-Pinetum koraiensis	10	Middle and northern Sikhote-Alin	Fieldworks (10)
2	Vaccinio vitis-idaeae-Pinetum koraiensis	14	Middle and northern Sikhote-Alin; south of Bureya highland	Fieldworks (14)
3	Diplazio sibirici-Abietetum nephrolepidis	64	Sikhote-Alin	Fieldworks (31), Gumarova 1993 (33)
4	Lycopodio annotini-Abietetum nephrolepidis	32	Sikhote-Alin	Fieldworks (17); Gumarova 1993 (15)
5	Spiraeo ussuriensis-Quercetum mongolicae	10	Changbai	Kim 1992 tables 4 and 5
6	Athyrio-Pinetum koraiensis	11	Changbai	Kim 1992 tables 6 and 7
7	Tilio-Betuletum platyphyllae	10	Changbai	Kim 1992 tables 8 and 9
8	Carici falcatae-Pinetum koraiensis	31	Northern Sikhote-Alin	Fieldworks (31)
9	Ulmo japonicae-Pinetum koraiensis	19	Middle Sikhote-Alin	Fieldworks (19)
10	Arisaemo amurensi-Pinetum koraiensis	21	Sikhote-Alin	Fieldworks (21)
11	Ribesi maximowicziani-Pinetum koraiensis	33	Sikhote-Alin	Fieldworks (33)
12	Abieti holophyllae-Quercetum mongolicae	64	Southern Sikhote-Alin, Changbai	Fieldworks (31); Kim 1992 tables 10 and 11 (12); Gumarova et al. 1994 tables 5 and 6 (21).
13	Polysticho subtripteron-Pinetum koraiensis	27	Southern Sikhote-Alin	Fieldworks (5); Gumarova et al. 1994 tables 7 and 8 (22)
14	Fraxino mandshurici-Abietetum holophyllae	17	Southern Sikhote-Alin 7	Fieldworks (7); Gumarova et al. 1994 table 10 (10)
15	Taxus cuspidata-Carpinus cordata community	8	Islands of Peter the Great Bay	Fieldworks (8)
16	Lychno-Quercetum mongolicae	33	Southern Korea; Northern Korea	Kim 1992 tables 17 and 18 (12); Kolbek et al. 2003b table 8.7 (21)
17	Veronico coreanae-Quercetum mongolicae	13	Southern Korea	Song et al. 1995 tables 3 and 4 (13)
18	Vaccinio-Quercetum mongolicae	45	Southern Korea; Northern Korea	Kim 1992 tables 19 and 20 (25); Kolbek et al. 2003b table 8.8 (5); Takeda et al. 1994 table 1 (15)
19	Partenocisso tricuspidati-Fraxinetum rhynchophyllae	13	Northern Korea, Southernmost eastern Russia	Fieldworks (2); Kolbek et al. 2003b table 8.9 (11)
20	Dryopterido-Quercetum mongolicae	18	Southern Korea	Kim 1992 tables 21 and 22 (18)
21	Ainsliaeo-Quercetum mongolicae	12	Southern Korea	Song et al. 1999 table 5 rel. 3–14 (12)
22	Festuco ovinae-Pinetum densiflorae	27	Southern Korea; Northern Korea	Song 1992b (10); Kolbek et al. 2003b table 8.10 (17)
23	Rhododendro mucronulati-Pinetum densiflorae	8	Southern Korea	Kim and Yim 1986 (8)
24	Artemisio-Quercetum mongolicae	71	Southern Korea; Northern Korea	Kim 1990 (31); Kolbek et al. 2003b table 8.12 (40)

Association		N	Region	Relevé source
Code	Name			
25	Saso-Quercetum mongolicae	46	Southern Korea; Northern Korea	KIM 1990 (25); KOLBEK et al. 2003b table 8.11 (21)
26	Synelesio palmatae-Carpinetum laxiflorae	7	Northern Korea	KOLBEK et al. 2003b table 8.13 (7)
27	Lindero-Quercetum mongolicae	21	Southern Korea	SONG et al. 1995 tables 3 and 4 (21)
28	Staphyleo-Quercetum serratae	36	Southern Korea	KIM 1990 table 8 (36)
29	Meliosmo-Quercetum serratae	24	Southern Korea	KIM 1990 table 7 (24)
30	Lespedezo-Quercetum serratae	9	Southern Korea	TAKEDA et al. 1994 table 1 (9)
31	Syneilesio-Quercetum serratae	9	Southern Korea	SONG et al. 1999 table 5 rel. 15–23
32	Carpinetum laxiflorae	43	Southern Korea	KIM 1992 table 16 (43)
33	Artemisio desertorum-Betuletum davuricae	7	Transbaikalia	* ERMAKOV 1997 table 1 rel. 7
34	Geranio davuricae-Betuletum davuricae	32	Transbaikalia	* ERMAKOV 1997 table 1 rel. 8
35	Carici vanheurkii-Betuletum davuricae	15	Transbaikalia	* ERMAKOV 1997 table 1 rel. 9
36	Galatello davuricae-Betuletum platyphyllae	13	Transbaikalia	* ERMAKOV et al. 2000 table 13 rel. 80
37	Oxytropido myriophyllae-Pinetum sylvestris	6	Transbaikalia	* ERMAKOV et al. 2000 table 13 rel. 81
38	Bromopsido pumpellianae-Pinetum sylvestris	51	Transbaikalia	* ERMAKOV et al. 2000 table 13 rel. 84
39	Veronicastro sibiricae-Betuletum davuricae	12	Transbaikalia	* ERMAKOV 1997 table 1 rel. 10
40	Geranio vlassoviani-Laricetum gmelinii	15	Transbaikalia	* ERMAKOV 1997 table 1 rel. 11
41	Aquilegio parviflorae-Quercetum mongolicae	8	Transbaikalia	* ERMAKOV 1997 table 1 rel. 12
42	Indigofero kirilowii-Quercetum mongolicae	24	Liaonin	Fieldworks (24)
43	Meehanio urticifoliae-Quercetum mongolicae	20	Liaonin	Fieldworks (20)
44	Gypsophyllo-Quercetum mongolicae	14	Hasan area	Fieldworks (14)
45	Sophoro flavescentis-Quercetum mongolicae	22	Hanka, Southern Sikhote-Alin	Fieldworks (22)
46	Lycopi lucidi-Quercetum mongolicae	37	Southern Sikhote-Alin	Fieldworks (37)
47	Campanulo glomeratae-Quercetum mongolicae	28	Southern Sikhote-Alin	Fieldworks (28)
48	Melico nutansi-Quercetum mongolicae	18	Middle and Southern Sikhote-Alin	Fieldworks (18)
49	Melampyro setacei-Quercetum mongolicae	17	Middle and Southern Sikhote-Alin	Fieldworks (17)
50	Lespedezo bicoloris-Quercetum mongolicae	55	Middle and Southern Sikhote-Alin	Fieldworks (44); KIM 1992 tables 14 and 15 (11);

* only type relevé is published

NUEL 1999), which produced the various tables required in the analysis and synthesis of vegetation data.

Plots were stratified into floristically similar groups by presence-absence criteria using TWINSPAN (HILL 1979). At the manual stage of data analysis, preliminary environmental plot tables were used to determine whether floristically similar plots at low hierarchical levels were also similar in environmental characteristics, such as elevation, slope aspect and inclination, and soil moisture and nutrient regime, identified by the indicator species analysis as described in POJAR et al. (1987). A diagnostic table (Table 3) showing the diagnostic combination of species was made. The vegetation units of subassociation and higher rank were named in accordance with phytosociological nomenclature (WEBER et al. 2000). "Nomenclatural type" is used in the sense of "typus".

2.4. Ordination

Detrended correspondence analysis (DCA) (HILL & GAUCH 1980) was applied to the data set (mean cover for species in vegetation unit including the relevés where the species is not present) based on the constancy table (Table 3) for ordination of vegetation units to show dissimilarity between all distinguished vegetation units.

2.5. Taxonomic problems

Differences in the botanical nomenclature for floristic references in China, Korea, Japan and Russia are considerable. In general, Russian botanists tend to use a narrower species concept compared to those in other East Asian countries. Many taxa considered as subspecies or varieties outside Russia are recognized as different species in the Russian literature. To standardize nomenclature and to avoid analysis of similar species with different names, we used a database (KRESTOV, unpubl.) that includes over 30,000 names (valid and synonyms) of vascular plants extracted from the main taxonomic observations of northern Asia. On other hand we tried to preserve the main species concepts accepted in Russia and Korea for the species endemic to these regions.

3. Results

3.1. Synopsis of deciduous temperate forests

The hierarchical system of lower syntaxa of deciduous temperate forests of the East Asian mainland includes 50 associations, 36 subassociations and 8 variants. Fourteen associations are described for the first time, 10 are validated from the uneffectively published associations by KIM (1992), GUMAROVA (1993) and GUMAROVA et al. (1994). All syntaxa were assigned to the higher units according to the following order. The format of units is following: I. – class, I-A. – order, I-A-I. – alliance, I-A-I-A. – suballiance. Asterisk marks the Hokkaido syntaxa not characterized in this paper.

I. Quercetea mongolicae Song ex Krestov et al. 2006
- I-A. Tilio amurensis-Pinetalia koraiensis Kim ex Krestov et al. 2006
  - I-A-I. Rhododendro daurici-Pinion koraiensis Krestov et al. 2006
  - I-A-II. Abieti nephrolepidis-Pinion koraiensis Gumarova ex Krestov et al. 2006
  - I-A-III. Tilio amurensis-Pinion koraiensis Kim ex Krestov et al. 2006
  - I-A-IV. Phrymo asiaticae-Pinion koraiensis Krestov et al. 2006
  - I-A-V. Jeffersonio-Quercion mongolicae Kim ex Krestov et al. 2006
- I-B. Aceri pseudosieboldiani-Quercetalia mongolicae Song ex Takeda et al. 1994
  - I-B-I. Rhododendro schlippenbachii-Quercion mongolicae Song ex Takeda et al. 1994
  - I-B-II. Rhododendro mucronulati-Pinion densiflorae Kim & Yim 1988
  - I-B-III. Lindero obtusilobae-Quercion mongolicae Kim 1990
    - I-B-III-A. Lindero obtusilobae-Quercenion mongolicae Kim ex Krestov et al. 2006
    - I-B-III-B. Callicarpo japonicae-Quercenion serratae Kim 1990
    - I-B-III–C. Carpinenion laxiflorae-tschonoskii Kim ex Krestov et al. 2006
- *I–C. Quercetalia serrato-grosseserratae Miyawaki et al. 1971
  - *I–C-I. Carpino-Quercion grosseserratae Takeda et al. 1986
  - *I–C-II. Pruno-Quercion mongolicae grosseserratae Wada 1982
  - *I–C-III. Carpino-Quercion serratae Miyawaki et al. 1971
  - *I–C-IV. Pinion densiflorae Suzuki-Tokio 1966

II. Querco mongolicae-Betuletea davuricae Ermakov & Petelin in Ermakov 1997
- II-A. Querco mongolicae-Betuletalia davuricae Ermakov 1997
  - II-A-I. Kitagawio terebinthaceae-Betulion davuricae Ermakov 1997
    - II-A-I-A. Paeonio lactiflorae-Betulenion davuricae Ermakov 1997
    - II-A-I-B. Calamagrostio epigei-Pinenion sylvestris Ermakov in Ermakov et al. 2000
  - II-A-II. Ligulario fischeri-Betulion davuricae Ermakov & Petelin in Ermakov 1997
    - II-A-II-A. Convallario keiskei-Betulenion davuricae Ermakov in Ermakov et al. 2000
- II-B. Lespedezo bicoloris-Quercetalia mongolicae Krestov et al. 2006

II-B-I. Corylo heterophyllae-Quercion mongolicae Krestov et al. 2006
II-B-II. Dictamno dasycarpi-Quercion mongolicae Kim ex Krestov et al. 2006

3.2. DCA results

DCA arranged the distinguished alliances along the first two axes (Fig. 2). The first axis reflects a gradient of continentality as a sequence of orders from Korean order Aceri-Quercetalia mongolicae in most humid conditions through Tilio-Pinetalia koraiensis in less humic conditions, Lespedezo-Quercetalia mongolicae in conditions of short moisture deficit in the growing season to Querco-Betuletalia davuricae in conditions of longer moisture deficit, i.e. almost arid conditions. The second axis correlates with a temperature regime and shows a sequence from coldest alliances of Tilio-Pinetalia koraiensis to warmest alliances of Querco-Betuletea davuricae.

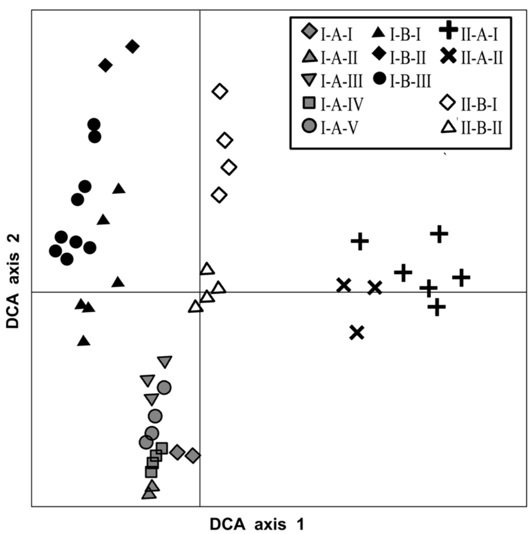

Fig. 2. DCA ordination of vegetation units of deciduous temperate forests of the Asian mainland based on average values of species cover in the constancy table. Codes for the alliances correspond with those used in the text. Black symbols correspond to Aceri-Quercetalia mongolicae, grey symbols to the Tilio-Pinetalia koraiensis, open symbols to the Lespedezo-Quercetalia mongolicae and crosses to the Querco-Betuletalia davuricae.

Table 3. Synoptic table for deciduous forests of Asian mainland (data sources are given in Table 2).

	Tilio-Pinetalia koraiensis															Aceri-Quercetalia mongolicae																	Querco-Betuletalia davuricae									Lespedezo-Quercetalia mong.								
Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Number of relevés in unit	10	14	64	32	10	11	10	31	19	21	33	64	27	17	8	33	13	45	13	18	12	27	8	71	46	7	21	36	24	9	9	43	7	32	15	13	6	51	12	15	8	24	20	14	22	37	28	18	17	55
Mean number of species per rel.	40	25	41	40	46	52	64	49	48	55	50	68	77	102	58	46	60	33	36	44	40	32	26	35	26	36	43	37	45	63	49	36	61	62	37	55	47	53	64	61	47	42	51	44	59	59	79	54	46	40
I. Quercetea mongolicae																																																		
Acer mono	V	II	IV	III	V	V	V	V	III	IV	V	V	V	V	IV	III	I	II	V	III	II	I	.	I	II	I	III	II	III	IV	II	III	.	.	.	.	.	.	.	.	.	I	V	I	.	.	IV	V	IV	III
Carex siderosticta	IV	III	III	III	IV	V	III	I	I	II	IV	II	III	.	II	V	V	V	III	V	I	II	II	III	III	V	IV	III	II	V	III	I	.	.	.	.	.	.	.	.	.	IV	V	III	III	V	IV	IV	III	I
Tilia amurensis	IV	III	IV	III	V	V	V	IV	II	V	V	II	V	.	IV	IV	III	IV	I	IV	.	.	.	I	I	.	II	I	I	.	.	I	.	.	.	.	.	.	.	.	.	II	IV	I	I	I	III	V	II	II
Corylus mandshurica	V	II	IV	III	IV	V	IV	V	III	IV	IV	I	IV	.	II	III	II	II	.	I	III	.	I	I	I	III	V	II	I	V	V	I	.	.	.	.	.	.	.	.	.	I	V	.	.	.	I	III	II	I
<u>*Quercus mongolica*</u>	V	V	III	III	V	V	IV	IV	I	III	IV	V	II	V	IV	V	V	V	IV	V	V	III	.	V	V	V	V	V	III	II	V	.	.	.	II	.	.	.	.	.	V	V	V	V	V	V	V	V	V	V
Maackia amurensis	II	I	I	I	III	II	IV	III	I	II	II	II	I	.	II	II	I	III	.	I	I	II	.	I	I	I	II	III	I	IV	I	I	.	.	.	.	.	.	.	.	.	I	II	II	III	IV	IV	III	II	II
I-A. Tilio amurensis-Pinetalia koraiensis																																																		
Carex ussuriensis	.	II	I	I	IV	IV	IV	II	I	I	II	III	III	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I
Philadelphus tenuifolius	III	I	V	IV	IV	IV	III	V	IV	V	V	V	V	V	V	.	III	.	I	.	.	.	.	.	.	.	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	IV	IV	II	II
<u>*Pinus koraiensis*</u>	V	V	V	V	I	V	V	V	III	V	V	IV	V	IV	V	I	I	IV	.	IV	I	.	.	I	II	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	II
Dryopteris crassirhizoma	III	I	V	IV	.	.	.	V	II	IV	IV	IV	V	V	II	I	I	I	III	IV	.	.	.	.	.	.	.	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Schisandra chinensis	II	I	III	II	IV	III	V	.	III	III	IV	V	IV	V	II	.	I	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	II	V	.	.	.	II	I	II	I
Acer tegmentosum	IV	III	IV	III	I	V	V	IV	II	IV	IV	V	III	IV	IV	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Carex campylorhina	I	I	III	IV	.	.	.	V	IV	IV	IV	II	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	II	II
Thalictrum filamentosum	II	.	V	IV	.	I	III	II	III	V	III	II	III	.	II	I	I	II	.	IV	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	I	I
Eleutherococcus senticocus	.	.	IV	III	III	V	IV	V	IV	V	V	V	V	IV	II	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	I	I	II	I
Caulophyllum robustum	.	.	I	I	.	.	.	III	II	II	I	IV	I	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.
Ulmus laciniata	I	I	III	II	.	.	.	III	III	IV	III	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I
Oxalis acetosella	III	II	III	V	.	IV	III	III	II	III	IV	V	IV	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Maianthemum bifolium	V	III	III	II	II	V	V	V	I	III	IV	II	III	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	V	IV	.	.	.	.	.	.	I	.	I
Fraxinus mandshurica	.	.	III	III	II	V	IV	III	V	V	III	II	IV	V	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I
Betula costata	IV	IV	V	V	.	.	.	IV	II	IV	V	I	IV	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.
Waldsteinia ternata	II	I	II	IV	.	.	.	IV	II	II	II	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Actinidia kolomikta	III	II	IV	V	.	.	.	.	I	IV	IV	II	III	.	I	.	I	.	.	.	.	.	.	.	I	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Viola selkirkii	II	I	III	IV	I	IV	II	I	II	III	IV	I	III	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	I	I	I
Euonymus pauciflora	III	II	III	III	II	V	V	II	I	II	IV	IV	I	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	III	II	I
Neomolinia mandshurica	II	I	III	III	III	V	IV	II	III	III	V	II	V	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	II	I	I	I
Berberis amurensis	II	.	III	II	III	V	IV	IV	I	IV	IV	I	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I
I-A-I. Rhododendro daurici-Pinion koraiensis																																																		
Viola sacchalinensis	III	III	.	I	.	.	.	I	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	I	IV	.	.	.	.	.	.	I	III	I	I
Rosa acicularis	III	III	I	I	.	.	.	II	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	IV	.	III	III	II	.	.	.	.	.	.	.	.	.	.
Rhododendron dauricum	IV	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I	V	III	.	III	II	.	.	.	.	.	.	.	.	.
Gymnocarpium dryopteris	IV	III	I	I	.	.	.	II	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I
1. Carici callitrichoi-Pinetum koraiensis																																																		
Polypodium vulgare	V	II	I	I	.	.	.	I	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex callitrichos	IV	I	I	I	II	V	II	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2. Vaccinio vitis-idaeae-Pinetum koraiensis																																																		
Vaccinium vitis-idaea	I	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	III	III	.	.	.	.	.	.	.	.	.
Orthilia secunda	I	IV	I	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	I	II	.	.	.	.	.	.	.	.	.	.
I-A-II. Abieti nephrolepidis-Pinion koraiensis																																																		
Abies nephrolepis	III	I	V	V	.	III	III	IV	III	III	V	I	IV	.	.	.	.	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Picea ajanensis	III	I	IV	V	.	III	III	IV	II	V	IV	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer ukurunduense	II	II	IV	V	.	III	IV	IV	II	IV	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Mitella nuda	II	I	III	III	.	II	II	III	I	II	III	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera maximowiczii	.	.	V	IV	.	.	.	I	.	II	II	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3. Diplazio sibirici-Abietetum nephrolepidis																																																		
Carex xiphium	II	I	IV	IV	.	.	.	.	II	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I
Leptorumohra amurensis	I	I	V	III	.	.	.	III	.	I	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diplazium sibiricum	III	I	V	III	.	V	I	.	I	III	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4. Lycopodio annotini-Abietum nephrolepidis																																																		
Phegopteris connectilis	I	.	II	V	.	.	.	I	I	II	I	III	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycopodium juniperoideum	I	I	II	IV	.	.	.	I	I	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lycopodium annotinum	I	.	.	IV	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dryopteris expansa	.	.	I	III	.	.	.	I	I	I	.	III	.	II	II	I	.	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chamaepericlymenum canadens	II	I	I	III	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
I-A-III. Tilio amurensis-Pinion koraiensis																																																		
Aegopodium alpestre	.	.	.	.	III	V	III	.	.	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	IV	.	.	.	.	.	I	.	.	.	.
Deutzia glabrata	.	.	.	.	III	V	II	.	.	.	I	IV	.	IV	.	.	I	.	III	.	.	.	.	I	I	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Sorbus amurensis	III	II	II	II	.	IV	III	III	I	I	II	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ulmus macrocarpa	.	.	.	.	IV	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium mandshuricum	.	.	.	.	II	V	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhamnus davurica	.	.	.	I	IV	I	IV	I	I	I	I	I	I	.	.	.	.	.	I	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	.	.	.	I	.	.	I
5. Spiraeo ussuriensis-Quercetum mongolicae																																																		
Thalictrum contortum	.	.	.	.	IV	.	.	.	I	I	I	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	II	V	V	.	.	I	I	I	II	.	.	I
Pyrus ussuriensis	.	.	.	.	V	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.
Asparagus schoberioides	.	.	.	.	V	.	.	.	I	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	I	II	I	I	I
Polygonatum humile	.	.	.	.	V	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	I	V	III	.	.	.	V	I	IV	.	.	.	IV	I	II	.	I	II
Spiraea ussuriensis	I	I	I	.	V	IV	II	I	.	.	I	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Brachybotrys paridiformis	.	.	.	.	IV	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.
Glycine soja	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lychnis fulgens	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	I	I	I
6. Athyrio crenati-Pinetum koraiensis																																																		
Picea koraiensis	.	II	.	I	.	III	I	II	II	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thalictrum baikalense	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	II
Pseudostellaria davidii	.	.	.	.	II	IV	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.
Enemion raddeanum	I	.	I	I	.	III	.	.	I	III	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
7. Tilio amurensis-Betuletum platyphyllae																																																		
Daphne koreana	.	.	I	.	.	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Larix olgensis	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera edulis	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Patrinia intermedia	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ribes komarovii	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solidago pacifica	.	.	.	.	.	.	V	.	.	.	.	I	.	.	.	II	I	IV	III	III	I	I	.	II	II	V	II	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	II	I	I	I
I-A-IV. Phrymo asiaticae-Pinion koraiensis																																																		
Galium davuricum	III	.	III	I	.	.	.	III	III	IV	V	II	III	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	III	IV	III	II
Sorbaria sorbifolia	II	I	I	II	.	.	.	IV	IV	IV	III	I	I	V	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	II	V	III	.	.	.	.	I	I	.	.	I

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Impatiens noli-tangere	.	.	III	II	.	.	.	III	V	V	I	I	III	.	.	.	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.
Athyrium sinense	I	I	III	III	.	.	.	I	IV	V	V	II	II	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	II	I
Adiantum pedatum	I	I	II	I	.	.	.	III	II	IV	III	I	III	.	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Phryma asiatica	I	.	II	II	.	IV	II	IV	III	IV	V	II	III	.	II	.	I	.	I	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	.	.	.	V	III	I	I
Lunathyrium pycnosorum	.	.	I	I	.	.	.	II	III	V	II	III	II	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Rubia cordifolia	.	.	II	I	.	.	.	II	V	IV	I	I	I	.	I	.	I	.	II	.	.	II	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	III	I	.	I
Scutellaria ussuriensis	I	.	I	.	.	.	.	II	III	III	II	I	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	I
Circaea alpina	I	.	III	III	.	III	III	III	II	III	IV	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilium distichum	I	.	II	II	.	.	.	III	II	IV	IV	I	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	I	.
Carex pallida	I	.	I	I	.	.	.	II	III	IV	III	I	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV	.	.	.	.	.	II	II	I	II
Adoxa moschatellina	.	.	III	III	.	.	.	I	III	V	IV	III	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Cardamine leucantha	.	.	II	.	IV	I	II	III	III	IV	II	I	I	.	I	.	.	.	II	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.
Aruncus dioicus	.	.	II	II	.	.	.	III	II	V	III	II	I	V	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	I	II	.	.	.
Juglans mandshurica	.	.	I	.	.	.	.	II	IV	III	I	I	II	.	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	V	.	.	.	II	.	II	I
Paris quadrifolia	.	.	III	II	.	.	.	I	III	V	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Anemonoides extremiorientalis	.	.	I	I	.	.	.	.	III	IV	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	II	I	I
Trigonotis radicans	.	.	I	I	.	.	.	IV	I	III	III	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.
Ligustrina amurensis	.	.	I	.	IV	IV	II	III	III	IV	III	I	IV	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
8. Carici falcatae-Pinetum koraiensis																																																		
Galium triflorum	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lonicera chrysantha	.	.	I	.	.	.	.	V	.	II	III	III	III	IV	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	.	.	.	.	.	.	.
Carex falcata	.	.	.	I	.	.	.	V	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Athyrium filix-femina	I	.	II	II	.	.	.	IV	II	III	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	I	I	I
Aconitum volubile	.	.	.	.	.	.	.	IV	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Smilacina davurica	.	.	I	I	.	.	.	III	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Osmorhiza aristata	.	.	I	I	.	.	.	III	I	II	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.
9. Ulmo japonicae-Pinetum koraiensis																																																		
Ulmus japonica	.	.	.	.	I	.	I	II	V	II	I	I	III	.	I	.	I	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	IV	.	I	.	IV	II	III	II
Padus avium	.	.	.	.	.	.	.	I	IV	II	I	I	I	III	.	I	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Matteuccia struthiopteris	.	.	.	.	.	.	.	II	IV	I	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.
Urtica angustifolia	.	.	I	.	.	.	.	II	IV	II	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Aconitum sczukinii	.	.	.	.	.	.	.	.	III	II	I	I	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.
Schizopepon bryoniifolius	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex sordida	.	.	.	.	.	.	I	I	III	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	I
Carex arnellii	.	.	.	.	.	.	.	.	III	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Menispermum dauricum	.	.	.	.	.	.	.	.	III	.	.	.	.	.	I	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I	.	I	I	.	.
Filipendula palmata	.	.	I	.	I	II	I	III	V	III	II	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	II	I	I	I
Equisetum hyemale	.	.	I	I	.	.	.	III	V	III	I	I	II	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
10. Arisaemo amurensae-Pinetum koraiensis																																																		
Ribes mandshuricum	I	.	II	I	.	.	.	IV	III	V	II	III	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arisaema amurense	.	.	II	I	.	.	.	II	II	IV	I	I	II	.	.	II	.	II	.	I	I	.	.	I	.	.	III	II	II	.	I	I	.	.	.	.	.	.	.	.	.	II	III	.	.	.	I	.	.	.
Stellaria bungeana	.	.	II	I	.	.	.	II	IV	V	I	.	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	I	I
Lamium album	I	.	II	.	.	.	.	I	III	IV	I	I	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.
Cornopteris crenulatoserrulata	.	.	.	I	.	.	.	.	III	V	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hylomecon vernalis	.	.	III	II	.	.	.	.	III	V	II	I	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.
Cacalia auriculata	.	.	II	I	.	.	.	I	I	III	I	I	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Coniogramme intermedia	.	.	I	.	.	.	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veratrum oxysepalum	.	.	II	I	.	.	.	I	I	III	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I
11. Ribesi maximowicziani-Pinetum koraiensis																																																		
Ribes maximoviczianum	I	I	II	.	.	.	.	I	I	III	V	III	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudostellaria sylvatica	II	I	III	III	.	.	.	.	.	II	IV	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.
Carex quadriflora	II	.	I	I	.	.	.	.	.	I	IV	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
Plagiorhegma dubia	I	.	I	.	.	.	I	I	I	I	IV	II	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	III	IV	III	II
Pseudocystopteris spinulosa	II	.	III	I	.	.	.	III	I	II	IV	I	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.
Anemonoides amurensis	I	.	I	.	.	.	.	.	I	I	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Thalictrum tuberiferum	I	.	I	I	.	.	.	.	.	I	III	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	I
I-A-V. Jeffersonio dubiae-Quercion mongolicae																																																		
Acer barbinerve	.	.	.	.	.	.	.	.	.	.	.	IV	V	IV	III	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Dryopteris goeringiana	.	.	I	I	.	.	.	.	I	I	I	II	III	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Acer mandshuricum	.	I	.	.	.	.	.	.	.	.	.	III	IV	IV	.	.	I	.	.	II	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus cordata	.	.	.	.	.	.	.	.	.	.	.	V	III	IV	II	II	.	II	I	III	II	.	.	I	I	.	.	III	II	III	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Kalopanax septemlobus	.	.	.	.	.	.	.	.	.	.	I	III	II	III	V	I	.	II	I	III	.	I	.	I	I	I	I	II	II	I	I	I	.	.	.	.	.	.	.	.	.	.	III	.	.	.	I	II	I	.
Abies holophylla	.	.	.	.	.	.	.	.	.	.	.	V	V	V	.	I	.	III	.	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.
12. Abieti holophyllae-Quercetum mongolicae																																																		
Actinidia arguta	.	.	.	.	.	.	.	.	.	.	.	IV	I	II	III	.	II	.	II	.	I	.	.	I	I	.	II	.	.	I	I	.	.	.	.	.	.	.	.	.	.	I	II	.	.	.	.	.	.	.
Lonicera praeflorens	.	.	.	.	III	V	V	.	.	.	I	V	I	III	I	.	.	.	.	.	.	II	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.
Viburnum sargentii	.	.	.	.	II	I	III	I	I	I	I	IV	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	II	IV	.	.	.	II	I	I	I
Asarum sieboldii	.	.	.	.	.	.	.	.	.	.	I	V	II	III	II	II	I	II	.	II	I	.	.	I	I	.	I	III	I	IV	III	I	.	.	.	.	.	.	.	.	.	.	II	.	.	I	II	.	I	.
13. Polysticho subtripteron-Pinetum koraiensis																																																		
Phellodendron amurense	.	.	I	.	.	.	.	II	II	II	I	I	IV	V	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	.	III	I	I	I
Prenanthes tatarinowii	.	.	.	.	.	.	.	.	.	.	I	I	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.
Aconitum selemdshense	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Platanthera tipuloides	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I
Polystichum subtripteron	.	.	.	.	.	.	.	.	.	.	.	II	V	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14. Fraxino mandshurici-Abietetum holophyllae																																																		
Anemonoides glabrata	.	.	.	.	.	.	.	.	.	.	.	I	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Alnus hirsuta	.	.	I	I	.	.	.	.	I	.	I	I	.	V	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex uda	.	.	I	.	.	.	.	.	II	I	I	I	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carex dispalata	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.
Astilbe chinensis	.	.	.	.	.	.	.	.	.	I	.	II	.	V	.	III	V	III	.	II	III	.	.	I	I	.	V	I	I	III	II	.	.	.	.	.	.	.	.	.	.	III	IV	.	I	I	I	.	.	.
Rabdosia excisa	.	.	I	.	.	.	II	I	I	II	I	II	I	V	II	I	III	I	.	III	.	.	.	I	II	.	II	I	.	III	.	I	.	.	.	.	.	.	.	.	.	.	.	I	I	I	V	II	I	II
Smilacina hirta	.	.	I	.	.	.	.	.	I	I	.	III	.	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	I	I	.
15. Taxus cuspidata-Carpinus cordata comm.																																																		
Taxus cuspidata	.	.	II	I	.	.	.	.	.	I	I	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euonymus macroptera	II	II	V	V	.	.	.	III	I	II	I	.	.	.	IV	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
I-B. Aceri pseudosieboldiani-Quercetalia mongolicae																																																		
Ainsliaea acerifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	IV	IV	I	IV	V	.	.	II	IV	.	V	IV	II	V	II	II	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.
Acer pseudosieboldianum	.	II	.	.	.	.	IV	.	.	.	I	I	IV	.	II	IV	IV	V	V	V	V	.	II	III	V	V	V	V	V	.	V	II	.	.	.	.	.	.	.	.	.	II	V	.	.	I	.	III	I	.
Stephanandra incisa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	II	II	I	III	I	II	II	III	V	V	IV	III	V	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Symplocos chinensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	IV	III	.	II	IV	.	.	II	II	.	III	V	II	V	III	I	.	.	.	.	.	.	.	.	.	III	V	.	.	.	.	.	.	.
Weigela florida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	V	I	II	II	III	.	.	II	II	III	V	III	III	V	III	I	.	.	.	.	.	.	.	.	.	III	III	.	.	.	.	.	.	.

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Athyrium yokoscense	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	IV	V	III	II	III	IV	.	.	II	I	I	V	III	I	V	III	I	.	.	.	.	.	.	.	.	.	II	V	I	I	IV	.	.	I	I
Lindera obtusiloba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	III	.	I	V	.	II	IV	IV	.	V	V	V	V	V	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fraxinus sieboldiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	II	.	I	V	.	II	III	IV	.	V	III	III	.	V	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Smilax nipponica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	I	.	.	IV	I	II	III	I	II	III	III	III	IV	V	II	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.
Pyrola japonica	I	.	.	I	.	.	.	I	.	.	I	.	I	.	I	.	I	I	II	I	I	I	.	II	II	III	III	I	II	IV	III	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	.	I	.
Rhododendron schlippenbachii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV	V	II	IV	V	.	III	IV	V	V	V	III	II	III	II	I	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.
Rhododendron mucronulatum	I	I	.	I	.	.	.	I	.	.	.	I	.	.	I	I	I	II	I	I	V	IV	V	IV	III	V	III	II	II	III	II	I	.	.	.	.	.	.	.	.	.	II	.	II	I	.	.	II	.	I
Cerasus sachalinensis	.	.	.	.	.	.	.	.	.	.	.	II	.	I	III	I	I	I	.	II	IV	.	III	I	II	.	I	II	II	V	IV	II	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.
I-B-I. Rhododendro schlippenbachii-Quercion mongolicae																																																		
Magnolia sieboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	IV	III	IV	I	I	.	I	I	I	III	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Angelica gigas	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V	I	.	II	I	.	.	.	.	.	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tripterigium regelii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V	IV	.	IV	III	.	.	II	I	.	III	III	I	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Astilbe koreana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	III	III	II	.	I	.	I	I	I	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Acer rubrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	I	IV	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ligularia stenocephala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	.	II	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus commixta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	I	III	.	.	.	I	I	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veratrum japonicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV	II	.	II	.	.	.	I	.	.	I	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
16. Lychno cognatae-Quercetum mongolicae																																																		
Galium kamtschaticum	.	I	I	I	.	.	.	.	I	I	I	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aconitum saxatile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V	I	.	I	.	.	.	I	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lychnis cognata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V	I	.	II	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pseudostellaria palibi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	I	.	IV	II	.	.	I	I	.	II	I	I	III	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cimicifuga heracleifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	I	I	.	.	.	I	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Codonopsis lanceolata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	I	.	.	.	.	.	II	I	.	II	III	II	.	II	I	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.
17. Veronico coreani-Quercetum mongolicae																																																		
Heracleum moellendorfii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polygonatum lasianthum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	V	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium setidens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica coreanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pleuropterus cilinervi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubus oldhamii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ajuga spectabilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ostericum koreanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	III	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Filipendula glaberrima	.	.	I	I	.	.	.	.	I	II	I	I	I	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lactuca triangulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I
Melandrium seoulense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vicia venosa	I	.	.	I	.	.	.	I	I	I	II	I	II	.	III	.	IV	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I
Hosta longipes	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	II	.	I	II	.	.	II	II	.	III	I	I	I	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilium tsingtauense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	I	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
18. Vaccinio koreani-Quercetum mongolicae																																																		
Vaccinium koreanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	.	I	II	.	.	I	I	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Patrinia saniculaefoli	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
19. Partenocisso tricuspidati-Fraxinetum rhynchophyllae																																																		
Codonopsis pilosula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Parthenocissus quinquefolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	II	.	II	I	I	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Neomolinia japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	V	.	.	.	.	I	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lactuca bungeana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hedera rhombea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rubia hexaphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cornus controversa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	III	III	.	.	.	I	I	.	I	II	II	III	II	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aconitum triphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Styrax obassia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	I	III	I	.	III	IV	III	III	V	IV	IV	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola keiskei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	I	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
20. Dryopterido crassirhizomae-Quercetum mongolicae																																																		
Pimpinella brachycarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.	IV	.	.	.	I	.	.	I	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.
Paris verticillata	.	.	.	.	II	I	I	.	.	.	.	.	I	.	.	III	.	I	.	III	.	.	.	.	.	.	.	I	I	.	I	I	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.
Syringa wolfii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.
21. Ainsliaeo acerifoliae-Quercetum mongolicae																																																		
Carex okamotoi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	.	I	IV	.	.	I	II	.	.	I	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Toxicodendron trichocarpum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	V	I	I	II	III	.	III	IV	III	V	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus alnifolia	.	.	.	.	I	.	II	.	.	.	.	I	II	.	II	II	I	III	III	I	V	II	I	IV	I	III	III	II	III	V	III	I	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	II	I	I
I-B-II. Rhododendro mucronulati-Pinion densiflorae																																																		
Juniperus rigida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	V	III	II	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Pinus densiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	V	.	II	V	V	IV	III	IV	.	I	II	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vaccinium oldhami	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22. Festuco ovinae-Pinetum densiflorae																																																		
Atractylodes koreana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fagara schinifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	II	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris rossii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saussurea eriophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Clematis mandshurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stevenia axillaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polystichum polyplepharon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilium concolor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thalictrum aquilegifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Meehania urticifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	I	.	II	.	IV	.	II	I	.	I	I	III	I	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.
Benzoin obtusilobum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	II	V	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Palura paniculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
23. Rhododendro mucronulati-Pinetum densiflorae																																																		
Smilax china	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	IV	I	.	.	.	.	.	IV	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Patrinia villosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	.	.	III	.	.	.	II	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.
Ostericum sieboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	III	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Albizia julibrissin	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
24. Artemisio keiskeanae-Quercetum mongolicae																																																		
Lespedeza cyrtobotrya	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	I	.	III	II	.	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	II	.	.	I	I	.	.	.	.
Carex humilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	IV	.	.	III	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
25. Saso borealis-Quercetum mongolicae																																																		
Sasa borealis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	.	II	I	.	.	I	V	.	II	IV	IV	I	IV	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Heloniopsis orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Syneilesis palmata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	I	.	I	.	I	IV	III	III	II	II	I	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Disporum smilacinum	.	.	.	I	.	.	.	I	.	I	.	.	.	.	.	III	III	III	.	II	IV	.	I	II	III	IV	IV	III	III	V	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.
26. Synelesio palmatae-Carpinetum laxiflorae																																																		
Carpinus laxiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	II	III	V	I	III	IV	IV	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum wrightii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saussurea nivea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.
Asarum heterotropoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hepatica asiatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	.	.	.	.	I	I	III	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.
27. Lindero obtusilobae-Quercetum mongolicae																																																		
Viola rossii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	III	.	.	.	.	.	IV	.	.	III	V	.	.	.	.	.	.	.	.	.	.	V	V	.	.	.	.	.	.	.
Polygonatum falcatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	II	.	I	I	.	.	III	II	.	IV	II	III	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ostericum melanotilingia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
I-B-III-B. Callicarpo japonicae-Quercenion serratae and 28. Staphylleo bumaldae-Quercetum serratae																																																		
Callicarpa japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	I	.	.	.	I	I	I	II	III	IV	III	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus serrata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	II	.	III	III	III	.	III	IV	V	V	IV	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prunus levelliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	III	.	II	I	I	.	III	III	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Stewartia koreana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Staphylea bumalda	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	III	I	.	.	.	I	I	.	I	II	III	III	I	III	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.
Euonymus ciliato-dentatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I	I	.	III	.	I	I	.	III	III	IV	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
29. Meliosmo myrianthae-Quercetum serratae																																																		
Lindera glauca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Meliosma myriantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	II	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum erosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	II	.	.	.	I	III	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zanthoxylum schinifoli	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	I	I	III	I	I	I	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.
Oplismenus undulatifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I	.	I	IV	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium pogonanthum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	.	.	.	I	III	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30. Lespedezo maximowiczii-Quercetum serratae																																																		
Castanea crenata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	I	I	I	I	III	I	I	II	V	I	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.
Oplismenus undulatifolius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	.	.	.	V	III	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viola diamantica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sapium japonicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	I	I	.	.	.	II	III	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Celtis jessoensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Thelipteris japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
I-B-III-C. Carpinenion laxiflorae																																																		
Platycarya strobilace	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	II	I	II	.	.	.	I	.	III	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Viburnum dilatatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	II	I	II	.	.	I	I	II	IV	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Carpinus tschonoskii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	II	I	II	.	.	I	I	.	III	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lindera erythrocarpa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	I	.	.	II	III	.	III	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Quercus aliena	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	II	.	I	.	.	I	I	.	II	II	.	.	.	.	.	.	.	.	.	I	II	.	.	.	.	.	.	.
Styrax japonica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	.	.	I	IV	III	IV	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
31. Syneilesio palmatae-Quercetum serratae																																																		
Quercus variabilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	III	I	.	II	III	I	V	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lespedeza maximowiczii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	.	.	IV	I	V	II	II	III	V	I	I	III	IV	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
32. Carpinetum laxiflorae																																																		
Alangium platanifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	I	II	I	.	III	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.
Acer koreanum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Zelkova serrata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Celtis sinensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Torreya nucifera	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Galium trachyspermum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	I	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ampelopsis heterophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	II	.	.	.	.	.	II	I	.	.	II	II	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
II. Querco mongolicae-Betuletea davuricae																																																		
Calamagrostis brachytricha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	V	IV	.	II	IV	.	.	II	I	I	III	II	III	II	III	I	V	V	I	.	.	.	V	I	I	III	.	III	III	III	V	I	II	II
Convallaria keiskei	III	.	I	I	III	III	II	IV	I	II	IV	I	III	.	II	.	I	.	.	.	.	I	.	.	.	.	.	.	.	I	.	.	.	IV	IV	.	.	.	V	V	V	V	V	III	IV	V	V	V	V	III
Vicia unijuga	.	.	.	.	.	.	.	.	.	.	I	I	.	.	I	.	II	.	.	.	.	.	.	.	.	.	I	.	.	I	II	.	.	IV	.	V	V	V	II	I	.	III	IV	II	V	V	IV	III	III	III
Synurus deltoides	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	III	V	I	I	I	I	.	.	.	I	.	I	.	.	.	I	.	.	V	I	IV	.	I	V	IV	IV	.	.	II	III	III	V	II	II	III
Potentilla fragarioides	.	.	.	.	II	.	II	.	.	.	I	I	.	I	II	.	V	.	.	.	.	III	III	II	I	.	I	.	.	.	I	.	V	V	V	V	V	II	V	.	IV	IV	III	V	V	IV	V	IV	IV	IV
Betula davurica	.	I	.	.	.	.	I	.	.	.	I	I	.	.	II	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	I	.	V	V	V	.	.	.	V	.	III	I	.	III	IV	III	IV	IV	IV	IV
Adenophora pereskiifolia	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	.	III	IV	.	.	.	V	V	V	V	III	V	IV
Sedum aizoon	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	V	V	IV	V	II	II	V	V	II	I	.	IV	V	IV	V	II	II	II
Hieracium umbellatum	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	IV	V	.	V	.	V	IV	V	I	I	.	III	III	IV	III	II	II	III
Sanguisorba officinalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	V	V	IV	V	V	V	V	V	V	III	.	III	IV	V	IV	II	II	III
Patrinia scabiosifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	V	II	III	I	.	V	.	.	II	.	V	V	IV	III	I	.	I
Iris uniflora	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	I	.	.	V	V	IV	V	V	IV	V	V	IV	.	.	III	III	IV	I	II	II	II
Artemisia gmelinii	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	III	I	III	I	.	.	I	I	.	II	IV	I	IV	I	I	II
II-A. Querco mongolicae-Betuletalia davuricae																																																		
Saussurea elongata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	.	V	V	IV	V	V	.	.	.	.	.	.	.	.	.	.
Astragalus membranaceus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	IV	I	V	V	V	I	I	I	.	.	.	.	.	.	.	.	.
Vicia pseudorobus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	IV	IV	.	I	V	.	V	.	.	.	.	.	I	.	I	I
Viola dactyloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	II	II	I	IV	V	.	II	.	.	.	.	.	.	.	.	.
Artemisia integrifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	IV	II	.	I	V	IV	IV	.	.	.	I	I	.	.	.	.
Adenophora tricuspidata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	.	V	I	I	V	III	.	.	.	.	.	.	.	.	.	.
Lilium pensylvanicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	II	.	II	IV	I	IV	.	.	.	.	.	I	I	.	I
Aster tataricus	.	.	.	I	.	.	.	.	.	.	I	I	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	II	V	IV	I	V	.	IV	I	.	.	III	II	II	I	I	I
Elymus confusus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	.	V	.	III	III	.	.	.	.	.	.	.	.	.	.	.
Adenophora coronopifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	III	.	I	I	I	.	.	.	.	.	.	.	.	.	.
Rosa davurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	IV	V	I	IV	IV	IV	.	.	.	.	.	I	I	I	II
Artemisia tanacetifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	IV	V	V	V	V	V	V	.	.	.	.	.	.	.	.	.
Lupinaster pentaphyllus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	V	V	V	V	IV	III	V	.	.	I	I	I	I	.	.	.
Galium boreale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	IV	III	IV	.	IV	V	V	V	.	.	II	II	II	III	.	II	I
Spiraea media	.	I	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	IV	.	III	V	V	IV	.	.	.	.	.	.	.	.	.
Carex amgunensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	V	II	IV	V	V	.	.	.	.	.	.	.	.	.	.
Thalictrum appendiculatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V	.	V	II	I	V	.	.	.	.	.	.	.	.	.	.	.
Festuca ovina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	.	.	.	.	.	.	.	.	.	III	V	.	V	.	I	IV	II	.	.	.	.	.	.	I	.	I	I
Vicia amoena	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	II	II	III	IV	.	.	.	I	I	I	I	I	II	I
Rubus saxatilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	II	.	III	IV	V	.	.	.	.	.	.	.	.	.	.
Chamaenerion angustifolium	.	I	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	.	.	II	III	III	IV	.	.	.	.	.	.	I	.	I
Elymus gmelinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	IV	IV	III	III	.	.	.	.	.	.	.	.	.	.	.
Geranium eriostemon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	V	.	V	V	V	.	.	.	I	I	III	.	.	.	.
<u>*Betula platyphylla*</u>	II	IV	I	I	.	.	.	I	I	I	II	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	III	V	V	V	V	V	V	.	.	.	I	.	II	I	III	II
<u>*Populus tremula*</u>	II	II	I	I	II	II	IV	II	.	I	II	I	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	III	.	III	IV	IV	V	.	.	I	I	II	I	I	II	I
II-A-I. Kitagawio terebinthaceae-Betulion davuricae																																																		

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Dendranthema zawadskii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	V	IV	.	V	V	V	.	II	.	.	.	.	.	.	.	.	.	.
Scorzonera radiata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	III	IV	V	V	II	.	III	.	.	.	.	.	.	.	.	.
Pulsatilla patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	.	V	V	V	III	I	.	.	.	.	.	.	.	.	.	.
Poa botryoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	IV	.	II	V	III	I	.	.	.	.	.	.	.	.	.	.	.
Artemisia sericea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	IV	.	V	.	III	.	.	.	.	.	.	.	.	.	.	.	.
Achnatherum sibiricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	.	IV	V	III	II	.	.	.	.	.	.	.	.	.	.	.
Aster alpinus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	.	III	V	IV	.	.	.	.	.	.	.	.	.	.	.	.
Galium verum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	I	III	I	I	II	.	I	.	.	II	III	III	II	.	I	I
Allium splendens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	IV	II	.	.	III	.	.	I	.	.	.	.	.	.	.	.	.
Schizonepeta multifida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	III	.	I	II	I	.	.	.	.	.	.	.	.	.	.	.	.
Patrinia rupestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	IV	.	IV	II	.	.	II	.	.	I	.	.	.	.	.	.
Bupleurum scorzonerifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	.	.	V	III	.	.	.	.	.	.	.	.	.	.	.	.
Viola gmeliniana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	IV	III	I	.	.	.	.	.	.	.	.	.	.	.
Stellera chamaejasme	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	.	II	V	I	.	.	.	.	.	.	.	.	.	.	.	.
II-A-I-A. Paeonio lactiflorae-Betulenion davuricae																																																		
Hemerocallis minor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	II	.	I	.	.	I	.	.	.	.	.	V	III	IV	I	I	II	III	.	V	I	.	.	.	.	.	.	.	.
Kitagawia terebinthacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	III	.	II	.	II	I	.	.	.	.	.	V	III	IV	II	.	.	I	.	II	.	.	.	.	.	.	I	.	I
Vicia popovii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	III	V	.	III	.	.	.	I	.	.	.	.	.	.	.	.	.
Scorzonera albicaulis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	V	V	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.
Bistorta alopecuroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.
Paeonia lactiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	I	.	.	.	V	.	.	I	.	.	I	I	IV	I	I	II
Tephroseris kirilowii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	IV	I	.	.	.	II	.	.	.	.	III	II	II	.	.	.	.
33. Artemisio desertori-Betuletum davuricae																																																		
Carex obtusata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Thalictrum petaloideum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.
Spiraea pubescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	.	III	V	.	I	.	.	.	.	.	.	.	.	.	.	.
Stemmacantha uniflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	II	.	II	V	II	.	.	.	.	.	.	.	.	.	.	.	.
Viola dissecta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Cotoneaster melanocarpus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	.	I	.	II	.	.	.	.	.	.	.	.	.	.	.	.
Eremogone juncea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Potentilla tanacetifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Poa transbaicalica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	II	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.
Silene jeniseensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	II	II	.	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia fischeriana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	I
Youngia tenuifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Saposhnikovia divaricata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.
Phlojodicarpus sibiricus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bupleurum sibiricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	III	IV	I	.	.	.	.	.	.	.	.	.	.	.	.
Cerastium arvense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dianthus versicolor	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Koeleria cristata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	III	.	.	I	V	I	.	.	.	.	.	I	I	.	.	.	.	.
Lespedeza juncea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	III	.	.	.	V	.	.	.	.	.	.	II	II	I	I	.	.	.
Thesium refractum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	I	.	IV	I	.	.	II	.	.	.	.	.	.	.	.	.
Filifolium sibiricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.
Adenophora gmelinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Iris humilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Hylotelephium triphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.
Spiraea dahurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
34. Geranio davuricae-Betuletum davuricae																																																		
Pyrola rotundifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	IV	IV	III	V	V	II	.	.	.	.	.	.	.	.	.
Malaxis monophyllos	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	I	IV	I	IV	III	.	.	.	.	.	.	.	.	.	.
Anemonastrum crinitum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	III	.	I	III	V	.	.	.	.	.	.	.	.	.	.
Valeriana alternifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	V	.	IV	.	I	V	V	.	.	.	.	.	.	.	.	.	.
Geranium davuricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V	.	.	.	.	V	III	.	.	.	.	I	.	I	I	I	I
Heteropappus bienis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.
35. Carici vanheurckii-Betuletum davuricae																																																		
Carex supermascula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.
Carex vanheurckii	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	I
Geranium orientale	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.
Euphorbia discolor	.	.	.	.	.	.	.	.	.	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	II	.	.	II	.	.	.	I	I	III	.	I	II
Dianthus chinensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	II	.	.	II	III	II	I	I	I	I
Calystegia inflata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Artemisia commutata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lilium pumilum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
II-A-I-B. Calamagrosto epigei-Pinenion sylvestris																																																		
Carex pediformis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V	III	.	.	.	.	.	.	.	.	.	.	.	.
Astragalus adsurgens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V	II	.	.	.	.	.	.	.	.	.	.	.	.
Calamagrostis epigeios	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	IV	V	.	.	.	.	.	.	.	.	.	.	.	.
Rhytidium rugosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	.	IV	V	III	.	II	.	.	.	.	.	.	.	.	.	.
Elymus sibinicus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	IV	III	II	.	.	.	.	.	.	.	.	.	.	I
Pinus sylvestris	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	V	V	.	.	.	.	.	.	.	.	.	.	.	.
36. Galatello dahuricae-Betuletum platyphyllae																																																		
Poa urssulensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	V	.	I	II	I	.	.	.	.	.	.	.	.	.	.
Galatella dahurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	I	.	.	.	.	.	.	.	.	.	.	.	.
Allium anisopodium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	I	.	.	.	.	.	.	.	.	.	.	.	.
Salix pseudopentandra	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	IV	.	.	I	I	.	.	.	.	.	.	.	.	.	.
Veratrum nigrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	IV	II	.	III	.	.	.	.	.	.	.	.	.	.	.
Salix abscondita	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	III	.	I	III	III	.	.	.	.	.	.	.	.	.	.
37. Oxytropido myriophyllae-Pinetum sylvestris																																																		
Oxytropis myriophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	V	I	.	.	.	.	.	.	.	.	.	.	.	.
Scabiosa comosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.
Helictotrichon schellianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.	.
Pulsatilla turchaninovii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	.	.	.	.	.	.	.	.	.	.	.	.	.
38. Bromopsido pumpellianae-Pinetum sylvestris																																																		
Geranium pseudosibiricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.	.
Bromopsis pumpelliana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	.	V	I	I	.	.	.	.	.	.	.	.	.	.
Aconitum barbatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	.	.	IV	.	.	III	.	.	.	.	.	.	.	.	.
Viola arenaria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.
Calamagrostis korotkyi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.
Pyrola chlorantha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.
II-A-II. Ligulario fischeri-Betulion davuricae																																																		

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Ligularia fischeri	.	.	I	.	.	.	.	.	I	II	I	.	.	.	I	.	II	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	.	.	.	.	V	V	II	.	.	.	.	.	III	.	.	.
Polemonium chinense	I	.	II	II	.	.	.	I	I	III	III	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	IV	V	III	.	.	.	.	.	III	II	II	II
Equisetum pratense	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	IV	II	I	IV	V	IV	.	.	.	.	.	I	.	.	I
Calamagrostis langsdorffii	I	II	I	I	.	.	.	II	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	II	.	I	V	V	I	.	.	.	.	I	II	I	II	II
Trollius ledebourii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	III	V	I	.	.	.	.	.	.	.	.	.
Hedisarum alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	.	.	.	.	.	.	.	.	.	.
Cacalia hastata	.	.	II	I	.	.	.	III	IV	IV	II	I	IV	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	II	.	.	II	.	III	IV	I	II	I
Angelica czernaevia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	V	V	.	.	.	.	.	.	I	I	I	I
Cimicifuga simplex	.	.	I	I	.	.	.	.	I	II	I	.	I	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	IV	IV	.	III	II	.	.	.	.	.	.	.
Pedicularis resupinata	.	I	.	.	.	.	.	.	.	.	.	I	.	III	.	III	III	II	.	III	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	I	.	I	III	V	.	.	.	.	III	II	I	.	.	.
Solidago dahurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	IV	.	.	.	.	.	.	.	.	.	.
Vicia baicalensis	.	.	.	.	I	V	.	.	.	.	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	V	II	.	.	.	.	.	I	I	I	I
Larix cajanderi	I	II	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	II	II	II	.	V	IV	.	.	.	.	.	.	.	.	.
39. Veronicastro sibirici-Betuletum davuricae																																																		
Viola brachysepala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	V	.	.	.	.	.	.	.	.	.	.	.
Veronicastrum sibiricum	.	.	.	.	.	.	.	.	.	.	.	II	.	III	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	.	V	I	I	.	.	I	.	I	III	I	I	II
Melica turczaninowiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	I	.	.	I	III	.	.	.	.	.	.	.	I	.	I	.
Serratula manshurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.
Viola collina	I	I	.	.	III	I	II	.	.	.	I	.	I	.	I	.	I	.	III	.	.	I	.	.	I	.	I	.	.	.	.	.	.	II	.	.	.	.	IV	.	.	III	IV	II	II	I	V	III	III	II
40. Geranio vlassowiani-Laricetum gmelinii																																																		
Saussurea purpurata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	.
Trientalis europaea	III	I	I	I	.	.	.	II	.	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.	I
Veratrum lobelianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.
Ribes nigrum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.
Iris sanguinea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.
Gentiana triflora	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	III	.	.	.	.	.	.	I	.	.	.
41. Aquilegio parviflorae-Quercetum mongolicae																																																		
Saussurea recurvata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.
Aquilegia parviflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.
Calamagrostis sugawarae	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	V	.	.	.	.	.	.	.	.	.
Gymnadenia conopsea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	I	II	.	.	IV	.	.	.	.	I	.	.	.	.
Helictotrichon dahuricum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	III	.	V	.	.	.	.	.	.	.	.	.
II-B. Lespedezo bicoloris-Quercetalia mongolicae																																																		
Doellingeria scabra	I	.	.	.	.	.	.	I	.	.	I	I	.	.	I	II	V	I	I	II	II	III	IV	III	I	V	V	II	II	IV	IV	II	.	.	.	.	.	.	.	.	.	V	IV	V	V	V	V	IV	V	IV
Fraxinus rhynchophylla	.	.	.	.	.	.	.	.	.	.	.	II	II	.	.	IV	III	II	IV	III	II	I	I	III	IV	IV	IV	III	III	.	III	II	.	.	.	.	.	.	.	.	.	IV	V	I	II	I	IV	I	I	I
Artemisia keiskeana	.	.	.	.	.	.	.	.	.	.	.	I	.	.	II	II	I	I	II	I	III	III	I	IV	III	V	III	I	I	.	III	I	.	.	.	.	.	.	.	.	.	V	.	IV	II	II	II	III	III	III
Rubus crataegifolius	.	.	.	.	.	.	.	I	I	I	.	I	.	.	.	.	IV	.	II	.	I	.	.	I	I	II	III	.	.	.	II	.	.	.	.	.	.	.	.	.	.	IV	III	II	IV	V	V	I	I	.
Melampyrum roseum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	II	II	.	III	I	IV	III	IV	III	IV	I	.	I	IV	I	.	.	.	.	.	.	.	.	.	III	.	IV	III	IV	IV	IV	I	III
Lespedeza bicolor	.	I	.	.	II	I	I	.	.	.	.	I	.	.	II	.	I	.	III	.	II	II	V	II	III	II	II	.	.	.	III	I	.	.	I	.	.	.	.	.	II	II	.	V	V	V	V	V	V	V
Atractylodes ovata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V	III	II	I	I	I	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	V	V	V	V	V	V	IV	IV	IV
Galium maximowiczii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	II	III	III	IV	.	.	I
Lactuca raddeana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	II	I	III	III	.	.	I
Amphicarpaea japonica	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	I	III	.	I	I
Vicia subrotunda	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	III	III	II	II	I
Lysimachia davurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	I	IV	IV	II	I	II

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Viola orientalis	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	III	IV	III	II	II
Carex lanceolata	II	II	I	.	IV	IV	IV	.	.	I	I	I	.	.	.	I	III	II	.	.	.	.	II	II	III	V	IV	I	III	.	III	I	.	IV	.	V	.	IV	III	II	.	II	II	II	II	II	IV	IV	II	III
Artemisia stolonifera	.	I	.	.	V	III	II	.	.	.	.	III	.	IV	I	.	V	.	.	.	I	.	.	.	.	.	IV	.	.	.	II	.	.	.	.	.	.	.	.	.	.	II	V	III	II	V	V	V	V	V
Dioscorea nipponica	.	.	I	.	IV	II	.	.	I	I	I	I	II	.	I	.	IV	.	.	.	I	.	.	.	.	.	II	.	.	.	I	.	.	.	.	.	.	.	.	.	.	II	IV	I	.	I	V	IV	IV	III
Pteridium aquilinum	I	I	.	.	.	.	.	II	.	I	I	I	.	.	I	.	.	.	.	.	.	.	V	II	.	.	II	.	.	.	II	.	.	I	.	.	.	.	III	.	II	III	I	IV	III	V	V	IV	IV	V
II-B-I. Corylo heterophyllae-Quercion mongolicae																																																		
Carex nanella	I	II	.	.	.	.	.	.	.	.	.	I	.	I	II	I	.	II	III	I	.	I	.	IV	I	I	.	II	II	I	I	I	III	.	.	.	.	.	.	.	.	V	.	V	V	V	II	I	I	II
Spodiopogon sibiricus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	.	II	V	.	IV	III	V	III	.	.	I	IV	.	.	.	.	.	.	.	.	.	.	IV	.	V	V	V	IV	II	III	III
Polygonatum odoratum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	.	I	IV	.	.	II	I	.	.	II	II	.	III	.	III	II	IV	II	.	II	.	.	I	V	II	IV	III	IV	II	I	I	I
Quercus dentata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	V	V	V	V	.	.	I
Corylus heterophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	.	.	III	II	I	I	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	V	V	V	V	II	III	III
Poa ochotensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	II	.	.	III	IV	V	IV	II	.	I
Artemisia desertorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	V	.	II	.	.	.	.	.	.	.	.	IV	V	IV	I	I	.	I
Veratrum maackii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	.	I	IV	I	III	IV	II	.	I	.
Potentilla freyniana	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	II	.	II	II	IV	.	.	.	.
Miscanthus sinensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	III	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	III	IV	III	I	.	.	.
Codonopsis lanceolata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	III	I	III	IV	I	II	I
Kitagawia eryngiifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	III	III	II	I	III	II	II
42. Indigofero kirilowii-Quercetum mongolicae																																																	
Adenophora triphylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	I	.	.	.	.	.	I	.	.	.	I	.	.	IV	IV	I	.	.	IV	V	V	V	II	.	.	.	.	.	I	.
Indigofera kirilowii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	II	II	.	.	I	.	IV	.	.	.	.	.	.	.	.	.	.	V	.	.	.	.	.	.	.	.
Ampelopsis brevipedunculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	II	.	.	.	.	.	.	.
Iris ensata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	I	.	.	.	.
Lilium buschianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	I	I	II	I	I	I	I
Clematis patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	.	.	.	.	.	.	.
Pseudostellaria heterophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.
Crataegus pinnatifida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	II	.	.	.	I	.	.	.
Dendranthema indicum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.
Celastrus orbiculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	I	.	.	I	.	I	I	.	.	II	II	.	I	I	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.	.	.	.
Epimedium koreanum	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	V	.	.	.	I	.	I	.
Clematis heracleifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	III	.	.	.	.	.	.	.
43. Meehanio urticifoliae-Quercetum mongolicae																																																	
Viola chaerophylloides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	I	.	.	I	I	II	.	II	II	II	.	II	II	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.
Disporum sessile	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	I	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.
Rhamnus yoshinoi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	.	.	.	.	.	.	.
Actinidia polygama	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	II	II	.	.	.	I	.	.	I	I	II	.	I	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	I	.
Angelica polymorpha	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	.	.	.	.	.	.	.
44. Gypsophyllo pacificae-Quercetum mongolicae																																																	
Syneilesis aconitifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	V	III	I	III	.	I	I
Trommsdorfia ciliata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	III	I	.	.	.	.
Pulsatilla cernua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	III	I	.	.	.	.
Leibnitzia anandria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	.	I	V	I	.	.	.	I	.	IV	III	II	I	.	.	.
Gypsophila pacifica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	II	I	I	.	.	.
Platycodon grandiflorus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	IV	II	I	.	.	.	.
Thesium chinense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	II	.	.	.	.

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Hieracium virosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	III	.	I	.	.	I	.
Viola mandshurica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	I	.	.	.	.
45. Sophoro flavescentis-Quercetum mongolicae																																																		
Bupleurum komarovianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	V	I	.	.	.	I
Sophora flavescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	I	.	.	.	.
Allium senescens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	I	IV	I	I	.	.	I
Lespedeza tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	IV	.	II	.	.	.	.	.	II	II	.	.	IV	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	.	.	.	.
Artemisia rubripes	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	I	.	.	.
Adenophora verticillata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	V	V	.	.	.	I	III	I	I	.	.	.
Lathyrus quinquenervius	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	I	.	.	.	.
Silene repens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	I	I	I	II	.	.	.	.	I	III	I	I	I	.	I
Artemisia laciniata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	.	.	I	.
Arundinella hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	II	III	I	.	.	.	.
Geranium sieboldii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	.	.	.	.
Viola patrinii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	I	.	.	.	.
46. Lycopi lucidi-Quercetum mongolicum																																																		
Maianthemum dilatatum	I	I	III	IV	.	.	.	.	I	III	II	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	I	V	I	.	I	.
Lycopus lucidus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	V	II	.	.	.
Angelica decursiva	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	IV	I	.	.	.
Lysimachia clethroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	I	II	I	.	IV	.	II	II	II	III	I	I	I	I	I	.	.	.	.	.	.	.	.	.	II	I	II	I	IV	III	II	II	.
Lathyrus komarovii	.	.	.	I	.	.	.	III	.	I	I	II	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	IV	IV	II	I	II
Valeriana fauriei	.	.	II	III	.	.	.	.	I	III	II	I	I	.	.	.	IV	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	IV	V	III	.	.	.
Vicia cracca	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	I	I	III	I	.	I	I
Clinopodium chinense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	III	V	I	.	.	.
II-B-II. Dictamno dasycarpi-Quercion mongolicae and 50. Lespedezo bicoloris-Quercetum mongolicae																																																		
Angelica cincta	.	.	.	.	.	.	.	.	I	II	.	I	II	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	V	III	III	II
Carex reventa	II	III	I	I	.	.	.	.	.	I	III	IV	III	V	IV	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	.	.	.	.	V	III	.	.	.	I	.	I	V	V	IV	IV
Geranium maximowiczii	.	.	.	.	.	.	.	.	.	.	.	II	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	III	.	.	.	.	.	V	V	I	II
Vicia amurensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	.	.	.	.	.	.	.	I	.	.	I	I	I	IV	IV	II	III
Dictamnus dasycarpus	.	.	.	.	.	.	.	.	.	.	I	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	I	II	I	.	.	.	III	I	.	.	.	.	.	I	V	IV	III	IV
Vincetoxicum acuminatum	.	.	.	.	.	.	.	.	.	.	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	IV	II	II
Bupleurum longiradiatum	.	.	.	.	II	III	IV	I	.	.	I	I	I	.	I	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	I	V	.	.	.	.	I	III	V	III	III
Hemerocallis middendorffii	II	.	.	I	.	.	.	I	.	.	I	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	I	III	II
Polygonatum involucratum	.	.	.	.	IV	I	I	I	.	.	I	I	II	.	I	.	I	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	I	I	IV	V	IV	III
Lathyrus humilis	II	.	I	I	.	.	.	.	.	.	II	II	II	.	III	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	V	III	V	V	V	IV	V	IV	.	.	.	.	.	II	V	IV	III
Fragaria orientalis	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V	V	V	V	III	V	V	V	IV	.	.	.	I	.	.	IV	III	III
47. Campanulo glomeratae-Quercetum mongolicae																																																		
Serratula manshurica	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	I	.	III	V	I	I	II
Campanula glomerata	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	V	.	II	.	II	V	.	.	.	.	.	I	I	V	I	I	II
Cimicifuga dahurica	.	.	.	I	.	.	.	.	.	.	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	IV	IV	.	.	.	.	.	I	IV	.	I	I
Veratrum ussuriense	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	IV	I	I	III
Chloranthus japonicus	.	.	I	.	.	.	.	I	I	I	I	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	IV	I	.	I	IV	II	II	I
Lathyrus davidii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	II	II	I	I	IV	I	II	I
Aconitum kirinense	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III	I	I	.
Viola brachyceras	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	III	I	.	I

Table 3. (cont.)

Association code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Artemisia dubia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II	.	.	.	.	.	.	.	.	.	II	I	**III**	.	.	.
Saussurea pulchella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	I	**III**	.	.	I
Eleutherococcus sessiliflorus	.	.	.	.	.	.	.	I	.	I	I	.	I	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**III**	I	.	I
48. Melico nutansi-Quercetum mongolicae																																																		
Melica nutans	I	I	.	.	.	.	.	I	.	.	I	I	.	.	II	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	**V**	I	I
Galium platygalium	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**IV**	I	II
Campanula punctata	I	.	.	.	**III**	II	.	.	.	.	I	II	.	I	I	.	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	**IV**	.	.	.	.	.	**III**	.	.	I	.	II	II	**IV**	II	II
49. Melampyroso setacei-Quercetum mongolicae																																																		
Melampyrum setaceum	.	.	.	.	.	.	.	.	.	.	.	I	.	.	I	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	I	**V**	.
Geranium vlassowianum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I	.	I	II	**V**	.	.	.	.	.	I	I	I	**IV**	II

4. Discussion

Since the time of delineation of the class Fagetea crenatae (Miyawaki et al. 1964), there have been several attempts to introduce class-level units reflecting a variation in deciduous vegetation of Eastern Asia as caused by climate. The first, not formally valid proposal of a new class was made by Song (1988). Quercetea mongolicae nom. nudum suggested for the mainland Asia with the only order Aceri-Quercetalia mongolicae validated later by Takeda et al. (1994) was employed to reflect the change in the deciduous forests caused by climate continentality.

A profound revision of the syntaxonomical system for the temperate deciduous forests in East Asia was undertaken by Kim (1992) in his Ph. D. thesis based on a detailed comparative study of the Japanese, Korean and Russian Far East relevé database. Although a single class Querco-Fagetea crenatae was kept for both insular and mainland parts of Asia, the difference in the temperate forests was reflected in the distinguishing of subclass Quercenea mongolicae Kim 1992 nom. ined. for the mainland and Fagenea crenatae Kim 1992 nom. ined. for the insular parts of temperate forests range. Quercenea mongolicae includes orders Tilio-Pinetalia koraiensis for the northern (Russian Far East) and Rhododendro-Quercetalia mongolicae for Korean parts of ranges.

The situation with variation of forests along the continentality gradient was clarified when Ermakov (1997, 2003) and Ermakov et al. (2000) introduced a new class on the basis of data obtained on the northwesternmost reaches of range of deciduous temperate forests. The new class Querco-Betuletea davuricae with single order Querco-Betuletalia davuricae was introduced to describe most of the continental part of temperate forest vegetation on and near the forest climatic limit caused by aridity (forest-steppe ecotone). However, this syntaxonomical decision was not discussed with respect to the results obtained from the Korean data by Song (1988), Song et al. (1995, 1999), Kim (1990, 1992) and Takeda et al. (1994) and the syntaxonomical situation in between the upper Amur and Japan, an area of about 3000 km along the latitude, remained unclear. The introduction of Querco-Betuletea davuricae leaves open a question: to what extent do Fagetea crenatae, described mostly on Japanese and Kim's (1990, 1992) data, occupy the mainland part of Eastern Asia and where is the boundary between these two classes?

4.1. The relationships between Fagetea crenatae and Quercetea mongolicae

Comparative analysis of floras of the insular and mainland sectors (Qian et al. 2003b, Krestov 2004) showed that although the both insular and mainland areas belong to the East Asian floristic area, which generally corresponds to the Takhtajan's (1978) East Asian floristic region, the floristic affinity between the insular and mainland sectors of the East Asia decreases from south to north. Qian et al. (2003a) found that the difference between floras of Hokkaido and North Korea is bigger than between floras of North Korea, northeast China and continental regions of the Russian Far East. KRESTOV (2005) showed that the floras of the Ussuri floristic district and southern Sakhalin appear to be the same close to both the flora of Hokkaido and the flora of Northeast China, North Korea and to the continental regions of the Russian Far East.

All areas have similar vertical vegetation belt sequences and similar orotemperate (SONG 1992a, KRESTOV & NAKAMURA 2002) and supratemperate (subalpine) vegetation. However, the lower vegetation belts are different. The vegetation of lower vegetation belts in northeast China, continental regions of the Russian Far East and westernmost Sikhote-Alin Range are represented by pure, drier *Quercus mongolica* forests, while the humid mixed broadleaved-coniferous forests are characteristic for the lower vegetation of Hokkaido (*Quercus mongolica* var. *grosseserrata* + *Abies sachalinensis*) and for most of the Sikhote-Alin Range (*Quercus mongolica* + *Pinus koraiensis*). As upper vegetation belt it occurs also in Korea. Both the Sikhote-Alin and Hokkaido zonal vegetation types are characterized by annual temperatures in the range from +1 to +6 °C and by well-expressed humid conditions with no period of moisture deficit. The main difference between Hokkaido and the Sikhote-Alin is the winter precipitation. Snow cover in Hokkaido is much deeper than in the Sikhote-Alin.

Another important issue resulting from the similarity of the Sikhote-Alin and Hokkaido forests are the relationships between the *Quercus mongolica* var. *grosseserrata-Abies sachalinensis* forests to the north and *Fagus crenata* forests (Saso kurilensis-Fagetum crenatae Suz.-Tok. 1949) to the south of the Kuromatsunai depression (TATEWAKI 1958) in the southeast of Hokkaido. The latter are representatives of humid oceanic monsoon summergreen broadleaved forests, and their distribution is restricted mainly to the Japanese Archipelago with the exception of most of Hokkaido. These forests are combined into the class Fagetea crenatae, which includes the orders Saso-Fagetalia crenatae Suz.-Tok. 1966, Fraxino-Ulmetalia Suz.-Tok. 1967 and Pinetalia pentaphyllae Suz.-Tok. 1966 (SUZUKI & MIYAWAKI 2001, SUZUKI 2002). The class is characterized by *Acanthopanax sciadophylloides*, *Acer palmatum* var. *amoenum*, *A. rufinerve*, *A. japonicum*, *A. sieboldianum*, *Callicarpa japonicae*, *Cornus controversa*, *Enkianthus subsessilis*, *Euonymus oxyphyllus*, *Euonymus sieboldianus*, *Fagus crenatae*, *Fraxinus lanuginosa*, *Ilex macropoda*, *Leptorumohra miqueliana*, *Lindera umbellata*, *Magnolia hypoleuca*, *Polygonatum lasianthum*, *Schizophragma hydrangeoides*, *Sorbus commixta*, *Viburnum wrightii* and others.

However, the order Quercetalia serrato-grosseserratae, distributed mostly on Hokkaido and in the Central Japan and traditionally considered a part of Fagetea crenatae, includes forests formed in subcontinental conditions in the interior parts of Hokkaido and in central Honshu. In contrast to Fagetea crenatae sensu stricto, it includes a number of species widely distributed on the continent: *Aegopodium alpestre*, *Anemonoides umbrosa*, *Callicarpa japonica*, *Carex siderosticta*, *Corylus mandshurica*, *Lindera glauca*, *Schisandra chinensis*, *Stephanandra incisa*, *Styrax* *obassia*, *Syringa reticulata*, and *Waldstenia ternata* (Hoshino 1998, Takeda et al. 1983). Characteristic species of Saso-Fagetalia crenatae, the nomenclatural type for the Fagetea crenatae, are *Acer japonicum*, *Acer distylyum*, *Acer micranthum*, *Acer tschonoskii*, *Diplazium squamigerum*, *Enkianthus cernuus*, *Euonymus planipes*, *Fagus crenata*, *Fraxinus apertisquamifera*, *Menziesia multiflora*, *Smilacina japonica*, *Trilium tschonoskii* and *Viburnum furcatum*, which are absent or rarely present in Quercetalia serrato-grosseserratae.

In the list of diagnostic species for Carpino-Quercion grosseserratae and Quercetalia serrato-grosseserratae in Hokkaido of Takeda et al. (1986) and Hoshino (1998), 19 of the 36 species characterize also the mixed broadleaved-*Pinus koraiensis* forests of Sikhote-Alin. The list of species common to the Sikhote-Alin and Hokkaido includes *Carpinus cordata*, *Cacalia hastata*, *Lunathyrium pycnosorum*, *Actinidia kolomicta*, *Cardamine leucantha*, *Cirsium kamtschaticum*, *Senecio cannabifolius*, *Carex pilosa*, *Arisaema peninsulae*, *Schisandra chinensis*, *Chloranthus japonicus*, *Angelica anomala* and others. Despite a physiognomic difference between *Quercus mongolica* var. *grosseserrata-Abies sachalinensis* forests (Carpino-Quercion grosseserratae Takeda et al. 1986) in Hokkaido and broadleaved-*Pinus koraiensis* forests of the Sikhote-Alin, most of their common species leaves one to conclude that these forests fall into the same class Quercetea mongolicae.

4.2. The relationships between Quercetea mongolicae and Querco mongolicae-Betuletea davuricae

According to Ermakov (1997), a zonal feature of *Betula davurica* and *Betula davurica-Quercus mongolica* forest flora is the presence of mesoxeric oak forest species. However, the analysis of broader areas, including the forests of Korea, the Sikhote-Alin, and the northeast China shows that this species complex is always present and is very significant in a variety of forest ecosystems, which, in addition to *Betula davurica* and *Quercus mongolica* can also be dominated by *Armeniaca* spp., *Larix principis-ruprechtii*, *Pinus densiflora*, *Quercus aliena*, *Q. dentata*, *Q. liaotungensis*, and others (Qian et al. 2003a, b, Kolbek et al. 2003a, Krestov 2003, 2005). In a number of studies this species complex is characterized as Daurian steppe species complex. However, as some recent comparative studies show, the vegetation type called “Daurian steppe” is very different in ecology and origin from true steppe (Belikovich & Galanin 2005), as the latter was defined by Lavrenko (1991).

The history of Dauro-Manchurian species complex is observed from the Miocene mesic mesothermic vegetation that included a variety of species of *Abies*, *Tsuga*, *Sequoia*, *Cercidiphyllum*, *Platanus*, *Ulmus*, *Fagus*, *Castanea*, *Quercus*, *Carpinus*, *Acer* and other (Ablaev 1978, 2000). The climates fluctuated between warm and cool in the Miocene, cooled further in the Miocene and Pliocene, and became extremely cold in Pleistocene (Tiffney 1985). In the late Pleistocene, a rapid expansion of climate aridization took place in East Asia (Velichko 1973, Grichuk 1984). This climate cooling, with the aridization followed, created an evolutionary barrier, a frost and drought tolerance, for most species. Survivors in that climatic situation reached their maximum development in the Late Pleistocene maximum, 18,000 BP, when *Quercus* and *Larix* woodlands, with steppe-like openings, occupied the whole territory of northeast China, most of Korean peninsula and the south of the Russian Far East (Grichuk 1984). The mountain massifs in Hokkaido, Sikhote-Alin and Changbai represented refugia, where humidity-dependent vegetation was dominated by *Picea jezoensis* and *Abies* spp. and where many temperate species survived (Grichuk 1984, Igarashi 1993).

The distinctiveness of the Dauro-Manchurian complex of species is also demonstrated by its high tolerance to fire. Herb buds are well protected and woody species that include the main dominants *Betula davurica* and *Quercus mongolica* demonstrate a very high sprouting capability. Recurring fires in the drier communities of Tilio-Pinetalia koraiensis inevitably lead to soil degradation processes, such as thinning of humus-containing soil horizons from a typical 15–20 to 3–5 cm. There is washing out of fine fracture from the upper soil horizons and an increase in soil drainage. Such changes in soils cause the formation of simple in structure *Betula davurica* and *Quercus mongolica* dominated forests with Dauro-Manchurian complex of species in the understorey.

Dauro-Manchurian complex of species formed in the Late Pleistocene within the modern distribution of *Quercus mongolica* forests in mainland Asia does define vegetation composition and structure in subcontinental and continental sectors of cold and cool temperate zones of the Asian mainland. The major climatic feature of this area, a selecting factor for species composition, is the occurence of a period of moisture deficit in soils in spring and early summer. A second important selective factor is the ground fires that occur mostly during the period of moisture deficit and as frequently as once every five to ten years (in fact, they are much more often). Therefore, a concept of Querco-Betuletea davuricae proposed by Ermakov (1997, 2003) for an ecotone on the summit on the western reaches of temperate forests, eastern reaches of subarid forestless vegetation and southern boreal forests (see map in Ermakov 1997: 65) must be extended for the whole area of distribution of the Dauro-Manchurian species complex. Thus, we considerably enlarge this class to included forests where the importance of *Quercus mongolica* is much higher than *Betula davurica*.

The major ecologically meaningful factor for the differentiation of pure oak and mixed broadleaved and broadleaved-coniferous forests on the territory of mainland Asia is the period of moisture deficit that occurs mostly in the spring and early summer as a consequence of very low or absent snow cover. The boundary between Quercetea mongolicae and Querco mongolicae-Betuletea davuricae has a strong relationship with the isoline of moisture index 1 (Box & Choi 2003) dividing regions with and without a moisture deficit during a growing season. The period of draught also explains the high frequency of ground fires (sometimes twice a year) in these areas (Dobrynin 2000). Since a big complex of drought and fire tolerant species of Manchurian and Dauro-Manchurian (Ermakov 2003) origin differentiates pure oak forests from the mixed broadleaved-coniferous forests of the Sikhote-Alin and Hokkaido, it is reasonable to divide deciduous oak forests of Querco mongilicae-Betuletea davuricae into the warmer and wetter Lespedezo bicoloris-Quercetalia mongolicae in the middle part of the Amur River basin, including its tributaries the Ussuri and Songari rivers, and colder and dryer Querco-Betuletalia davuricae in the upper part of Amur River basin with the greater influence of south Siberian and Daurian floras.

The Korean peninsula includes a sequence of horizontal zones from warm-temperate, represented by vegetation common with Japan of the class Camellitea japonicae, and cool temperate vegetation considered in this paper as Aceri-Quercetalia mongolicae, an order of Quercetea mongolicae. The order Aceri-Quercetalia mongolicae includes some floral elements, such as genera *Ilex*, *Sasa*, *Kalopanax* and others linked to Japan. The Changbai mountain range serves as a substantial barrier to Arctic air masses in winter and Asiatic monsoons in the summer time. Many Japanese species have their northwestern limit there. We can therefore consider the Changbai mountain range a border between warmer Aceri-Quercetalia mongolicae and cooler Tilio-Pinetalia koraiensis.

4.3. Classes of temperate deciduous vegetation in East Asia

Deciduous temperate forests of Northeast Asia can be devided into the four classes reflecting the variation in climate along a continentality gradient.

(1) Fagetea crenatae includes vegetation formed under the influence of a monsoon, very humid oceanic or suboceanic climate with relatively even distribution of precipitation among summer and winter seasons in the middle temperate subzone. It occurs only on the Japanese Archipelago, with an exception for *Fagus engleriana* forests, which probably relates to this class, but their distribution is restricted to local areas in eastern China (Nakamura et al. 2004).

(2) Quercetea mongolicae reflects monsoon humid maritime climate conditions with the amount of summer precipitation higher than winter precipitation and the lack of any period of moisture deficit. It occurs in Korea, easternmost montane belt of China (east of Lesser Hingan), Sikhote-Alin mountains (Fig. 3), montane belt of central Japan and lower elevations of Hokkaido north of Kuromatsunai depression.

(3) Querco mongolicae-Betuletea davuricae unites forest vegetation in conditions of semiarid subcontinental climate with summer precipitation considerably higher than winter precipitation and with the period of moisture deficit in spring and early summer. This class represents forests of the forest-steppe ecotone near the westernmost reaches of forest vegetation and is limited in its distribution to the west by a moisture deficit. It mostly occupies the regions of northeast China and eastern Russia west of the

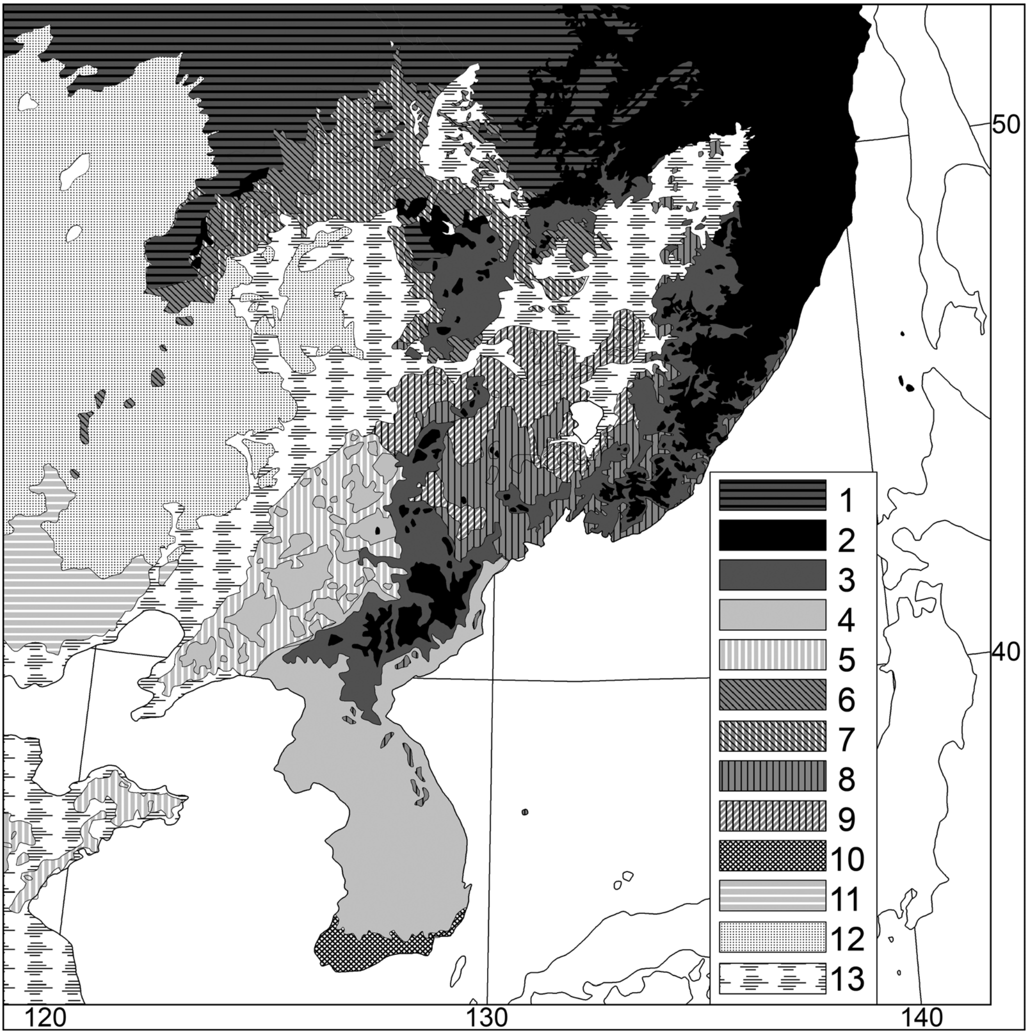

Fig. 3. Scheme of distribution of main syntaxa in the Asian mainland based on vegetation maps of LAVRENKO & SOCHAVA (1954), YIM (1968), SOCHAVA (1969) and ANONYMOUS (1982). 1 – Boreal *Larix gmelinii* forests (unknown syntaxa), *Pinus sylvestris* forests (unknown syntaxa) and *Betula platyphylla* forests (unknown syntaxa), 2 – boreal Abieti-Piceetalia forests, 3 – temperate Tilio-Pinetalia koraiensis forests, 4 – temperate Aceri-Quercetalia forests and 5 – shrubs, 6 – temperate Querco-Betuletalia davuricae forests and 7 – shrubs, 8 – Lespedezo-Quercetalia forests and 9 – shrubs, 10 – warm temperate Camellitea japonicae forests, 11 – scrub in the forest-steppe ecoton (unknown syntaxa), 12 – steppe and desert (unknown syntaxa), 13 – wetlands (unknown syntaxa).

Lesser Hingan and in the low elevation belts of the southern Sikhote-Alin (Fig. 3).

(4) A poorly known or yet unknown but very distinctive forest vegetation type characterized by species of *Alangium*, *Aphananthe*, *Callicarpa*, *Carpinus*, *Celtis*, *Lindera*, *Liquidamber*, *Meliosma*, *Parabenzoin*, *Platycarya*, *Quercus*, *Sapium*, *Styrax*, *Zelkova*, with high significance of *Aphananthe*, *Celtis* and *Zelkova* and that is distributed in southern Korea, eastern Japan and eastern China, represents perhaps another class intermediate between Camellitea japonicae and Quercetea mongolicae (Suzuki 2001).

4.4. Variation in temperate deciduous forests and phytogeographical schemes

The classification of deciduous forests in the 20th century was approached from different viewpoints, mainly by Russian and Japanese phytogeographers and forest ecologists. After the publication of the large-area vegetation maps of the Soviet Union (Lavrenko 1947, Alekhin 1951, Lavrenko & Sochava 1954) and the Russian Far East (Sochava 1969), Kolesnikov (1961) a scheme was suggested for Far Eastern vegetation regionalization using criteria of climatic climax potential vegetation. According to this scheme, both mainland and insular mixed nemoral forests of the Russian Far East were related to the East Asian conifer-broadleaved forest area, based on the presence and high significance of coniferous species (*Abies holophylla*, *A. sachalinensis* and *Pinus koraiensis*) in mixed stands composed of *Betula costata*, *Fraxinus mandshurica*, *Tilia amurensis*, *T. mandshurica* in zonal habitats. The climatic differences within the range of broadleaved-*Pinus koraiensis* forests led to the division of this area into the Far Eastern province with the significant presence of *Pinus koraiensis* and *Quercus mongolica* in forest communities in cold, temperate submaritime climate conditions, into the Korean-Southern Manchurian province with presence of *Abies holophylla*, *Carpinus cordata* in species rich mixed forests in cool temperate submaritime climate conditions, into the Southern Kuril-Sakhalin province with the presence of *Abies sachalinensis* and *Quercus mongolica* var. *grosseserrata* in cool temperate maritime climate conditions, and into the Middle Amur province in cold subcontinental climate conditions. Widely distributed *Quercus mongolica* forests were traditionally considered seral vegetation, appearing after regular ground fires in the mixed forest stand following the elimination of mesic and shade tolerant species and the invasion of drought and fire tolerant species (Krestov 1997, 2003, Dobrynin 2000).

Until now the most comprehensive study of Far Eastern broadleaved-*Pinus koraiensis* forests was made by Kolesnikov (1956a), who used an approach based on dominance and differentiated these forests into three climatically different types: southern, with *Carpinus cordata* and southern Manchurian floristic elements; typical (middle), with true Manchurian element; and northern, enriched with the boreal floristic element. These divisions were confirmed with the alliances distinguished in this study, respectively Jeffersonio-Quercion mongolicae, Phrymo asiaticae-Pinion koraiensisis and Abieti nephrolepidis-Pinion koraiensis. The more continental type of forests, whose existence is predicted by Kolesnikov (1956a), was described by Kim (1992) from northern spurs of Changbai area as an alliance Tilio-Pinion koraiensis.

In Korea, the problem of vegetation zonation was approached from the point of view of dominant vegetation types (Honda 1922, Ueki 1933, Wang 1961, Chung & Lee 1965, Rim 1965, Yim 1968 and Okumura 1974). All vegetation maps agree in differentiating (1) evergreen broadleaved, (2) deciduous broadleaved and mixed broadleaved-coniferous and (3) coniferous forests zones. The latter is developed in the mountain range on the north of the Korean peninsula and represents a vertical elevation belt. The differences between the maps mentioned are subdivision of a zone of deciduous broadleaved and mixed broadleaved-coniferous forests into subzones and in the position of boundaries. Yim & Kira (1975) examined the existing vegetation maps with the warmth and coldness Kira's indices using climatic records from 148 climatic stations and confirmed the major biotemperature limits for the phytogeographical zones found by Kira (1977) and Hämet-Ahti et al. (1974) for vegetation of Japan: warmth indices 45°, 55° and 85° correspond respectively to the southern borders of boreal and northern temperate and middle temperate subzones of temperate zone. Kim (1992) has given syntaxonomical interpretation of the Korean vegetation zones relating Vaccinio-Piceetea to the boreal, Rhododendro-Quercetalia (Aceri-Quercetalia mongolicae in our paper) to the cool temperate and Camellitea japonicae to the warm temperate zones. The Kim's cool temperate zone, in terms of our approach, includes northern (Pino koraiensis-Quercion mongolicae) and middle (Rhododendro-Quercion mongolicae) subzone of temperate zone. A scheme of syntaxonomical interpretation of vegetation subzones and continentality sectors within temperate zone of East Asia is shown on Table 4.

5. Syntaxonomy

I. Quercetea mongolicae Song ex Krestov et al. cl. nov. hoc loco
Nomenclatural type: Aceri-Quercetalia mongolicae Song ex Takeda et al. 1994. **Diagnostic taxa:** *Acer mono*, *Actinidia arguta*, *Athyrium yokoscense*, *Carex siderosticta*, *Carpinus cordata*, *Dryopteris crassirhizoma*, *Kalopanax septemlobus*, *Pyrola japonica*, *Smilacina hirta*, *Sorbus alnifolia.* **Corresponding name:** Quercenea mongolicae Kim 1992.

We validate the class introduced and described by Song (1988). The class combines cool and cold temperate vegetation types of mainland regions and the lower elevations of Hokkaido, where there is no period of moisture deficit during the growing period. The class includes 3 orders, of which Quercetalia serrato-grosseserratae Miyawaki et al. 1971 occurs exclusively in Hokkaido, and Aceri-Quercetalia mongolicae and Tilio-

Table 4. Distribution of dominant species, phytogeographic areas (KRESTOV 2003) and related zonal orders according to vegetation subzones and climatic sectors.

Subzone		Sectors				
		continental	subcontinental	submaritime	maritime mainland	maritime insular
Southern boreal	dominant	*Larix gmelinii*, *Pinus sylvestris*	*Larix gmelinii*	*Larix gmelinii*	*Abies nephrolepis*, *Picea jezoensis*	*Abies sachalinensis*, *Picea jezoensis*
	area	Eastern Siberian larch area	Eastern Siberian larch area	Eastern Siberian larch area	Western-Okhotsk dark-conifer area	Western-Okhotsk dark-conifer area
	alliance	in part: Pulsatillo turczaninowii-Pinion sylvestris, but mainly unknown alliance of Vaccinio-Piceetea	unknown alliance of Vaccinio-Piceetea	unknown alliance of Vaccinio-Piceetea	Abieti nephrolepidis-Piceion jezoensis Song 1990	Piceion jezoensis Suzuki-Tokio ex Jinno et Suzuki 1973
Northern temperate (Cold temperate)	dominant	*Quercus mongolica*, *Betula davurica*	*Quercus mongolica*, *O. dentata*, *Q. liaotungensis*, *Betula davurica*	*Pinus koraiensis*, *Fraxinus* spp., *Tilia* spp., *Quercus mongolica*, *Pinus koraiensis*	*Pinus koraiensis*, *Fraxinus* spp., *Tilia* spp., *Quercus mongolica*, *Pinus koraiensis*	*Quercus mongolica* var. *grosseserrata*, *Abies sachalinensis*, *Kalopanax septemlobus*
	area	Dauria steppe woodland area	Manchurian oak area	Manchurian broadleaved conifer area	Manchurian broadleaved conifer area	Sakhalin-Hokkaido broadleaved conifer area
	alliance	Kitagawio terebinthaceae-Betulion davuricae	Dictamno dasycarpi-Quercion mongolicae	Abieti nephrolepidis-Pinion koraiensis (north), Athyrio-Quercion mongolicae (south)	Abieti nephrolepidis-Pinion koraiensis (north), Phrymo-Pinion koraiensis (middle), Jeffersonio-Quercion mongolicae (south)	Carpino-Quercion grosseserratae Takeda et al. 1986

Table 4. (cont.)

Subzone		Sectors				
		continental	subcontinental	submaritime	maritime mainland	maritime insular
Middle temperate (Cool temperate)	dominant	*Caragana microphylla*, *Cleistogenes squarrosa*, *Koeleria cristata*, *Stipa grandis*, *S. krylovii*, *Thymus dahuricus*,	*Caragana microphylla*, *Ostryopsis davidiana*, *Quercus mongolica*, *Ulmus macrocarpa*, *Vitex negundo*	*Quercus mongolica*, *Q. acutissima*, *Q. aliena*, *Q. dentata*, *Q. liaotungensis*	*Quercus mongolica*, *Q. acutissima*, *Q. aliena*, *Q. dentata*, *Q. serrata*	*Fagus crenata*, *F. japonica*, *Quercus mongolica* var. *grosseserrata*
	area	Temperate steppe area	Temperate oak scrub area	Manchurian broadleaved area	Korean broadleaved area	Japanese broadleaved area
	alliance	unknown	unknown	Corylo heterophyllae-Quercion mongolicae	Pino koraiensis-Quercion mongolicae (north), Lindero-Quercion (south)	Saso kurilensis-Fagion crenatae, Sasamorpho-Fagion crenatae, Tsugion sieboldii

Table 5. Typus relevés: sources, locations and site characteristics. Vegetation unit codes coincide with those in section 5. Syntaxonomy, Tables 2 and 3. Abbreviations in localities: CH – China, RU – Russia, SK – South Korea. In Latitude and Longitude columns, the coordinates are given in degrees in decimal form. Coordinates with 1 decimal digit were identified roughly from the map, coordinales with 3 decimal digits were measured with GPS.

Plot num.	Veg. unit code	Source	Date	Locality	Latitude (°N)	Longitude (°E)	Elev. (m)	Aspect	Slope	Plot size (m^2)	Spec. num.
1	1	Krestov, fieldwork (r. 151)	1994. 06. 17	Iman river (RU)	45.340	136.412	200	NW	25	400	42
2	2	Krestov, fieldwork (r. 466)	2002. 08. 23	Bikin river (RU)	49.144	132.857	370	W	38	400	30
3	3	Gumarova 1993 (t. 3, r. 7)	N/A	Ussuri river (RU)	44.0	133.9	810	N	10	400	52
4	4	Gumarova 1993 (t. 5, r. 3)	1976. 08. 16	Ussuri river (RU)	44.0	133.9	700	N	12	400	31
5	5	Kim 1992 (t. 5, r. 3)	N/A	Maoershan mt. (CH)	45.3	127.5	395	SEE	15	500	47
6	5b	Kim 1992 (t. 5, r. 7)	N/A	Maoershan mt. (CH)	45.3	127.5	400	W	15	400	50
7	6	Kim 1992 (t. 7, r. 4)	N/A	Tairing (CH)	47.1	128.8	450	W	8	900	59
8	6a	Kim 1992 (t. 7, r. 11)	N/A	Tairing (CH)	47.1	128.8	500	S	20	600	43
9	7	Kim 1992 (t. 9, r. 4)	N/A	Changbaishan mt. (CH)	42.1	127.9	850	W	2	750	69
10	7b	Kim 1992 (t. 9, r. 10)	N/A	Changbaishan mt. (CH)	42.1	127.9	1070	NW	2	625	55
11	8	Krestov, fieldwork (r. 490)	1992. 08. 07	Khor river (RU)	48.126	136.543	230	SSW	12	400	41
12	8b	Krestov, fieldwork (r. 476)	1992. 08. 03	Khor river (RU)	48.064	136.522	230	SSE	3	400	50
13	9	Krestov, fieldwork (r. 99)	1990. 07. 21	Iman river (RU)	45.755	135.482	160		0	400	65
14	10	Krestov, fieldwork (r. 114)	1993. 06. 13	Bikin river (RU)	46.764	135.578	260	SSW	6	400	47
15	10a	Krestov, fieldwork (r. 126)	1993. 06. 17	Bikin river (RU)	46.486	135.454	260	NE	15	400	51
16	11	Krestov, fieldwork (r. 38)	1991. 09. 16	Iman river (RU)	45.741	135.457	360	SSW	20	400	55
17	12	Kim 1992 (t. 11, r. 9)	N/A	Ussuri reserve (RU)	43.6	132.2	250	S	2	750	62
18	12b	Kim 1992 (t. 11, r. 2)	N/A	Ussuri reserve (RU)	43.6	132.2	200	N	15	750	54
19	12c	Gumarova et al. 1994 (t. 6, r. 61)	1992. 08. 19	Vladivostok (RU)	43.187	131.995	140	SW	12	400	91
20	13	Gumarova et al. 1994 (t. 8, r. 79)	1992. 09. 04	Vladivostok (RU)	43.204	131.994	125	NNW	10	400	59
21	13a	Gumarova et al. 1994 (t. 7, r. 20)	1992. 07. 15	Vladivostok (RU)	43.212	132.060	180	N	16	400	98
22	14	Gumarova et al. 1994 (t. 9, r. 120)	1993. 07. 26	Vladivostok (RU)	43.252	132.117	130		0	400	89

Table 5. (cont.)

Plot num.	Veg. unit code	Source	Date	Locality	Latitude (°N)	Longitude (°E)	Elev. (m)	Aspect	Slope	Plot size (m²)	Spec. num.
23	16a	Kim 1992 (t. 18, r. 3)	N/A	Odae Mt. (SK)	37.8	128.6	1280	S	20	900	55
24	16b	Kim 1992 (t. 18, r. 8)	N/A	Odae Mt. (SK)	37.8	128.6	1100	S	35	500	44
25	18a	Kim 1992 (t. 20, r. 3)	N/A	Tokyusan Mt. (SK)	35.9	127.8	1110	SE	40	250	32
26	18b	Kim 1992 (t. 20, r. 22)	N/A	Chombongsan Mt. (SK)	38.1	128.5	920	E	20	500	42
27	20	Kim 1992 (t. 22, r. 5)	N/A	Odae Mt. (SK)	37.8	128.6	1200	E	25	500	37
28	20b	Kim 1992 (t. 22, r. 12)	N/A	Solak Mt. (SK)	38.1	128.5	1260	NE	30	400	40
29	42	Ban et al., fieldwork	2002. 08. 12	Kuandian (CH)	40.595	124.545	210	NW	45	400	52
30	43	Ban et al., fieldwork	2002. 08. 11	Yangmugou (CH)	40.595	124.545	270	NNE	25	400	51
31	44	Verkholat, fieldwork (r. 550)	1995. 07. 09	Hasanskiy district (RU)	42.788	131.275	80	SW	32	400	49
32	45	Verkholat, fieldwork (r. 574)	1981. 08. 14	Hasanskiy district (RU)	42.750	131.221	230	SEE	8	400	71
33	45b	Verkholat, fieldwork (r. 571)	1998. 06. 25	Hasanskiy district (RU)	42.653	131.023	80	SE	25	400	54
34	46	Verkholat, fieldwork (r. 524)	1998. 06. 03	Hasanskiy district (RU)	42.658	131.015	110	SE	3	400	65
35	47	Verkholat, fieldwork (r. 266)	1972. 08. 12	Pidan Mt. (RU)	43.124	132.595	390	SE	5	400	60
36	47b	Verkholat, fieldwork (r. 604)	1999. 10. 04	Nadezhdinskiy d. (RU)	42.896	132.883	140	SW	25	400	93
37	48	Verkholat, fieldwork (r. 235)	1972. 07. 21	Nadezhdinskiy d. (RU)	43.127	132.660	400	SE	20	400	52
38	49	Krestov, fieldwork (r. 69)	1990. 06. 27	Iman river (RU)	45.806	135.325	260	SSW	15	400	44
39	50	Kim 1992 (table 15, r. 2)	N/A	Ussuri reserve (RU)	43.6	132.2	145	S	10	400	43
40	50a	Kim 1992 (table 15, r. 8)	N/A	Ussuri reserve (RU)	43.6	132.2	230	SWW	35	400	38

Table 6. Typus relevés: species composition.

Plot number	0000000001111111111222222222233333333334
	1234567890123456789012345678901234567890
Carex callitrichos	2...+..+.......r........................
Gymnocarpium dryopteris	rr.+.....+2.............................
Polypodium vulgare	r.r.....................................
Rhododendron dauricum	1r......................................
Abelia coreana	1.......................................
Orthilia secunda	.r......................................
Rosa acicularis	.+.....+++r.............................
Vaccinium vitis-idaea	.r......................................
Viola sacchalinensis	.+.......2r....r..................r.....
Adoxa moschatellina	..+...........r...+++...................
Carex xiphium	.r3+........+........................2..
Diplazium sibiricum	+.2...++.+....1.........................
Leptorumohra amurensis	..4+......21............................
Chamaepericlymenum canadense	r..+....................................
Dryopteris expansa	...1........2.....++1...................
Lycopodium annotinum	...3....................................
Lycopodium juniperoideum	...2......r.............................
Phegopteris connectilis	..+1..........1.+.+.1+..................
Asparagus schoberioides	....++.............................r....
Lychnis fulgens	....+r.............................+....
Polygonatum humile	....r+.........................rr......+
Pyrus ussuriensis	....r+..+...........++..................
Sedum aizoon	.....+........................rr.rr+..++
Spiraea ussuriensis	....2+.11......r.+..1+..................
Thalictrum contortum	....++..............r...................
Galium mandshuricum	....r.r++...............................
Rabdosia raddeana	......+.................................
Ribes mandshuricum	r.r.r.+r...r1.rr.++1+...................
Pseudostellaria davidii	......++................................
Thalictrum baikalense	......r+................................
Betula platyphylla	.2..11.123.....r..+..1............1.2..+
Daphne koreana	........+...............................
Lonicera caerulea	........r+..............................
Patrinia intermedia	........rr..............................
Ribes komarovii	........++..............................
Solidago decurrens	r.......+1........+.++1.2+.+........rr++
Aconitum volubile	........+..r............................
Athyrium filix-femina	...r......rr............................
Carex falcata	..........21............................
Carex planiculmis	...........r............................
Galium triflorum	..........rr............................
Lonicera chrysantha	....+.....rr..rr....+1..................
Osmorhiza aristata	...........r...r....+...................
Smilacina davurica	........r..r............................

Plot number	0000000001111111111222222222233333333334
	1234567890123456789012345678901234567890
Aconitum sczukinii	............r1....++++..................
Carex arnellii	............2...........................
Carex sordida	............1......................r....
Matteuccia struthiopteris	......++.+..2.......+...................
Menispermum dauricum	............r...........................
Padus avium	.........1..2.......+.....1.............
Schizopepon bryoniifolius	............r...........................
Ulmus japonica	....r.......23..+....1................1.
Urtica angustifolia	......r.....1r..........................
Stellaria bungeana	..........r.2...........................
Arisaema amurense	.............r1....++++++....1..........
Cacalia auriculata	..r..........rr.++........+.............
Cardamine leucantha	....+r..r..r222.++++11....+........r....
Cornopteris crenulatoserrul.	.............42....1....................
Equisetum hyemale	......r.2.2r2r+......2..................
Filipendula palmata	......+....r2+.....+.1..................
Hylomecon vernalis	............112...++1..............+....
Impatiens noli-tangere	....r.+...rr111....+...............r....
Lamium album	..+...r.+...rrr....................r....
Lunathyrium pycnosorum	........+...122..+.1++..................
Rubia cordifolia	...........rrrr.........................
Aconitum umbrosum	.............1..........................
Aconitum fischeri	..............r.........................
Coniogramme intermedia	..............1.........................
Galium odoratum	..............r.........................
Carex quadriflora	.........2.....r........................
Plagiorhegma dubia	............+..r..+..+.............+rr..
Pseudocystopteris spinulosa	........+.rr...2...+++..................
Pseudostellaria sylvatica	.r.+..+.r+.....r....1+..................
Ribes maximowiczianum	r.1......+....rr..+++...................
Abies holophylla	................1221231..++.............
Asarum sieboldii	................++1+1.+....+............
Lonicera praeflorens	.....+1+++......+1+.+2+.................
Viburnum sargentii	....++r...r.....+.+.+1......1...........
Paris manshurica	..+..............+......................
Dryopteris crassirhizoma	r.++..+r..r2112r+2+221....+.............
Euonymus maximowicziana	...................++...................
Polystichum subtripteron	..................r11...................
Cerasus sachalinensis	....................+.....+.............
Neomolinia koryoensis	....................+...................
Polystichum braunii	....................r...................
Aegopodium alpestre	....+.++1...........rr..................
Phellodendron amurense	............r.....r..+......1.....21....
Prenanthes tatarinowii	..................+..+..................

Table 6. (cont.)

Plot number	0000000001111111111222222222233333333334 1234567890123456789012345678901234567890
Saussurea subtriangulata	..................+.++..................
Viburnum bureyaeticum	.....+..........+....1..................
Angelica gigas	......................++..+.............
Cimicifuga heracleifolia	......................r+................
Galium kamtschaticum	............r.........++................
Lychnis cognata	......................+.................
Viola albida	.......................1................
Lespedeza tomentella	.......................+................
Betula schmidtii	.......................1................
Patrinia saniculaefolia	........................++..............
Vaccinium koreanum	........................++..............
Acer palmatum	........................1r..............
Viburnum wrightii	.........................+.1............
Abies nephrolepis	3.23..++.+.22.22...........1............
Acer rubripes	.........+............+...21............
Ligularia stenocephala	......................+....+............
Pimpinella brachycarpa	...........................+.1..........
Pseudostellaria palibiniana	......................++..++............
Syringa wolfii	..........................+.............
Angelica anomala	...........................+.......+....
Adenophora triphylla	.....+................++....11........+2
Ampelopsis brevipedunculata	.........................+..3...........
Celastrus orbiculata	....................+.......1...........
Clematis patens	............................1...........
Crataegus pinnatifida	.....r...r..................1.....r.....
Indigofera kirilowii	............................1...........
Iris ensata	............................1...........
Lilium buschianum	............................1..rr...r...
Caulophyllum robustum	...........r1.....++++.......1..........
Epimedium koreanum	............................13..........
Juglans mandshurica	....r.......12....++++.......3..........
Meehania urticifolia	........+.................++.1..........
Rhamnus yoshinoi	............................13..........
Leibnitzia anandria	..............................r....+....
Pulsatilla cernua	..............................r.........
Syneilesis aconitifolia	..............................2++..1....
Trommsdorfia ciliata	..............................2.rr......
Adenophora verticillata	...............................r........
Allium senescens	...............................rr.......
Artemisia laciniata	................................3.......
Artemisia rubripes	.r..............................2.......
Arundinella hirta	..............................3.42....1.
Bupleurum komarovianum	...............................2+.......
Lathyrus quinquenervius	...............................2.r......
Lespedeza tomentosa	...............................r2.......
Silene repens	................................r.......
Sophora flavescens	...............................22.......
Viola patrinii	..............................r.rr......
Gypsophila pacifica	..............................r+2.......
Maianthemum dilatatum	............1r1r....+..........r.3......
Angelica decursiva	.................................r......
Clinopodium chinense	.................................rr.....
Lathyrus komarovii	..........rr....+.+.1+.........2.r1+22..
Lycopus lucidus	.................................r.r....
Lysimachia clethroides	............................1....r......
Valeriana coreana	..............+..+1.++.........r.2......
Campanula glomerata	..................................rr....
Chloranthus japonicus	.............................1....+2r.+.
Cimicifuga dahurica	...................................2....
Paeonia lactiflora	..................................r2....
Serratula coronata	..................................r2....
Festuca pseudosulcata	..................................2.....
Campanula punctata	....++..........+.+..r..............2.+.
Galium platygalium	....................................1...
Rhododendron mucronulatum	........................+...........1..+
Melica nutans	....................................11..
Geranium vlassowianum	..................................rr.1..
Melampyrum setaceum	.....................................1..
Artemisia keiskeana	.......................1....3.3.......+1
Carex lanceolata	.....4111+......+.+..+..++...........133
Dictamnus dasycarpus	..................................1.r...
Doellingeria scabra	..................+....+....31r22212r1..
Lespedeza bicolor	............................1.3+22332423
Iris uniflora	.......+......................2r2rr.1..+
Kitagawia therebintacea	......................................+.
Melampyrum roseum	.......................++...3.r..2.12.++
Potentilla fragarioides	.....+..r.........+.........1.22+.r2r.++
Spodiopogon sibiricus	..............................334223..+1
Bupleurum breviradiatum	....+
Artemisia sacrorum	1
Dendranthema pallasiana	1
Saussurea odontolepis	....+
Adenophora divaricata	......................................++
Quercus mongolica	1r..55.22.2r.r12314.++45453353412r422454
Tilia amurensis	1.+21+1++1222222++1131211112.......22.1.
Acer mono	2r+.3+1.++.22.32+12+12++.+2+.5....r.221.
Pinus koraiensis	4r12.r32.14433242323.+...+.+........r...
Corylus mandshurica	1r3.++++++32223.++..1....+...3......1.+.

Plot number	0000000001111111111222222222233333333334
	1234567890123456789012345678901234567890
Philadelphus tenuifolius	r.1++.+.+.21r222+1+211+......1..........
Acer tegmentosum	r.++..1..+.2r.32.+++++....11............
Maianthemum bifolium	2.1+..1.+2rr...r++1.+1..............r...
Oxalis acetosella	1.11..1.++..+r.r+11111..................
Betula costata	1r+1..11..rr.r22..1141..................
Actinidia kolomikta	rr+...+.r...r.1r.+1111.....+............
Euonymus pauciflora	r.r+1...1+rr...r+.+.+........1......1...
Picea ajanensis	1r33..++++rr.r.2...........1............
Carex campylorhina	.r+.......222+.r..1+1+..............r2..
Carex siderosticta	.r..+++++...r...++1++122+2+211...2.3r1++
Eleutherococcus senticocus	..r.+.+++.212212.++1++.......1..........
Thalictrum filamentosum	..1.....+r3..r12+12122+............r.1..
Schisandra chinensis	..1.1...+...r.1r1+112+....+.13..........
Syringa amurensis	....1++r+...12r.2+++21..................
Neomolinia mandshurica	....+.++++..r..r+1++.+.......1.....r....
Convallaria keiskei	.....r.+..rr...2+.+.+1......11rr2.r311+.
Phryma asiatica	......r+...rr..r+1+.++.......1.....+..+.
Acer pseudosieboldianum	........+.......2++12+3+1+11.5......2...
Viola collina	.r..r+..r......r+........+......r..r..+.
Viola selkirkii	..++..+r+...r...+++1+...+...............
Acer barbinerve	..+1............12+111+..+..............
Lilium distichum	..+.....r...rrr.....++....+.........+rr..
Vitis amurensis	....+.+.+.......+++111.......3....r...+.
Berberis amurensis	....++++++rr....+.+.+......+............
Carex ussuriensis	....1.++11..r..r121.++..................
Artemisia stolonifera	....++.+..........+..+.........r...121r.1
Deutzia amurensis	....+.1+.........++++1.+..+.............
Fraxinus mandshurica	.....r+r....22rr+.r2+5..................
Cacalia hastata	.....r..r..r1rrr...+.............r.2....
Calamagrostis brachytricha	.....+...............132...1.r2...2.2.+
Maackia amurensis	.....r.++.......+++......+.....2.rr.2...
Galium davuricum	............1.rr+++.++..........r....11..
Vicia unijuga	..................+...++....11.322.11.+.
Corylus heterophylla	.........................+1.22222+..1.
Acer ukurunduense	2.11..+..1.21.2....r....................
Populus tremula	r1....+.11.r.....................+r..1...
Cerasus maximowiczii	r.........r...rr.++..+......+...........
Polemonium chinense	r............r.r+...+...................
Calamagrostis langsdorffii	r.......+..+.......................+....
Sorbus amurensis	r.+......1.r............................
Thalictrum tuberiferum	r.++....................................
Atragene ochotensis	r...........r..r........................
Carex nanella	.r...............r.+........3.r332..2...
Sorbaria sorbifolia	.rr.....+..r21r......2..................

Plot number	0000000001111111111222222222233333333334
	1234567890123456789012345678901234567890
Aralia elata	.r.....+...rr...1...rr..................
Aster ageratoides	.r........................1.......r...
Carex reventa	..1.....1.........+.11.............2r21..
Circaea alpina	..2...1..+.r2..1.1r.r...................
Adiantum pedatum	..+.+.++...2..1..+..1...................
Athyrium sinense	..+...........r...++11..................
Cacalia praetermissa	..+...............++1...................
Milium effusum	..+.........r..r........................
Carex pseudosabynensis	..r..................1...........r......
Paris verticillata	..+......r..................++..........
Mitella nuda	..1+..1..3.r2..r.2......................
Trigonotis radicans	..++......rr....++....+..............2....
Anemonoides extremiorientalis	..++...............+....................
Ulmus macrocarpa	....+++.................................
Chrysosplenium pilosum	....r.............++....................
Euonymus alata	.....+..1.......+++..+......11........2.
Rubus crataegifolius	.....+...+..........+.......1r++r.2....
Dioscorea nipponica	.....r.......r...+...........11.....r.r+.
Polygonatum odoratum	.....r..................+....3.rr.r.+...+
Polygonatum involucratum	.....r...........+...........1.....+rr1.
Synurus deltoides	.....+..r...................+.........1rr2....
Vicia baicalensis	.....+++.........+...................r...+.
Moehringia lateriflora	.....r...+......r+...+...............r.....
Rosa davurica	.....r...+..........................2.....
Ulmus laciniata	......+....rr2...++1+1..................
Actaea asiatica	......r...........++..+.+....+...........r...
Scutellaria dentata	......r............+.+++...............r....
Rubia chinensis	......+..............+.+...++............
Bupleurum longiradiatum	.......+++..........+................r.r...
Tilia mandshurica	.......+...2....1..............1.2.......+.
Agrimonia pilosa	........r.....................11.....r....
Thalictrum minus	........r.r....r..............1..r+r.r....
Paeonia obovata	........r.r....1.+......................
Carex drymophila	........11.......11.....................
Actinidia arguta	.........r.......+.+112.....+1..........
Trientalis europaea	.........rrr...r........................
Aruncus dioicus	..........r..r1...+.11.................1.
Pteridium aquilinum	..........r...................1..r.rr+r2+.
Euonymus macroptera	..........r...r...++....................
Hemerocallis middendorffii	..........r.........................r..r..
Waldsteinia ternata	..........r12...+....+..................
Artemisia sylvatica	............r.........+.................2.
Anemonoides umbrosa	............12..+.......................
Carex pallida	.............rr.....+...................

Table 6. (cont.)

Plot number	0000000001111111111222222222233333333334 1234567890123456789012345678901234567890
Lathyrus humilis	................+++..+.+.1...1.1......1.
Carpinus cordata	................125531+..+.2............
Kalopanax septemlobus	................+.++1.+..112.1..........
Sorbus alnifolia	................+.++++12................
Viola acuminata	................+...........11..........
Saussurea grandifolia	................+.......+......+1.......
Betula davurica	.................1............2.1r221+..
Malus baccata	.................+................r...+.
Acer mandshuricum	.................1.+.+..................
Rabdosia excisa	.................++.+..............3r...
Astilbe chinensis	..................+r++.1+..+11..........
Osmundastrum asiaticum	..................+++4.......1..........
Angelica cincta	..................+.r.............r2r...
Pedicularis resupinata	..................r..++.+.++...+.2......
Heracleum dissectum	..................++...............+....
Pleurospermum uralense	..................+.+......+............
Geranium maximowiczii	..................+................2r...
Actinidia polygama	...................2.r...+...1..........
Smilacina hirta	....................++.............+....
Veratrum maackii	......................1..+..1..r22r.....
Tripterygium regelii	......................++++11............
Viola orientalis	......................32...+.......3r..+
Ainsliaea acerifolia	......................21.+12............
Rhododendron schlippenbachii	......................+331.2............
Symplocos chinensis	......................+1+....1..........
Astilbe koreana	......................+..++.............
Disporum smilacinum	......................+..+.+............
Codonopsis lanceolata	.......................+....1......+.r..
Viola rossii	.......................+..+.11..........
Athyrium yokoscense	.......................+++.......r......
Cephalanthera longibracteata	.......................++............r..
Clematis heracleifolia	.......................+....11..........
Fraxinus sieboldiana	.......................+++..............
Cornus controversa	..........................+1+...........
Magnolia sieboldii	..........................1+1...........
Atractylodes ovata	............................3.22+r131r..
Patrinia scabiosifolia	............................1.2232.1...+
Lysimachia davurica	............................1....rrr..+.
Sanguisorba officinalis	............................1..+2rr.....
Galium maximowiczii	............................11...r.r....
Lactuca raddeana	.............................1r..r......
Adenophora pereskiifolia	..............................r1+21+.r.1
Quercus dentata	..............................4334.4....
Vicia amurensis	..............................r...r+1.1.

Plot number	0000000001111111111222222222233333333334 1234567890123456789012345678901234567890
Amphicarpaea japonica	..............................rrr..r....
Artemisia desertorum	..............................r132......
Artemisia gmelinii	..............................2+2..2....
Miscanthus sinensis	..............................r2.3.....3
Poa ochotensis	..............................2r.2.+....
Bistorta manshuriensis	..............................r..r.r....
Dianthus chinensis	..............................rr2.......
Kitagawia eryngiifolia	..............................r.+.1.....
Lespedeza juncea	..............................r.+......1
Tephroseris kirilowii	..............................r+.2......
Hieracium umbellatum	...............................r+rr+....
Poa nemoralis	...............................r..r.rr..
Aster tataricus	...............................+.r...r..
Galium verum	...............................rr..+....
Picris davurica	................................rr.....1

Non-diagnostic species included in one or two relevés: *Acer ginnala* 35: r; *A. triflorum* 23: +, 30: 1; *Achillea asiatica* 34: r; *Aconitum albo-violaceum* 20: +; *A. ciliare* 7: r; *A. jaluense* 23: +; *A. longicassidatum* 23: +; *Actaea erithrocarpa* 3: r; *Adenophora remotifolia* 26: +; *Adonis amurensis* 36: 1; *Allium ochotense* 23: +; *A. sacculiferum* 34: r; *A. strictum* 35: r; *Alnus hirsuta* 22: 1; *Anemonoides amurensis* 1: r, 36: 1; *A. reflexa* 1: r, 16: r; *A. udensis* 4: +, 36: r; *Angelica cartilagino-marginata* 9: r; *A. dahurica* 6: r, 15: r; *A. polymorpha* 30: 1; *Aralia continentalis* 9: r; *Arisaema peninsulae* 26: +; *Artemisia dubia* 32: 1, 36: 2; *Aster maackii* 33: 2, 34: r; *Athyrium multidentatum* 5: r, 7: +; *A. vidalii* 23: +, 27: +; *Atractylodes japonica* 39: 1, 40: 2; *Betula ermanii* 23: 1; *Brachybotrys paridiformis* 5: +, 9: 4; *Calla palustris* 14: r; *Caltha sylvestris* 22: +; *Carex appendiculata* 14: r; *C. breviculmis* 23: +, 24: +; *C. dispalata* 22: 1; *C. humilis* 40: +; *C. longirostrata* 32: r; *C. pilosa* 5: 1, 7: 1; *Carpesium triste* 35: r; *Cerastium pauciflorum* 36: r; *Chamaenerion angustifolium* 2: r; *Chelidonium majus* 16: r; *Chrysosplenium ramosum* 14: r; *Cimicifuga simplex* 29: 1; *Circaea cordata* 17: 1; *Cirsium maackii* 34: r; *C. schantarense* 19: +, 21: +; *C. vlassovianum* 34: r, 38: r; *Clematis fusca* 36: r, 38: r; *C. mandschurica* 35: r; *Climacium dendroides* 7: 1; *Clintonia undensis* 1: r, 4: +; *Cnidium monnieri* 40: +; *Corydalis ambigua* 36: +; *C. ochotensis* 16: r, 19: r; *C. remota* 7: r, 36: +; *Corylus sieboldiana* 23: +, 27: +; *Crataegus maximowiczii* 10: r, 35: r; *Cypripedium calceolus* 37: r, 39: +; *C. guttatum* 34: r; *C. macranthon* 5: r, 38: r; *Deutzia prunifolia* 25: +; *Disporum ovale* 23: +, 29: 1; *D. sessile* 30: 1; *Dontostemon dentatus* 31: r; *Dryopteris goeringiana* 13: 2, 18: +; *Eleutherococcus sessiliflorus* 9: +; *Enemion raddeanum* 3: +, 15: r; *Epipactis papillosa* 5: r, 38: r; *Equisetum pratense* 36: r; *Erigeron acris* 31: r, 35: r; *Erythronium japonicum* 23: +; *Euonymus planipes* 23: +, 27: +; *Eupatorium lindleyanum* 33: +, 34: r; *Euphorbia discolor* 35: r, 36: r; *Filipendula glaberrima* 14: r; *Fragaria orientalis* 9: r, 38: 1; *Galium boreale* 32: r; *Gentiana scabra* 32: r, 34: r; *G. triflora* 9: r, 35: r; *Geranium davuricum* 32: r; *G. eriostemon* 30: 1, 39: +; *G. krameri* 33: +; *G. wilfordii* 17: +; *Glycine soja* 5: +, 6: +; *Gymnocarpium jesoensis* 3: +, 4: +; *Helonopsis orientalis* 26: +; *Hepatica asiatica* 27: +, 28: 1; *Hierochloë glabra* 32: r; *Hololeion maximowiczii* 33: r; *Hosta longipes* 24: +, 25: +; *Huperzia serrata* 1: r; *Hylocomium splendens* 1: 2; *Hypericum ascyron* 6: +, 39: +;

H. attenuatum 38: r; *Inula japonica* 33: r; *Ixeridium gramineum* 32: r; *Kitagawia komarovii* 38: r; *Lactuca triangulata* 10: r; *Larix olgensis* 9: +, 10: +; *Lathyrus davidii* 36: 1, 38: r; *L. vaniotii* 30: 1; *Leontopodium leontopodioides* 32: r, 33: r; *Lespedeza cyrtobotrya* 25: +; *Ligularia schmidtii* 32: 2; *Lindera obtusiloba* 25: +, 26: 2; *Linnaea borealis* 1: 1; *Linum stelleroides* 34: r; *Lonicera maximowiczii* 3: r; *Lupinaster pentaphyllus* 35: r; *Lythrum salicaria* 34: r; *Melandrium album* 34: r, 36: r; *Muhlenbergia japonica* 17: +; *Neottia papilligera* 21: r; *Onoclea sensibilis* 5: r, 40: +; *Oreorchis patens* 38: r; *Orostachys malachophylla* 31: r; *Padus maackii* 2: r; *Panax ginseng* 6: r; *Parasilaus asiaticus* 14: 2; *Paris quadrifolia* 14: r, 15: r; *Parnassia palustris* 34: r; *Phegopteris polypodioides* 10: +; *Phlomoides maximowiczii* 36: +; *Picea koraiensis* 8: r; *Pinus densiflora* 25: 1; *Platanthera freynii* 5: r; *Platycodon grandiflorus* 31: r, 32: r; *Pleurozium schreberi* 1: 3; *Poa pseudopalustris* 18: +, 40: +; *P. ussuriensis* 36: r, 37: 1; *Polygonatum falcatum* 24: +, 25: +; *P. lasianthum* 24: +; *P. quinquefolium* 40: +; *Populus koreana* 10: 1; *P. maximowiczii* 7: 2; *Potentilla freyniana* 23: +, 34: r; *Primula patens* 32: r; *Prunella vulgaris* 35: r; *Pyrola japonica* 17: +, 26: +; *P. renifolia* 1: r; *P. rotundifolia* 21: +; *Rabdosia inflexa* 29: 1, 30: 1; *Ranunculus japonicus* 32: r; *Rhamnus davurica* 6: +, 9: r; *R. ussuriensis* 5: +; *Rhizomatopteris sudetica* 3: r; *Ribes burejense* 9: r; *R. fasciculatum* 27: +; *R. horridum* 16: r; *R. triste* 10: +; *Rodgersia podophylla* 27: 1; *Rubus komarovii* 2: r; *Rumex acetosa* 32: r; *Salix raddeana* 10: +; *Sambucus buergeriana* 10: +; *S. racemosa* 2: r, 8: r; *S. sibirica* 13: 1; *Sapium japonicum* 25: +; *Sasa borealis* 26: 5; *Saussurea amurensis* 38: r; *S. epiphylla* 24: +; *S. gracilis* 23: 1, 29: 1; *S. mandshurica* 6: +, 9: r; *S. nikoensis* 29: 1; *S. pulchella* 32: r, 36: r; *S. triangulata* 39: +; *S. umbrosa* 22: r; *Saxifraga manchuriensis* 19: r; *Scabiosa lachnophylla* 31: r, 33: +; *Securinega suffruticosa* 29: 1; *Senecio argunensis* 32: 1; *Seseli seseloides* 36: r; *Shibateranthis stellata* 36: +; *Silene macrostyla* 40: +; *Siphonostegia chinensis* 31: r; *Smilacina japonica* 23: +, 28: +; *Smilax nipponica* 30: 1; *Spiraea beauverdiana* 1: r; *S. media* 11: r; *S. sericea* 35: r; *Staphylea bumalda* 30: 1; *Stephanandra incisa* 24: +, 26: +; *Styrax obassia* 25: +, 26: +; *Symplocarpus renifolius* 22: 2; *Syneilesis palmata* 24: +, 26: +; *Syringa reticulata* 30: 1; *S. velutina* 28: +; *Taraxacum mongolicum* 2: r, 32: r; *Thalictrum aquilegifolium* 23: +; *Thelypteris glandulif* 30: 1; *Thesium chinense* 31: r; *Toxicodendron trichocarpum* 25: +, 26: +; *Trillium kamtschaticum* 10: r; *Trisetum sibiricum* 21: +; *Urtica laetevirens* 14: r; *Veratrum dahuricum* 21: +; *V. oxysepalum* 14: r; *Veronicastrum sibiricum* 19: +, 35: r; *Vicia amoena* 32: r, 36: r; *V. cracca* 34: r, 35: r; *V. pseudorobus* 35: 1; *V. ramuliflora* 19: +, 21: +; *V. venosa* 16: r, 38: r; *Vincetoxicum acuminatum* 36: 2, 37: r; *Viola diamandiaca* 23: +; *V. hirtipes* 31: r, 32: r; *V. mandshurica* 31: r, 32: r; *V. phalacrocarpa* 6: r, 36: r; *V. variegata* 40: +; *Weigela florida* 24: +, 29: 1; *Yungia denticulata* 6: r.

Pinetalia koraiensis occur exclusively on the mainland, in Korea, Changbai and Sikhote-Alin ranges.

I-A. Tilio amurensis-Pinetalia koraiensis Kim ex Krestov et al. ord. nov. hoc loco

Nomenclatural type: Tilio-Pinion koraiensis Kim ex Krestov et al. (validated in this paper). **Diagnostic taxa:** *Acer tegmentosum*, *Aegopodium alpestre*, *Berberis amurensis*, *Betula costata*, *Carex campylorhina*, *C. ussuriensis*, *Convallaria keiskei*, *Corylus mandshurica*, *Eleutherococcus senticocus*, *Euonymus pauciflora*, *Fraxinus mandshurica*, *Ligustrina amurensis*, *Neomolinia mandshurica*, *Philadelphus tenuifolius*, *Pinus koraiensis*, *Schisandra chinensis*, *Thalictrum filamentosum*, *Ulmus laciniata*, *Viola selkirkii* and *Waldsteinia ternata.* **Synonyms:** Tilietalia amurensis Galkina et Petelin 1990 nom. ined., Schisandro-Pinetalia koraiensis Gumarova 1993 nom. ined.

We validate the order introduced and described by Kim (1992). Tilio-Pinetalia koraiensis includes broadleaved and mixed coniferous-broadleaved vegetation types that developed on the Asian mainland in humid conditions and with a lack of moisture deficits and/or droughts. According to Kim (1992) this order includes two alliances reflecting colder and warmer regional climate. The alliance Jeffersonio-Quercion mongolicae is restricted in distribution to the Changbai area in northeast China and to the south of the Russian Far East and includes mostly disturbed associations.

The Tilio-Pinion koraiensis is distinguished on the basis of a limited data set obtained for the southernmost part of the Russian Far East. This alliance includes ecologically contrasting associations and appears to be ecologically and climatically indefinite. Therefore, the analysis of a geographically complete data set from the territory of the Russian Far East allows us to distinguish four alliances.

I-A-I. Rhododendro daurici-Pinion koraiensis Krestov et al. all. nov. hoc loco
Nomenclatural type: Vaccinio vitis-idaeae-Pinetum koraiensis Krestov et al. (described in this paper). **Diagnostic taxa:** *Carex callitrichos*, *Gymnocarpium dryopteris*, *Orthilia secunda*, *Pyrola minor*, *Rhododendron dauricum*, *Rosa acicularis*, *Vaccinium vitis-idaea*, and *Viola sacchalinensis*.

The alliance represents zonal communities in the northwestern most continental and cold regions of the order range, and azonal communities on drier, well-drained sites in the maritime and submaritime sectors of the cold temperate zone in the northern part of the order distribution range and at higher elevations in the southern part of the order. The alliance includes species poor communities with simple structure, the most important feature of which is the dominance of *Pinus koraiensis* and *Quercus mongolica* in tree layers and a complex of draught and cold-tolerant species that are indicators of nutrient poor soils. In addition to type association, the alliance also includes association Carici callitrichoi-Pinetum koraiensis that occure on warmer sites.

1. Carici callitrichoi-Pinetum koraiensis Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 1 in Tables 5 and 6. **Diagnostic species:** *Carex callitrichos*, *Gymnocarpium dryopteris*, *Polypodium vulgare*, *Rhododendron mucronulatum.* **Diagnostic table:** Electronic appendix, Table 1.

This association is widely distributed in the maritime and subcontinental sectors of the Northern temperate subzone on the dry, nutrient-medium, well drained, and well insolated but cool sites on south-faced, steep slopes near ridges at elevations below 600 m a.s.l. These kind of communities are found in the Sikhote-Alin reserve, and in the Iman, Bikin and Aniuy River basins. The tree layer commonly consists of two strata dominated by *Quercus mongolica* and/or *Pinus koraiensis* depending on the age of dominants. Solitary broadleaved trees of *Acer mono*, *Betula costata* and *Maackia amurensis* may occur in or under the canopy layer. *Pinus koraiensis* saplings are abundant. Shrub layer is poorly developed and includes the solitary *Rhododendron mucronulatum*, *R. dauricum* and *Spiraea ussuriensis*. A cover of herbs usually reaches at last 20–40 %. Most abundant are *Carex callitrichos*, *Chimaphila japonica*, *Orthilia secunda*, *Pyrola japonica. Chelidonium asiaticum*, *Lathyrus humilis*, *Vincetoxicum inamoenum* are common in gaps. The association is characterized by species whose distribution is restricted to the northern part of the Manchurian floristic area and by *Polypodium sibiricum*. This association corresponds to the association group Querceto-Pineta nanocaricosa taigae described in Sukachev's methodology (Krestov 2003).

2. Vaccinio vitis-idaeae-Pinetum koraiensis Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 2 in Tables 5 and 6. **Diagnostic species:** *Orthilia secunda*, *Rosa acicularis*, *Vaccinium vitis-idaea*, *Viola sacchalinensis.* **Diagnostic table:** Electronic appendix, Table 2.

This association occurs in the subcontinental sector of the northern temperate subzone on the dry, nutrient-poor, well drained, and cool but colder than previous association sites, on steep slopes of different aspects near ridges above 500 m a.s.l., on the northern Sikhote-Alin, and at lower elevations north of the Amur River. The tree layer consists of three strata. *Pinus koraiensis*, *Betula costata*, *Quercus mongolica* and occasionally *Picea jezoensis* and *Larix gmelinii* dominate in the upper, *Abies nephrolepis* and *Acer mono* in the middle and *A. ukurunduense* in the lower strata. The shrub layer is sparse and represented by *Euonymus macroptera*, *Rhododendron dauricum*, *Rosa acicularis*, *Spiraea beauverdiana* and *S. media. Vaccinium vitis-idaea* is the most common in the herb layer. Accompanying species are *Carex xyphium*, *Diphasiastrum complanatum*, *Linnaea borealis* and *Orthilia secunda*. This association corresponds to the same association group in Krestov (2003), however, it reflects colder and nutrient-poorer sites. Another description of this association can also be found in Kolesnikov (1938), Dylis & Vypper (1953).

I-A-II. Abieti nephrolepidis-Pinion koraiensis Gumarova ex Krestov et al. all. nov. hoc loco
Nomenclatural type: Diplazio sibirici-Abietetum nephrolepidis Gumarova ex Krestov et al. (validated in this paper). **Diagnostic taxa:** *Abies nephrolepis*, *Acer tegmentosum*, *A. ukurunduense*, *Euonymus macroptera*, *Lonicera maximowiczii*, *Mitella nuda*, *Oxalis acetosella* and *Picea jezoensis*.

We validate the alliance introduced and described by Gumarova (1993). The alliance represents zonal communities in the northern maritime, cool and cold regions of the order range, and azonal communities on well-drained river valleys in the maritime and submaritime sectors of the cold temperate zone in the northern part of the order distribution range and at higher elevations in the southern part of the order. The alliance includes communities, the most important feature of which is the presence of *Picea jezoensis* and *Abies nephrolepis* in tree layers and a complex of moisture-dependent and cold-tolerant species that are indicators of nutrient poor soils.

3. Diplazio sibirici-Abietetum nephrolepidis Gumarova ex Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 3 in Tables 5 and 6. **Diagnostic taxa:** *Adoxa moschatellina, Carex xyphium*, *Diplazium sibiricum*, *Leptorumohra amurensis.* **Diagnostic table:** Gumarova (1993), Tables 3 and 4.

We validate the association introduced and described by Gumarova (1993). This association is the main vegetation type for zonal sites of colder, mesic, well drained sites on gentle and moderately steep (about 20°) slopes in the maritime and sector of the northern temperate subzone. On the northern Sikhote-Alin it occurs at elevations ranging from 100 to 700 m a.s.l. and on slopes with different aspects. In the middle and southern Sikhote-Alin it occupies only the colder locations, such as northern slopes near the upper boundary of the vertical belt of the mixed broadleaved-Korean pine forests. The communities are dominated by *Betula costata*, *Picea jezoensis*, *Pinus koraiensis* and *Tilia amurensis*. Lone trees of *Fraxinus mandshurica* may be present. The second stratum contains the same species as the canopy, with a mix of *Abies nephrolepis* and *Acer mono*. The third stratum, if present, contains lone trees or groups of *Acer tegmentosum* and *A. ukurunduense*. The shrub layer is sparse. Constant representatives are *Actinidia kolomikta*, *Rosa acicularis* and *Philadelphus tenuifolius*. Herb cover is 80–95 %. The dominants are *Dryopteris crassirhizoma*, *D. expansa* and *Leptorumohra amurensis*. A complex of true boreal species, such as *Chamaepericlymenum canadense*, *Linnaea borealis*, *Maianthemum bifolium* and *Oxalis acetosella*, is characteristic of this association. A moss layer of *Hylocomium splendens* and *Pleurozium schreberi* may also be found in the gaps of herb layers.

4. Lycopodio annotini-Abietetum nephrolepidis Gumarova ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 4 in Tables 5 and 6. **Diagnostic taxa:** *Chamaepericlymenum canadense*, *Dryopteris expansa*, *Lycopodium annotinum*, *L. juniperoideum*, *Phegopteris connectilis.* **Diagnostic table:** Gumarova (1993), Tables 5 and 6.

We validate the association introduced and described by Gumarova (1993). This association occupies the same cold and well drained but drier sites as the previous one, and are on moderately steep (above 20°) slopes in the maritime sector of the Northern temperate subzone with the same elevation intervals. In the middle and southern Sikhote-Alin it occupies only the colder locations, such as northern slopes near the upper boundary of the vertical belt of the mixed broadleaved-Korean pine forests. The communities are dominated by *Betula costata*, *Picea jezoensis* and *Pinus koraiensis. Tilia amurensis* and *Quercus mongolica* are more significant than in the previous association. The second stratum contains the same species as the canopy, with a mix of *Abies nephrolepis* and *Acer mono*. The third stratum, if present, contains single trees or groups of *Acer ukurunduense*. The shrub layer is sparse. Constant representatives are *Actinidia kolomikta* and *Rosa acicularis*. Herb cover is 70 %. The dominants are *Dryopteris expansa* and a complex of taiga small herbs. *Chamaepericlymenum canadense*, *Lycopodium annotinum*, *Maianthemum bifolium*, *Oxalis acetosella* and others are characteristic for this association. Somewhat important are also *Pseudocystopteris spinulosa*, *Mitella nuda* and *Waldsteinia ternata*. A moss layer of *Hylocomium splendens* and *Pleurozium schreberi* may also be found in gaps of the herb layer.

2I-A-III. Tilio amurensis-Pinion koraiensis Kim ex Krestov et al. all. nov. hoc loco

Nomenclatural type: Athyrio-Pinetum koraiensis Kim ex Krestov et al. (validated in this paper). **Diagnostic taxa:** *Aegopodium alpestre*, *Carex ussuriensis*, *Deutzia glabrata*, *Fraxinus mandshurica*, *Sorbus amurensis*, *Ulmus macrocarpa*.

We validate the alliance introduced and described by Kim (1992). The alliance unites communities on mesic, nutrient medium and cold sites in the middle part of the cold temperate zone in submaritime sectors mainly on the Changbai massif. They occupy lower slopes of different aspects and are at lower elevations (up to 600 m) in the northern, 600–800 m in the middle and above 800 m in the western Sikhote-Alin and Changbai. As with the previous alliance, this one includes a considerable number of boreal species in the nemoral communities. The communities of this alliance, however, are enriched by such species as *Ribes komarovii*, *Ulmus macrocarpa* that are linked to the interior part of Eastern Asia. At colder sites this alliance is replaced by communities of Abieti nephrolepidis-Piceion jezoensis Song 1992, which represents the warmest communities of Vaccinio-Piceetea Br.-Bl. in Br.-Bl. et al. 1939 (Krestov & Nakamura 2002).

5. Spiraeo ussuriensis-Quercetum mongolicae Kim ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 5 in Tables 5 and 6. **Diagnostic species:** *Asparagus schoberioides*, *Lespedeza bicolor*, *Lychnis fulgens*, *Polygonatum humile*, *Pyrus ussuriensis*, *Sedum aizoon*, *Spiraea ussuriensis*, *Thalictrum contortum.* **Diagnostic table:** Kim (1992), Tables 4 and 5.

We validate the association introduced and described by Kim (1992) for the Maoershan Mts. in northeast China. It represents seral *Quercus mongolica* communities that arose following long-term human impact. This association most likely represents the westernmost reaches of Quercetea mongolicae on the Asian mainland. Kim (1992) described colder and moister 5a, Spiraeo-Quercetum mongolicae aegopodietosum alpestris Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type is same as association) and warmer and drier 5b, Spiraeo-Quercetum mongolicae adenophoretosum tetraphyllae Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 6 in Tables 5 and 6).

6. Athyrio crenati-Pinetum koraiensis Kim ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 7 in Tables 5 and 6. **Diagnostic species:** *Carex callitrichos*, *Dryopteris crassirhizoma*, *Galium mandshuricum*, *Isopyrum raddeanum*, *Pinus koraiensis*, *Ribes mandshuricum*, *Pseudostellaria davidii.* **Diagnostic table:** Kim (1992), Tables 6 and 7.

We validate the association introduced and described by Kim (1992) at the Ryangshu Ecological Station of the Chinese Northeast Forestry University. The association occurs in the Shaoshingangrin Mountains and most of these forests are badly disturbed. It represents typical vegetation of Tilio-Pinetalia koraiensis at the westernmost on its distribution range.

Two subassociations were distinguished. 6a, Athyrio-Pinetum koraiensis rosetosum acicularis Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 8 in Tables 5 and 6) represents dryer and colder sites on steeper slopes. 6b, Athyrio-Pinetum koraiensis athyrietosum multidentati Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type is same as association) occupies warmer fresh and moist sites on moderate and mid-slopes of Changbai Mt.

7. Tilio amurensis-Betuletum platyphyllae Kim ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 9 in Tables 5 and 6. **Diagnostic species:** *Betula platyphylla*, *Daphne koreana*, *Lonicera edulis*, *Patrinia intermedia*, *Ribes komarovii*, *Solidago virgaurea* and *Moehringia lateriflora.* **Diagnostic table:** Kim (1992), Tables 8 and 9.

We validate the association introduced and described by Kim (1992). The association represents secondary mixed forests on the northern macroslope of Mt. Changbai below the elevation of 1150 m a.s.l. and secondary forests in the Sikhote-Alin that arise on mixed broadleaved-*Pinus koraiensis* forests sites following logging. Subassociation 7a, Tilio-Betuletum platyphyllae brachybotrietosum paridiformis Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type is same as association) is restricted to Mt. Changbai only, and subassociation 7b, Tilio-Betuletum platyphyllae abietetosum nephrolepidis Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 10 in Tables 5 and 6) occurs also in the Russian Far East.

I-A-IV. Phrymo asiaticae-Pinion koraiensis Krestov et al. all. nov. hoc loco

Nomenclatural type: Arisaemo amurensi-Pinetum koraiensis Krestov et al. (described in this paper). **Diagnostic taxa:** *Adiantum pedatum*, *Adoxa moschatellina*, *Anemonoides extremiorientalis*, *Aruncus dioicus*, *Paris verticillata*, *Athyrium sinense*, *Carex pallida*, *Circaea alpina*, *Galium davuricum*, *Ligustrina amurensis*, *Lilium distichum*, *Phryma asiatica*, *Scutellaria ussuriensis*, *Sorbaria sorbifolia*, *Trigonotis radicans*.

The alliance occurs on zonal sites in the middle part of the cold temperate zone within maritime and submaritime sectors. Communities are common in the middle Sikhote-Alin at an elevation interval 50–600 m a.s.l. and they also occur north of the Amur River basin near the city Birobidzhan (right across from the mouth of the Songari River in northeast China). The main climatic parameters are a mean annual temperature range from +2 to +4 °C, annual precipitation 700–800 mm and a Kira warmth index over 55 °C. The alliance is characterized by a presence and high significance of mesic mesothermic Manchurian species in all layers of the community.

8. Carici falcatae-Pinetum koraiensis Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 11 in Tables 5 and 6. **Diagnostic species:** *Aconitum volubile*, *Athyrium filix-femina*, *Carex falcata*, *C. planiculmis*, *Ga-*

lium triflorum, *Lonicera chrysantha*, *Osmorhiza aristata*, *Smilacina davurica.* **Diagnostic table:** Electronic appendix, Table 3.

The association occurs on the northern Sikhote-Alin, representing the maritime sector of the northern temperate zone. It occupies zonal sites on gentle, southern slopes of the low mountains in Khor (tributary of Ussuri), Aniuy (tributary of Amur) and Samarga River basins. The association is dominated by *Betula costata*, *Fraxinus mandshurica*, *Pinus koraiensis*, *Quercus mongolica* and *Tilia amurensis*. Lone trees of *Picea jezoensis* are common in the canopy. This species is also represented in saplings. The second stratum contains *Abies nephrolepis* and *Acer mono*. The third stratum includes *Acer ukurunduense* and *A. tegmentosum*. The shrub layer is well developed and represented by synusiae of *Corylus mandshurica*, *Eleutherococcus senticocus*, *Lonicera chrysantha* and *Philadelphus tenuifolius*. Herb cover is 60–80 % of the total site and includes *Carex campylorhina*, *C. falcata*, *Dryopteris crassirhizoma*, *Osmorhiza aristata*, *Thalictrum filamentosum* as dominants and a complex of other species with northern Manchurian distribution. The layer of bryophytes can be fragmentally developed around the stem bases and in the gaps of a herb layer. It includes typical boreal *Hylocomium splendens*, *Pleurozium schreberi* and *Rhytidiadelphus triquetrus* as well as temperate *Pleuroziopsis ruthenica*. The association was described in large by Dylis & Vypper (1953) based on the northern Sikhote-Alin using Sukachev's methodology. Also it partly corresponds to the association group Nemoreto-Piceeto-Pineta herbosa taigae (Krestov 2003).

Two subassociations were distinguished. 8a, Carici falcatae-Pinetum koraiensis typicum Krestov et al. subass. nov. hoc loco (nomenclatural type: same with nomenclatural type of the association) represents dryer and colder sites on the steeper slopes of the northern Sikhote-Alin. 8b, Carici falcatae-Pinetum koraiensis smilacinetosum davuricae Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 12 in Tables 5 and 6, diagnostic table: electronic appendix, Table 4) occupies warmer fresh and moist sites on moderate and mid-slopes of the middle Sikhote- Alin.

9. Ulmo japonicae-Pinetum koraiensis Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 13 in Tables 5 and 6. **Diagnostic species:** *Aconitum sczukinii*, *Carex arnellii*, *C. sordida*, *Matteuccia struthiopteris*, *Menispermum dauricum*, *Padus avium*, *Schizopepon bryoniifolius*, *Ulmus japonica*, *Urtica angustifolia.* **Diagnostic table:** Electronic appendix, Table 5.

This association occurs throughout northern temperate zones on azonal sites usually in the middle parts of the large rivers Iman, Bikin, Khor (tributaries of the Ussuri River), on thick and stable alluvial deposits with well formed deep, nutrient-rich fresh to moist soils. This association represents the most advanced stages of succession on river alluvial deposits. The communities are richest in species composition and have the most complex structure. A canopy layer includes up to ten species of tall trees such as *Betula costata, Fraxinus mandshurica*, *Juglans mandshurica*, *Phellodendron* *amurense*, *Picea koraiensis*, *Pinus koraiensis*, *Quercus mongolica*, *Tilia amurensis*, *T. mandshurica* and *Ulmus japonica*. In the subtree layer, in addition to the above mentioned tree species, the younger individuals of *Abies nephrolepis*, *Acer mono*, *A. tegmentosum*, *Malus baccata*, *Ulmus laciniata* may occur also. The third stratum is also well developed and represented by *Acer ukurunduense*, *Ligustrina amurensis*, *Padus avium*. The shrub layer covers 40–60 % of stand area and includes a variety of nemoral shrubs, such as *Corylus mandshurica*, *Eleutherococcus senticocus*, *Euonymus alata*, *Lonicera chrysantha*, *Philadelphus tenuifolius*, as well as the true valley shrubs *Sorbaria sorbifolia*, *Spiraea salicifolia*, *Swida alba*. The herb layer in this community type covers entire areas of the stand and contains sedges *Carex arnellii*, *C. campylorhina*, *C. egena, C. jaluensis*, *C. pallida* and *C. siderosticta* and representatives of hygrophilic forbs *Asyneuma japonicum*, *Cardamine leucantha*, *Filipendula palmata*, *Urtica angustifolia*, *Veratrum oxysepalum*, and ferns *Athyrium filix-femina, Cornopteris crenulatoserrulata*, *Matteuccia struthiopteris*, *Osmundastrum asiaticum.* Vasiliev (1979) distinguished and best described this association using Sukachev's methodology.

10. Arisaemo amurensi-Pinetum koraiensis Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 14 in Tables 5 and 6. **Diagnostic species:** *Arisaema amurense*, *Cacalia auriculata*, *Cardamine leucantha*, *Cornopteris crenulatoserrulata*, *Equisetum hyemale*, *Filipendula palmata*, *Hylomecon vernalis*, *Impatiens noli-tangere*, *Lamium album*, *Lunathyrium pycnosorum*, *Ribes mandshuricum*, *Rubia cordifolia*, *Stellaria bungeana.* **Diagnostic table:** Electronic appendix, Table 6.

The association occurs throughout the entire northern temperate zone, at an elevation interval of 10–500 m a.s.l., and it occupies gentle slopes or higher river terraces with deep moist and nutrient very rich soils. This association is dominated by *Betula costata*, *Fraxinus mandshurica*, *Juglans mandshurica*, *Phellodendron amurense*, *Pinus koraiensis*, *Tilia amurensis* and *T. mandshurica*. In the subtree layer, in addition to the aforementioned tree species, the younger individuals of *Abies nephrolepis*, *Acer mono* and *Ulmus laciniata* may also occur. The third stratum is also well developed and represented by *Acer tegmentosum* and *A. ukurunduense*. The shrub layer is well developed and dominated by *Eleutherococcus senticocus*, *Euonymus pauciflora*, *Lonicera chrysantha*, *Philadelphus tenuifolius*. The herb layer in this community type covers up to 60–80 % of stand area and is dominated by *Athyrium filix-femina*, *Cardamine leucantha*, *Carex campylorhina*, *Carex pallida*, *Carex sordida*, *Coniogramme intermedia*, *Cornopteris crenulatoserrulata*, *Filipendula palmata* and *Veratrum oxysepalum*. Two subassociations of this association are delineated. 10a, Arisaemo amurensi-Pinetum koraiensis coniogrammetosum intermediae Krestov et al. subass. nov. hoc loco (type relevé 15 in Tables 5 and 6; diagnostic table: electronic appendix, Table 7.). The subassociation represents colder forests in the narrower valleys of the middle and northern Sikhote-

Alin mountain range and occurs somewhat rarely. It is characterized by a presence of *Coniogramme intermedia* and *Galium odoratum*. The subassociation 10b, Arisaemo amurensi-Pinetum koraiensis typicum Krestov et al. subass. nov. hoc loco (nomenclatural type is same with the association) occurs widely throughout the northern and partially in the middle temperate subzones on the sites typical for the association. It includes variant 10b1, typicum of dryer and 10b2, *Veratrum oxysepalum* on wetter sites. This association corresponds to the association group Nemoreto-Pineta grandifilicosa nemoretae (Krestov 2003). It also was described by Dylis & Vypper (1953) and Smagin (1965).

11. Ribesi maximowicziani-Pinetum koraiensis Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 16 in Tables 5 and 6. **Diagnostic species:** *Carex quadriflora*, *Jeffersonia dubia*, *Pseudocystopteris spinulosa*, *Pseudostellaria sylvatica*, *Ribes maximoviczianum.* **Diagnostic table:** Electronic appendix, Table 8.

This association includes communities in the submaritime sector of the northern and middle temperate subzones, on fresh and nutrient medium to rich sites on medium-steep southern slopes. In the northern subzone this association is characterized by warmer, and in the middle subzone by cooler sites. The canopy of this association is dominated by *Pinus koraiensis* and *Quercus mongolica*. Less important species in the canopy are *Betula costata*, *Tilia amurensis*, *T. mandshurica* and *Picea jezoensis*. The same species in combination with *Acer ukurunduense*, *Prunus maximowiczii* occupy the second stratum. The shrub layer is sparse and represented by small groups of *Corylus mandshurica*. Lone shrubs of *Euonymus pauciflora* and *Ribes maximoviczianum* are constantly present. The herb layer is 50 % of stand size. The most abundant are ferns *Dryopteris crassirhizoma* and *Pseudocystopteris spinulosa*, sedges *Carex campylorhina* and *C. reventa* and small forbs *Bupleurum longiradiatum*, *Convallaria keiskei*, *Lathyrus humilis* and *Waldsteinia ternata*. This association varies slightly in floristic composition, depending on the temperature regime. We distinguish two variants. 11a1, typicum occurs across the Middle temperate subzone, and 11a2, *Thalictrum tuberiferum* occupies cooler sites mainly in the northern temperate subzone. Corresponding vegetation type was described in a number of physiognomical vegetation studies (Kolesnikov 1938, Dylis & Vypper 1953, Krestov 2003).

I-A-V. Jeffersonio dubiae-Quercion mongolicae Kim ex Krestov et al. all. nov. hoc loco

Nomenclatural type: Abieti holophyllae-Quercetum mongolicae Kim ex Krestov et al. (validated in this paper). **Diagnostic taxa:** *Abies holophylla, Acer barbinerve*, *A. mandshuricum*, *Carex ussuriensis*, *Carpinus cordata*, *Dryopteris goeringiana* and *Kalopanax septemlobus*.

We validate the alliance introduced and described by Kim (1992). The alliance occurs on the southern spurs of the Sikhote-Alin range, in the Lao-Ye mountain system and on Changbai Mt. (Kim 1992, Qian et al. 2003b, Kolbek et al. 2003a). This alliance is distinguished by a complex of temperate species, whose northern limit is near the 44°N parallel. These are *Abies holophylla*, *Acer mandshuricum*, *A. pseudosieboldianum*, *Carpinus cordata*, *Kalopanax septemlobus*, *Lonicera praeflorens*, *Weigela praecox* and others. Forests in this alliance range are badly disturbed by fire and have been replaced by low productive communities of *Quercus mongolica*. Natural forests of the alliance represent one of the richest species vegetation types in the temperate zone in the world. The alliance was introduced by Kim (1992) based on very limited data set from the southernmost portion of the Russian Far East. The diagnostic combination of this alliance includes climatically and ecologically different species, such as hygric and cold tolerant *Carex drymophila*, *Galium davuricum*, mesic temperate *Anemonoides udensis*, *Cacalia auriculata*, *Polemonium racemosum*, *Thalictrum filamentosum* and xeromesic temperate *Betula davurica*, *Corylus heterophylla, Jeffersonia dubia.*

12. Abieti holophyllae-Quercetum mongolicae Kim ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 17 in Tables 5 and 6. **Diagnostic species:** *Abies holophylla*, *Actinidia arguta*, *Asarum sieboldii*, *Carpinus cordata*, *Lonicera praeflorens*, *Ribes mandshuricum*, *Viburnum sargentii.* **Diagnostic table:** Kim (1992), Tables 10 and 11. **Synonym:** Campanulo punctatae-Quercetum mongolicae Gumarova et al. 1994 nom. ined.

We validate the association introduced and described by Kim (1992). The association occupies slightly dry and fresh, moderately steep slopes in the southernmost Sikhote-Alin spurs (Przevalskiy, Livadiyskiy and Makarovskiy ranges), on the Muraviov-Amurskiy peninsula (Vladivostok suburbs), on the Borisovka plateau and, likely, in the northeast China and North Korea. Distribution of this association is currently restricted to a local area because other sites have burned, giving rise to secondary pure *Quercus mongolica* forests. The canopy, 30–35 m tall, is represented by taller *Abies holophylla* and *Pinus koraiensis* and shorter *Quercus mongolica* trees. The undercanopy tree layer includes, in addition to younger *Abies holophylla* and *Pinus koraiensis*, a variety of low, broadleaved trees such as *Acer mono*, *A. pseudosieboldianum*, *Fraxinus rhynchophylla* and *Sorbus alnifolia* 14–18 m tall. The shrub layer is sparse. *Deutzia amurensis*, *Euonymus alata* and *Philadelphus tenuifolius* are most abundant. The herb layer is well developed. Main species are those of the mesophytic group and include *Carex campylorhina*, *C. lanceolata*, *C. siderosticta*, *Dryopteris crassirhizoma*, *Moehringia lateriflora*, *Pseudocystopteris spinulosa* and others. Three subassociations of this association are delineated. 12a, Abieti holophyllae-Quercetum mongolicae typicum Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type identical to the association) occupies warmer and drier sites on well-insolated southern slopes. 12b, Abieti holophyllae-Quercetum mongolicae aceretosum tegmentosae Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 18 in Tables 5 and 6) occupies wetter lower parts of slopes. 12c, Abieti holophyllae-

Quercetum mongolicae oxalidetosum acetosellae Gumarova et al. ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 19 in Tables 5 and 6) represents communities on colder sites on northern slopes and includes a number of umbrophytic species in the herb layer *Oxalis acetosella*, *Smilacina hirta*, *Lunathyrium pycnosorum*, *Adoxa moschatellina* and others.

13. Polysticho subtripteron-Pinetum koraiensis Gumarova et al. ex Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 20 in Tables 5 and 6. **Diagnostic species:** *Dryopteris crassirhizoma*, *D. expansa*, *Euonymus maximowicziana*, *Polystichum subtripteron*, *Prunus sargentii.* **Diagnostic table:** Gumarova et al. (1994), Tables 7 and 8.

We validate the association introduced and described by Gumarova et al. (1994). The association occupies fresh and moist, moderately sloping sites in the southernmost Sikhote-Alin spurs (Przevalskiy, Livadiyskiy and Makarovskiy ranges), on the Muraviov-Amurskiy peninsula (Vladivostok suburbs), on the Borisovka plateau and, likely, in the northeast China and North Korea. It represents a middle temperate subzone occupying nutrient rich and moist sites on gentle slopes. Distribution of this association is presently restricted to a local area because other sites have burned giving rise to secondary pure *Quercus mongolica* forests. The association has very complex tree layer and rich species composition. The tallest trees, *Abies holophylla* and *Pinus koraiensis,* form a relatively sparse stratum above the main canopy and reach a height of 40–45 m. The main canopy (27–33 m tall) includes, in addition to younger *Abies holophylla* and *Pinus koraiensis*, a variety of such broadleaved trees as *Betula davurica Fraxinus mandshurica*, *Kalopanax septemlobus*, *Quercus mongolica*, *Tilia amurensis*, *T. mandshurica*. The subcanopy stratum includes, in addition to aforementioned trees *Acer mandshuricum*, *A. mono*, *A. tegmentosum*, *Fraxinus rhynchophylla*, *Prunus sargentii* and *Sorbus alnifolia*. The lower stratum is 8–14 m tall and includes *Acer pseudosieboldianum* and *Carpinus cordata*, shorter examples of *Prunus sargentii* and *Sorbus alnifolia*. The shrub layer is well developed. Most abundant are *Acer barbinerve, Corylus mandshurica*, *Philadelphus tenuifolius*. Constant species are *Lonicera praeflorens*, *Spiraea ussuriensis* and *Viburnum sargentii*. Herb development depends on shrub layer density. The main species are *Carex lanceolata*, *Dryopteris crassirhizoma*, *D. goeringiana*, *Polygonatum involucratum*, *Valeriana fauriei*, *Vicia subrotunda* and others.

Two subassociations of this association are distinguished. 13a, Polysticho subtripteron-Pinetum koraiensis caricetosum reventae Gumarova et al. ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 21 in Tables 5 and 6) occupies warmer and drier sites well protected from winds. Physiognomically, it is differentiated by denser tree layer, a high abundance of vines *Actinidia arguta*, *A. kolomikta*, *Celastrus flagellaris*, *Schisandra chinensis*, and the presence of *Carex reventa* and a complex of mesophytic forbs. 13b, Polysticho subtripteron-Pinetum koraiensis typicum Gumarova et al. ex Krestov et al. subass. nov. hoc loco (nomenclatural type: same as the association) represents communities on colder, wetter and nutrient richer sites, without a *Carex reventa* layer and with the presence of a well developed layer of ferns including *Dryopteris crassirhizoma*, *D. goeringiana*, *Polystichum subtripteron* and others.

14. Fraxino mandshurici-Abietetum holophyllae Gumarova et al. ex Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 22 in Tables 5 and 6. **Diagnostic species:** *Aconitum subvillosum*, *Aegopodium alpestre*, *Phellodendron amurense*, *Platanthera tipuloides*, *Polystichum subtripteron*, *Prenanthes tatarinowii*, *Saussurea subtriangulata*, *Viburnum burejaeticum.* **Diagnostic table:** Gumarova et al. (1994), Tables 9 and 10.

We validate the association introduced and described by Gumarova et al. (1994). This association occurs in the southern spurs of the Sikhote-Alin range and is likely in northeast China and North Korea. It represents a middle temperate subzone and occupies nutrient medium to rich and fresh sites on gentle and medium steep slopes. As in the previous association, there is an overcanopy stratum of *Abies holophylla* and *Pinus koraiensis*. The main canopy includes, in addition to younger *Abies holophylla* and *Pinus koraiensis, Fraxinus mandshurica*, *Juglans mandshurica, Kalopanax septemlobus*, *Quercus mongolica*, *Tilia amurensis* and *T. mandshurica*. The subcanopy stratum includes, in addition to aforementioned trees, *Acer mono*, *A. mandshuricum*, *A. tegmentosum*, *Fraxinus rhynchophylla*, *Phellodendron amurense* and *Sorbus alnifolia*. The lower stratum includes *Carpinus cordata*, *Ligustrina amurensis* and lone individuals of *Prunus sargentii* and *Sorbus alnifolia*. The shrub layer is well developed. Most abundant are *Acer barbinerve*, *Eleutherococcus senticocus*, *Philadelphus tenuifolius*. The herb layer is poor to well-developed. The main species are those belonging to the growth form of tall and medium forbs, such as *Aconitum subvillosum*, *Aegopodium alpestre*, *Cacalia hastata*, *Caulophyllum robustum*, *Cimicifuga dahurica*, *Platanthera tipuloides*, *Polystichum subtripteron*, *Prenanthes tatarinowii* and *Saussurea subtriangulata.*

15. *Taxus cuspidata-Carpinus cordata* comm.
Diagnostic species: *Euonymus macroptera, Taxus cuspidata*.

This is a rare plant community. It occurs just at a few locations in the maritime sector of the middle temperate subzone, namely on Petrov Island and at several points of the Pidan Mt. Range on nutrient medium and fresh sites. Local distribution of this community is possibly a result of its low fire tolerance. In its typical insular communities, the tree layer is relatively short and includes somewhat thick trees of *Kalopanax septemlobus*, *Pinus koraiensis* and *Tilia amurensis*. The undercanopy stratum is represented by *Acer pseudosieboldianum*, *Carpinus cordata*, *Prunus sargentii* and *Taxus cuspidata*. A peculiar feature of this association is the presence and high significance of woody vines such as *Actinidia arguta*, *Celastrus orbiculata*, *Schisandra chinensis* and *Vitis amurensis*. The shrub layer is moderately developed. The main species are *Acer barbinerve*, *Corylus mandshurica* and

Euonymus macroptera. The herb layer includes synusiae of small sedges *Carex nanella* and *C. ussuriensis*, and medium forbs, such as *Thalictrum filamentosum*, *Paeonia obovata*, *Vicia venosa*, etc. Perhaps a number of the associations introduced by GALKINA & PETELIN (1990) in the manuscript represent some derivative stages of this association, which was badly transformed by fires on the other islands of the Peter the Great Bay.

I-B. Aceri pseudosieboldiani-Quercetalia mongolicae Song ex Takeda et al. 1994
Diagnostic taxa: *Acer pseudosieboldianum*, *Ainsliaea acerifolia*, *Athyrium yokoscense*, *Hosta longipes*, *Lindera obtusiloba*, *Meehania urticifolia*, *Pyrola japonica*, *Rhododendron schlippenbachii*, *Smilax nipponica*, *Stephanandra incisa*, *Symplocos chinensis*, *Viola rossii* and *Weigela florida.* **Synonyms:** Quercetalia serrato-mongolicae Nakanishi et al. 1983 prov., Rhododendro-Quercetalia mongolicae Kim 1992 nom. ined., Aceri-Quercetalia mongolicae Kim 1988 nom ined., Quercetalia serrato-mongolicae Kim et Yim 1988, Aceri-Quercetalia mongolicae Kim 1989.

The order represents the warmest of the Asian mainland cool temperate deciduous and mixed broadleaved-coniferous forests of the Korean peninsula, and is well known from the literature (SONG 1988, KIM 1990, 1992, TAKEDA et al. 1994, KOLBEK et al. 2003a). Among the features distinguishing this order, the most striking is its very high species diversity. Forests include many species having their natural distribution limit on the southern slope of the Changbai (Paektu) Range. These are *Ainsliaea acerifolia*, *Lindera obtusiloba*, *Magnolia sieboldii*, *Quercus aliena*, *Q. serrata*, *Styrax obassia*, *Tripterygium regelii* and many others. It includes many species common to Japanese Fagetea crenatae (KIM 1992), however, the high significance and frequency of species characteristic of mainland Asia, such as *Artemisia keiskeana*, *A. stolonifera*, *Carex lanceolata*, *Calamagrostis brachytricha*, *Dioscorea nipponica*, *Doellingeria scabra*, *Fraxinus rhynchophylla*, *Melampyrum roseum*, *Rubus crataegifolius*, allows us to consider this order within Quercetea mongolicae.

I-B-I. Rhododendro schlippenbachii-Quercion mongolicae Song ex Takeda et al. 1994
Diagnostic taxa: *Acer tschonoskii* var. *rubripes*, *Angelica gigas*, *Astilbe koreana*, *Fraxinus sieboldiana*, *Ligularia stenocephala*, *Lindera obtusiloba*, *Magnolia sieboldii*, *Pedicularis resupinata* var. *oppositifolia*, *Pimpinella brachycarpa*, *Pinus koraiensis*, *Tilia amurensis*, *Tripterygium regelii*, *Styrax obassia*, *Synurus deltoides*, *Toxicodendron trichocarpum.* **Synonyms:** Lindero-Quercion mongolicae Kim 1992 nomen ined.

The alliance represents the upper montane broadleaved and broadleaved-coniferous forests in South Korea in the elevation range of 1000–1500 m a.s.l. (Mts. Sorak, Odae, Sobaek, Jiri) and in North Korea in the elevation range of 500–1100 m (Mt. Paektu) (KIM 1990). One of the major features of the alliance is the presence of representatives of Tilio-Pinetalia, such as *Dryopteris crassirhizoma*, *Pinus koraiensis*, *Tilia amurensis.* These occur at their southern limits. Despite the presence of cold temperate species, the alliance's species composition is a well-expressed thermophilous type. Five associations within the alliance are observed in published surveys of Korean vegetation.

16. Lychno cognatae-Quercetum mongolicae Kim 1990
Diagnostic species: *Aconitum saxatile*, *Angelica gigas*, *Cimicifuga heracleifolia*, *Galium kamtschaticum*, *Lychnis cognata*, *Pseudostellaria palibiniana.* **Diagnostic table:** Kim (1992), Tables 17 and 18. **Lower syntaxa:** 16a, Lychno cognatae-Quercetum mongolicae disporetosum ovatae Kim ex Krestov et al. subass. nov. hoc loco (North (Kolbek et al. 2003a) and South (Kim 1992) Korea) (nomenclatural type: relevé 23 in Tables 5 and 6), 16b, Lychno-Quercetum mongolicae galietosum kamtschaticum Kim ex Krestov et al. subass. nov. hoc loco (known from South Korea (Kim 1992), but there is an evidence of presence in North Korea) (nomenclatural type: relevé 24 in Tables 5 and 6), and 16c, Lychno-Quercetum mongolicae astilbetosum thunbergii Kolbek et al. 2003 (North Korea).

17. Veronico coreani-Quercetum mongolicae Song et al. 1995
Diagnostic species: *Ajuga spectabilis*, *Cirsium setidens*, *Filipendula glaberrima*, *Heracleum moellendorfii*, *Hosta longipes*, *Lactuca triangulata*, *Lilium tsingtauense*, *Melandrium seoulense*, *Ostericum koreanum*, *Pleuropterus cilinervi*, *Polygonatum lasianthum*, *Rubus oldhamii*, *Veronica rotunda* var. *coreanum*, *Vicia venosa*. Originally Song (1988) proposed Fraxineto-Abietetum koreanae nom. nudum for the coniferous and deciduous forests on Mts. Jiri and Deogyu. But after a comparison of the vegetation of this vegetation zone with the vegetation below the Mt. Sobaeck Song et al. (1995) validly introduced a new syntaxon, Veronico coreanae-Quercetum mongolicae.

18. Vaccinio koreani-Quercetum mongolicae Kim 1990
Diagnostic species: *Patrinia saniculaefolia*, *Vaccinium koreanum*, *Viburnum wrightii.* **Synonyms:** Corylo-Quercetum mongolicae Song 1988 nom. nud. **Diagnostic table:** Kim (1992), Tables 19 and 20. **Lower syntaxa:** 18a, Vaccinio-Quercetum mongolicae hostetosum longipes Kim ex Krestov et al. subass. nov. hoc loco (above 1100 m on Mts. Sobaek, Tokyu and Kaya, southernmost Korea, nomenclatural type: relevé 25 in Tables 5 and 6) and 18b, Vaccinio-Quercetum mongolicae abietetosum holophyllae Kim ex Krestov et al. subass. nov. hoc loco (above 1100 m on Taebaek Mts., eastern Korean peninsula, nomenclatural type: relevé 26 in Tables 5 and 6). Kolbek et al. (2003a) described this association on Mt. Myohyang (North Korea), but with no subassociations.

19. Partenocisso tricuspidati-Fraxinetum rhynchophyllae Kolbek et al. 2003
Diagnostic species: *Aster tataricus*, *Codonopsis pilosula*, *Deutzia glabrata*, *Hedera rhombea*, *Lactuca bungeana*, *Neomolinia japonica*, *Parthenocissus*

tricuspidata, *Rubia hexaphylla*, *Sorbus alnifolia*, *Staphylea bumalda*. The association was described from Mt. Myohyang, North Korea (KOLBEK et al. 2003a). Nearly the same or similar communities occur in the southernmost Russian Far East on rocky steep slopes faced to the sea (KURENTSOVA 1968).

20. Dryopterido crassirhizomae-Quercetum mongolicae Kim ex Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 27 in Tables 5 and 6. **Diagnostic species:** *Abies nephrolepis*, *Acer mandshuricum*, *A. tschonoskii*, *Dryopteris crassirhizoma*, *D. expansa*, *Ligularia stenocephala*, *Paris verticillata*, *Pimpinella brachycarpa*, *Pseudostellaria palibiniana*, *Syringa wolfii.* **Diagnostic table:** KIM (1992), Tables 21 and 22. **Distribution:** Mts. Solak, Chombong, Odae, Tokyu, Chiri (South Korea). **Lower syntaxa:** 20a, Dryopterido-Quercetum lilietosum distichi Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: same with association), 20b, Dryopterido-Quercetum coryletosum thunbergii Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type: relevé 28 in tables 5 and 6).

21. Ainsliaeo acerifoliae-Quercetum mongolicae Song et al. 1999
Diagnostic species: *Ainsliaea acerifolia*, *Athyrium yokoscense*, *Carex okamotoi*, *Rhododendron schlippenbachii*, *Rhododendron mucronulatum.* **Distribution:** Mts. Palgong, Kumo and Hwangak, South Korea, below 1000–1200 m (SONG et al. 1999).

I-B-II. Rhododendro mucronulati-Pinion densiflorae Kim et Yim 1986
Diagnostic taxa: *Festuca ovina*, *Juniperus rigida*, *Lespedeza bicolor*, *Pinus densiflora*, *Rhododendron mucronulatum*, *R. schlipenbachii*, *Vaccinium oldhamii.*

The alliance unites communities dominated by *Pinus densiflora* occurring on the driest sites in the submaritime and maritime sectors of middle temperate zone. Mostly dry conditions are caused by edaphotope with high content of coarse fragments in the soil profile or sandy soils, rapid drainage and a position on steep slopes or ridges. However, some climate features, such as the lack of snow in winter and the following spring and early summer drought, also support dry conditions for *Pinus densiflora* habitats.

22. Festuco ovinae-Pinetum densiflorae Song 1992
Diagnostic species: *Artemisia desertorum*, *Patrinia villosa*, *Pinus densiflora*, *Pyrola japonica*, *Saussurea pulchella*, *Veronica linariaefolia.* **Synonyms:** *Juniperus rigid-Pinus densiflora* comm. **Distribution:** North and South Korea (SONG et al. 1995a), in the Russian Far East this association has its northern limit occurring mostly of steep slopes, ridges, calcareous rocks, sea coast rocks and sand deposits on the western coast of Hanka lake (KRESTOV 2003). Major factor limiting its distribution at present is the intensive frequent fires. **Lower syntaxa:** 22a, Festuco ovinae-Pinetum densiflo-

rae peucedanetosum terebintacei Kolbek et al. 2003 (nomenclatural type is identical to the association) and 22b, Festuco ovinae-Pinetum densiflorae lilietosum parthenenioni Kolbek et al. 2003.

23. Rhododendro mucronulati-Pinetum densiflorae Kim et Yim 1986
Diagnostic species: *Pinus densiflora*, *Rhododendron mucronulatum.* **Distribution:** South Korea, the communities are enriched with southern species, such as *Platycarya strobilacea*, *Quercus acutissima*, *Q. variabilis* and others (Kim & Yim 1986).

I-B-III. Lindero obtusilobae-Quercion mongolicae Kim 1990
Diagnostic species: *Acer pseudosieboldianum*, *Ainsliaea acerifolia*, *Athyrium yokoscense*, *Fraxinus sieboldiana*, *Lindera obtusiloba*, *Pyrola japonica*, *Rhododendron schlippenbachii*, *Smilax nipponica*, *Symplocos chinensis*, *Viola rossii*, *Weigela florida.* **Synonyms:** Aceri-Quercion mongolicae Kim et Yim 1986, Carpinion laxiflorae Kim et Yim 1986, Callicarpo-Quercion serratae Kim 1990, Rhododendro-Quercion mongolicae Kim 1988.

The alliance occurs in the south of the Korean peninsula and represents typical *Quercus mongolica* forests of the Aceri-Quercetalia mongolicae, occupying the lower mountain belt. It is found in North Korea in the foothills of Mt. Kumgang. It includes three suballiances reflecting mainly the moisture gradient in the alliance. Of them, Lindero-Quercenion mongolicae retains the characteristic vegetation features, Callicarpo-Quercenion serratae apears to be transitional between warm temperate vegetation and Carpinenion laxiflorae tschonosckii Kim 1992. Quercenion mongolicae appears to represent the derivative warm temperate vegetation on the northern limit of its distribution and is not characterized in this paper.

I-B-III-A. Lindero obtusilobae-Quercenion mongolicae Kim ex Krestov et al. suball. nov. hoc loco
Nomenclatural type and **diagnostic species** are identical to the alliance. The suballiance represents communities on the well-developed soils.

24. Artemisio keiskeanae-Quercetum mongolicae Kim 1990
Diagnostic species: *Artemisia keiskeana*, *Betula schmidtii*, *Calamagrostis brachytricha*, *Melampyrum roseum*, *Saussurea tanakae*, *Viola orientalis.* **Lower syntaxa:** 24a, Artemisio-Quercetum mongolicae juniperetosum rigidae Kim 1990 (South Korea and regions around Pyongyang and Kaesong (Kolbek et al. (2003a) in North Korea) with variants 24a1, typicum and 24a2, calamagrostietosum arundinacei, 24b, Artemisio-Quercetum mongolicae deutzietosum prunifoliae Kolbek et al. 2003 (Mt. Myohyang, North Korea) and 24c, Artemisio-Quercetum mongolicae stryacetosum obassiae Kolbek et al. 2003 (South Korea and the only location on Mt. Kumgang in North Korea).

25. Saso borealis-Quercetum mongolicae Kim 1990
Diagnostic species: *Heloniopsis orientalis*, *Sasa borealis*, *Styrax obassia*, *Syneilesis palmata.* **Synonyms:** Quercetum variabilis Kim et Yim 1986, Rhododendro-Quercetum mongolicae Kim et Yim 1986. **Distribution:** widely in South Korea (Kim 1992, Kim & Yim 1986), in North Korea only on Mts. Kumgang, Chonma and Sujang (Kolbek et al. 2003a). **Lower syntaxa:** variants 25a1, typicum and 25a2 potentillosum fragarioidis are distinguished by Kolbek et al. (2003a).

26. Synelesio palmatae-Carpinetum laxiflorae Kolbek et al. 2003
Diagnostic species: *Carpinus laxiflora*, *Corylus mandshurica*, *Disporum smilacinum*, *Galium maximowiczii*, *G. triflorum*, *Osmundastrum claytonianum*, *Saussurea alpicola*, *Smilax nipponica*, *Viburnum wrightii.*

27. Lindero obtusilobae-Quercetum mongolicae Song et al. 1995
Diagnostic species: *Artemisia keiskeana*, *Carex humilis*, *Halosciastrum melanotilingia*, *Lindera obtusiloba*, *Patrinia villosa2, Polygonatum falcatum*, *Stephanandra incisa*, *Viola rossi.* **Distribution:** South Korea, in elevation interval 300 to 1200 m (Song et al. 1995). **Lower syntaxa:** 27a, Lindero-Quercetum mongolicae quercetosum serratae Song et al. 1995 and 27b, Lindero-Quercetum mongolicae typicum Song et al. 1995.

I-B-III-B. Callicarpo japonicae-Quercenion serratae Kim 1990
Diagnostic species: *Callicarpa japonica*, *Carpinus laxiflora*, *Celastrus orbiculata*, *Lindera glauca*, *Prunus leveilleana*, *Quercus serrata*, *Stewartia koreana*, *Styrax japonica*, *Viburnum erosum*, *Zelkova serrata*. The suballiance represents communities in the lower elevation in the South Korea, transitional to the Camellietea japonicae (Kim 1990). **Synonyms:** Callicarpo-Quercion serratae Kim 1990, Lespedezo-Quercion serratae Takeda et al. 1994.

28. Staphyleo bumaldae-Quercetum serratae Kim 1990
Diagnostic species: *Lindera erythrocarpa*, *Staphylea bumalda*, *Stephanandra incisa*, *Viola collina.* **Distribution:** southernmost of South Korea (Kim 1990).

29. Meliosmo myrianthae-Quercetum serratae Kim 1990
Diagnostic species: *Callicarpa dichotoma*, *Castanea crenata*, *Cephalotaxus koreana*, *Lindera erythrocarpa*, *L. sericea*, *Meliosma myriantha.* **Distribution:** Mts. Chombong, Odae, Sokri, Chiak, Tokyu, Naejang, Kaeryong, Chogae, Kaji, Kumchong and Chiri in South Korea (Kim 1990).

30. Lespedezo maximowiczii-Quercetum serratae Takeda et al. 1994
Diagnostic species: *Astilbe chinensis*, *Castanea crenata*, *Celtis jessoensis*, *Corylus mandshurica*, *Lespedeza maximowiczii*, *Lonicera monantha*, *Oplismenus undulatifolius*, *Parathelypteris nipponica*, *Philadelphus schrenckii*, *Polygonatum lasyanthum*, *Pseudostellaria palibiniana*, *Rhododendron mucronulatum*, *R. schlippenbachii*, *Sapium japonicum*, *Smilax china*, *Staphylea*

bumalda, *Stephanandra incisa*, *Styrax japonica*, *Viola diamantica*, *Vitis amurensis*, *Weigela florida.*

I-B-III–C. Carpinenion laxiflorae-tschonoskii Kim ex Krestov et al. suball. nov. hoc loco
Nomenclatural type: Carpinetum laxiflorae Kim et Yim 1986. **Diagnostic species:** *Carpinus tschonoskii*, *Lindera erythrocarpa*, *Platycarya strobilace*, *Quercus aliena*, *Styrax japonica*, *Viburnum dilatatum*. The suballiance represents hornbeam forests in the southernmost Korea, transitional to the Camellietea japonicae. **Corresponding names:** Carpinion laxiflorae Kim et Yim 1986. **Synonyms:** Aceri-Quercion mongolicae Kim et Yim 1988, Corno-Zelkovion serratae Kim et Yim 1988.

31. Syneilesio palmatae-Quercetum serratae Song et al. 1999
Diagnostic species: *Atractylodes ovata*, *Rabdosia inflexa*, *Quercus variabilis*, *Spodiopogon sibiricus*, *Syneilesis palmata*, *Vitis amurensis.* **Distribution:** elevation interval 300–1200 m in montane area of South Korea (Song et al. 1999). **Lower syntaxa:** 31a, Syneilesio-Quercetum serratae styracetosum japonicae Song et al. 1999 occurs on wetter sites with the evidence of the deep snow, and 31b, Syneilesio-Quercetum serratae typicum Song et al. 1999 occurs on drier sites.

32. Carpinetum laxiflorae Kim et Yim 1986
Diagnostic species: *Acer pseudosieboldianum* var. *koreanum*, *Alangium platanifolium* var. *macrophyllum*, *Ampelopsis heterophylla*, *Celtis sinensis*, *Galium trachyspermum*, *Torreya nucifera*, *Zelkova serrata.* **Synonyms:** Torreyo-Zelkovetum serratae Kim et Yim 1986, Quercetum variabilis Kim et Yim 1986, Carpinetum tschonoskii Kim et Yim 1986, Corno-Linderetum erythrocarpae Kim et Yim 1988, *Quercus aliena-Carpinus tschonoskii* comm. (Kim & Yim 1986) and *Daphniphyllum macropodium* comm. (Kim & Yim 1986). **Distribution:** lower elevation (350 m a.s.l.), mountain feet along the valleys in montane area of South Korea (Kim & Yim 1988, Kim 1992).

II. Querco mongolicae-Betuletea davuricae Ermakov et Petelin in Ermakov 1997
Diagnostic taxa: *Adenophora pereskiifolia*, *A. sublata*, *Artemisia keiskeana*, *A. stolonifera*, *Betula davurica*, *Calamagrostis brachytricha*, *Campanula cephalotes*, *Carex lanceolata*, *C. nanella*, *Dioscorea nipponica*, *Doellingeria scabra*, *Elymus confusus*, *Fragaria orientalis*, *Fraxinus rhynchophylla*, *Geranium eriostemon*, *Iris uniflora*, *Lilium pensylvanicum*, *Melampyrum roseum*, *Polygonatum odoratum*, *Quercus mongolica*, *Rosa davurica*, *Rubus crataegifolius*, *Spodiopogon sibiricus*, *Synurus deltoides*, *Vicia pseudorobus*. This class includes broadleaved temperate deciduous forests developing in a condition of a shortage of moisture in spring and early summer. Unlike the mesic temperate mixed broadleaved and coniferous-broadleaved forests, xeromesic temperate forests are developed in drier, colder continental conditions. The main tree species are mesothermic *Betula davurica*, *Quercus dentata*, *Q. liaotungensis* and *Q. mongolica*.

Authors of Querco-Betuletea davuricae have substantiated this class by the presence and high significance of the xeromesic Dauro-Manchurian species complex (Ermakov 1997). In continental forests, species from essentially different phytocoenotic groups (oak-grove, meadow-oak-grove, boreal and meadow-steppe) are of great importance. The majority of these species are not true forest plants since they grow in both open forests and meadow, steppe and shrub communities. These micro-mesothermic, meso- and megatrophic, xeromesic and relatively shade intolerant species represent, according to Verkholat & Krylov (1982), an ancient autochthonous nucleus of the flora of East-Asian continental forests. Most of them belong to the Daurian-Manchurian chorological group with its western range limit at the Yablonevy Range (southern Siberia). Some like *Adenophora coronopifolia*, *A. tricuspidata*, *Artemisia integrifolia*, *Polygonatum humile* and *Vicia unijuga* belong to a larger, South-Siberian-Manchurian chorological group. They are disjunctively distributed in the forest-steppe zone of South Siberia and represent here a relict East-Asian moderately thermophilous element.

II-A. Querco mongolicae-Betuletalia davuricae Ermakov 1997
Diagnostic taxa: *Adenophora coronopifolia*, *A. tricuspidata*, *Artemisia integrifolia*, *A. tanacetifolia*, *Aster tataricus*, *Astragalus membranaceus*, *Betula platyphylla*, *Carex amgunensis*, *Chamaenerion angustifolium*, *Elymus confusus*, *E. gmelinii*, *Festuca ovina*, *Galium boreale*, *Lilium pensylvanicum*, *Populus tremula*, *Rosa davurica*, *Rubus saxatilis*, *Saussurea elongata*, *Spiraea media*, *Thalictrum appendiculatum*, *Trifolium lupinaster*, *Vicia amoena*, *V. pseudorobus* and *Viola dactyloides*. The order represents continental and ultracontinental cold temperate dry mixed coniferous-broadleaved (*Betula davurica*, *B. platyphylla*, *Larix gmelinii*, *Pinus sylvestris*) and broadleaved (*Betula davurica*, *B. platyphylla*, *Quercus mongolica*) forests as azonal vegetation types near and on the forest-steppe ecotone in the uppermost part of the Amur River basin and as zonal vegetation type in the middle part of Amur basin (Zea plain). The upper Amur part of the distribution area is characterized by annual temperatures as low as −3 °C and by very low precipitation in a range from 250 to 310 mm. In such conditions the zonal vegetation type on the warmer sites is represented by steppe (Cleistogenetea squarrosae Mirkin et al. 1986), but on the colder sites by boreal associations of Rhytidio rugosi-Laricetea sibiricae K. Korotkov et Ermakov 1999. Communities of Querco mongolicae-Betuletalia davuricae are distributed on the warmest sites at higher elevations with lower day temperatures. The coldness decreases evapotranspiration that compensates for the low atmospheric moisture. Occurring at the edge of temperate forest vegetation, the communities of this order are characterized by Siberian boreal forest and temperate Daurian steppe species.

According to Ermakov (2003), this order includes 3 alliances and 4 suballiances, of which Bistorto viviparae-Betulenion platyphyllae demonstrates strong deviation from temperate vegetation, and its position in the order must be revised with a review of a more extensive data set from the western Dauria.

II-A-I. Kitagawio terebinthaceae-Betulion davuricae Ermakov 1997
Diagnostic taxa: *Achnatherum sibiricum*, *Allium splendens*, *Artemisia gmelinii*, *A. sericea*, *Astragalus membranaceus*, *Bupleurum scorzonerifolium*, *Galium verum*, *Kitagawia terebinthacea*, *Patrinia rupestris*, *Polygonatum odoratum*, *Scorzonera radiata*, *Tephroseris integrifolia*, *Thesium refractum* and *Vicia popovii*. The alliance unites *Betula davurica*, *B. platyphylla* and *Quercus mongolica* communities in the ecotone between forest and Dauro-Manchurian steppe vegetation in the ultracontinental sector of the northern part of cold temperate zone. The alliance is characterized by a complex of mesoxeric species common to the steppe communities of Cleistogenetea squarrosae. In the upper part of the Amur River basin they occur on the warmer parts of slopes in the elevation range of 600–1100 m a.s.l. The alliance includes warmer Paeonio lactiflorae-Betulenion davuricae and colder Calamagrosto epigei-Pinenion sylvestris suballiances.

II-A-I-A. Paeonio lactiflorae-Betulenion davuricae Ermakov 1997
The suballiance includes *Betula davurica*, *B. platyphylla* and *Quercus mongolica* forests of the warmer, east Daurian regions in the basins of Argun River and in the middle part of Amur River basin (Ermakov 2003). It is characterized by the species complex of the alliance and includes three associations.

33. Artemisio desertori-Betuletum davuricae Ermakov 1997 corr. hoc loco
Diagnostic species: *Adenophora gmelinii*, *Bupleurum sibiricum*, *Carex obtusata*, *Cerastium arvense*, *Cotoneaster melanocarpus*, *Dianthus versicolor*, *Eremogone juncea*, *Euphorbia fischeriana*, *Filifolium sibiricum*, *Hylotelephium triphyllum*, *Iris humilis*, *Koeleria cristata*, *Lespedeza juncea*, *Phlojodicarpus sibiricus*, *Poa transbaicalica*, *Potentilla tanacetifolia*, *Saposhnikovia divaricata*, *Silene jeniseensis*, *Spiraea dahurica*, *Spiraea pubescens*, *Stemmacantha uniflora*, *Thalictrum petaloideum*, *Thesium refractum*, *Viola dissecta*, *Youngia tenuifolia.* The association occupies the drier sites of southern slopes at elevations of 800–1000 m a.s.l. in the ultracontinental sector of northern temperate subzone in eastern Dauria that come in contact with the meadow-steppe communities (Ermakov 2003). Similar communities are known from the western coast of Lake Hanka.

34. Geranio davuricae-Betuletum davuricae Ermakov 1997
Diagnostic species: *Anemonastrum crinitum*, *Geranium davuricum*, *Heteropappus bienis*, *Malaxis monophyllos*, *Pyrola rotundifolia*, *Valeriana alternifolia.* The association occupies moderately dry cool sites on the northerly slopes in the elevation range 850–900 m a.s.l. in the basin of Argun river in the Eastern Dauria (Ermakov 2003).

35. Carici vanheurckii-Betuletum davuricae Ermakov et Petelin in Ermakov 1997
Diagnostic species: *Artemisia commutata*, *Calystegia inflata*, *Carex supermascula*, *C. vanheurckii*, *Dianthus chinensis*, *Euphorbia discolor*, *Geranium orientale*, *Lilium pumilum.* The association occupies warmer fresh sites on the steep southerly slopes in the elevation range 250–200 m a.s.l. in the eastern part of Tukuringra-Dzhagdy range in the submaritime sector of northernmost of cool temperate zone (ERMAKOV 2003).

II-A-I-B. Calamagrosto epigei-Pinenion sylvestris Ermakov in Ermakov et al. 2000
The suballiance includes *Betula platyphylla* and *Pinus sylvestris* forests of colder and more continental western Daurian regions in the basins of Ingoda, Onon and Selenga (only eastern part of basin) Rivers. It is characterized by cold tolerant taiga species *Astragalus adsurgens*, *Calamagrostis epigeios*, *Cypripedium guttatum*, *Elymus sibiricus*, *Pinus sylvestris*, *Poa sibirica*, *Rhododendron dauricum*, *Vicia amoena*. The suballiance includes three associations and two subassociations.

36. Galatello davuricae-Betuletum platyphyllae Ermakov in Ermakov et al. 2000
Diagnostic species: *Allium anisopodium*, *Galatella dahurica*, *Poa urssulensis*, *Salix abscondita*, *S. pseudopentandra*, *Veratrum nigrum.* The association occupies sandy sites on northern slopes in the elevation range 800–900 m a.s.l., near the upper part of the forest-steppe belt in the southern and southwestern part of Dauria in the ultracontinental sector of northernmost of cool temperate zone (ERMAKOV 2003).

37. Oxytropido myriophyllae-Pinetum sylvestris Ermakov in Ermakov et al. 2000
Diagnostic species: *Helictotrichon schellianum*, *Oxytropis myriophylla*, *Pulsatilla turchaninovii*, *Scabiosa comosa.* Small massifs of xeromesic *Betula platyphylla-Pinus sylvestris* forests occupy drier sites with nutrient-poor soils on the southern slopes in the elevation range of 600–700 m a.s.l. in the southern Dauria (Ermann range) in the ultracontinental sector of northernmost of cool temperate zone (ERMAKOV 2003).

38. Bromopsido pumpellianae-Pinetum sylvestris Ermakov in Ermakov et al. 2000
Diagnostic species: *Aconitum barbatum*, *Bromopsis pumpelliana*, *Calamagrostis korotkyi*, *Geranium pseudosibiricum*, *Pyrola chlorantha*, *Viola arenaria.* Moderately moist *Betula platyphylla-Pinus sylvestris* forests occupy zonal sites of the hemiboreal (ERMAKOV 2003) zone in Western Dauria on Yabloneviy, Malakhovskiy, Daurskiy and Tsagan-Daban mountain ranges and Hentei highlands (ERMAKOV 2003). **Lower syntaxa:** 38a, Bromopsido pumpellianae-Pinetum sylvestris typicum Ermakov in Ermakov et al. 2000, 38b, Bromopsido pumpellianae-Pinetum sylvestris potentilletosum longifoliae Ermakov in Ermakov et al. 2000, on

drier and nutrient richer sites and 38c, Bromopsido pumpellianae-Pinetum sylvestris vaccinietosum vitis-idaeae Ermakov in Ermakov et al. 2000 corr. hoc loco, on drier and nutrient poorer sites.

II-A-II. Ligulario fischeri-Betulion davuricae Ermakov et Petelin in Ermakov 1997
Diagnostic taxa: *Angelica czernaevia*, *Carex pallida*, *Cimicifuga simplex*, *C. dahurica*, *Equisetum pratense*, *Ligularia fischeri*, *Moehringia lateriflora*, *Polemonium racemosum*, *Pyrola incarnata*, *Rosa davurica*, *Sorbaria sorbifolia*, *Thalictrum contortum*. The alliance occurs on cold humid sites with nonfreezing megatrophic and mesotrophic soils in the continental sector of the northernmost strip of the cold temperate zone. These are *Betula davurica* and *B. platyphylla* forests with a mix of *Larix gmelinii*, *Populus tremula*, *Quercus mongolica* occurring on convex gentle slopes as well as on river terraces at elevations of 600–1100 m. During dry spring and early summer seasons these habitats remain moister, but are colder in comparison with zonal periodically dry ecotopes. The combination of mesic mesothermic and cryo-tolerant species is typical of the floristic composition of these forests. According to Ermakov (2003) the alliance includes two suballiances. However, a comparative analysis of species composition showed that only Convallario keiskei-Betulenion davuricae may be characterized as temperate vegetation. The syntaxonomical position of Bistorto viviparae-Betulenion platyphyllae can be attributed to the boreal class by using bigger dataset from this and relevant vegetation types.

39. Veronicastro sibirici-Betuletum davuricae Ermakov 1997 corr. hoc loco
Diagnostic species: *Melica turczaninowiana*, *Serratula manshurica*, *Veronicastrum sibiricum*, *Viola brachysepala*, *Viola collina.* Old growth *Betula davurica-Betula platyphylla* forests are widely distributed on plans and southerly gentle slopes in the elevation range 1000–1200 m on warmer fresh and moist well drained sites with well developed clayey soils in eastern Dauria (Ermakov 1997).

40. Geranio vlassoviani-Laricetum gmelinii Ermakov 1997
Diagnostic species: *Gentiana triflora*, *Iris sanguinea*, *Ribes nigrum*, *Saussurea purpurata*, *Trientalis europaea*, *Veratrum lobelianum. Larix gmelinii* dominated forests with *Betula davurica* and *B.platyphylla* occur on fresh and moderately cool northerly gentle slopes faced to the narrow river valleys in the elevation range 800–850 m in eastern Dauria (Argun river basin) (Ermakov 2003).

41. Aquilegio parviflorae-Quercetum mongolicae Ermakov et Petelin in Ermakov 1997
Diagnostic species: *Aquilegia parviflora*, *Calamagrostis sugawarae*, *Gymnadenia conopsea*, *Helictotrichon dahuricum*, *Saussurea recurvata.* The association represents rare communities at the northeastern extreme of the range of *Quercus mongolica*. It occurs on convex southern slopes with well-

developed fresh soils in the eastern part of Tukuringra range at elevations of 250–350 m a.s.l. (ERMAKOV 2003).

II-B. Lespedezo bicoloris-Quercetalia mongolicae Krestov et al. ord. nov. hoc loco

Nomenclatural type: Dictamno dasicarpi-Quercion mongolicae Kim ex Krestov et al. (described in this paper). **Diagnostic taxa:** *Artemisia desertorum*, *A. gmelinii*, *Atractylodes ovata*, *Corylus heterophylla*, *Galium maximowiczii*, *Hieracium umbellatum*, *Lactuca raddeana*, *Lespedeza bicolor*, *Lysimachia davurica*, *Patrinia scabiosifolia*, *Poa ochotensis*, *Potentilla fragarioides*, *Pteridium aquilinum*, *Quercus dentata*, *Sanguisorba officinalis*, *Synurus deltoides*, *Veratrum maackii*, *Vicia unijuga*, *Viola orientalis*.

The order represents widely distributed seral, post fire and fire supported low productivity *Quercus mongolica* forests that are even in structure and species composition. These forests are distributed in the Russian Far East, northeast China (QIAN et al. 2003b) and on Korean peninsula (KIM 1990, 1992, SONG et al. 1999, KOLBEK et al. 2003a). The order is characterized by a drought and fire-tolerant species complex that originated from tertiary forest flora and that integrated into a complex in the Late Pleistocene Maximum, an aridization period in the region (VASILIEV 1958).

Most of the order's range lies in northeastern China, reaching northeastern Mongolia in the west and the coast of the Sea of Japan in the Russian Far East in the east. In Russia it appears in the upper Amur River basin, called Dauria, and in the basin of Lake Hanka, and in the lower elevations of the southern and middle Sikhote-Alin Range (KRESTOV 2003). These areas have been strongly influenced by human activity for many centuries, which partly explains the current state of vegetation in the area. Modern vegetation cover contains meadows, shrubs and forests in nearly equal proportions. Most meadows and some wetlands were transformed into agricultural lands. The basic forest type is Mongolian oak (*Quercus mongolica*) that form pure stands or mix with *Betula davurica*. All forest community components are drought tolerant and fire resistant. Fire is the most important factor influencing natural selection in the oak forests. Meadows in the zone occur on sunny, well-drained slopes (steppe-like meadows) and in lowlands next to wetland vegetation. The characteristic feature of the meadows is the presence of xeric and xeromesic herbs and grasses (*Arundinella hirta*, *Cleistogenes kitagawae*, *Stipa baicalensis*, different species of *Allium*, *Artemisia*, *Astragalus*, *Galium*, *Scabiosa*, etc.). Mesic and hygric meadows dominated by *Calamagrostis langsdorffii* and *Miscanthus sinensis* occur in lowlands. *Pinus densiflora* (near Lake Hanka), *P. sylvestris* (in the upper Amur), *Armeniaca sibirica* and *Ulmus macrocarpa* form small, patchy stands on hill slopes and ridges.

II-B-I. Corylo heterophyllae-Quercion mongolicae Krestov et al. all. nov. hoc loco

Nomenclatural type: Licopi lucidi-Quercetum mongolicae Krestov et al. (described in this paper). **Diagnostic taxa:** *Artemisia desertorum*, *Ca-*

rex nanella, *Corylus heterophylla*, *Codonopsis lanceolata*, *Kitagawia eryngiifolia*, *Miscanthus sinensis*, *Poa ochotensis*, *Polygonatum odoratum*, *Potentilla freyniana*, *Spodiopogon sibiricus*, *Veratrum maackii.*

The alliance includes the drier and the warmer parts of the order's distribution area that occurs mainly in northeast China. In the Russian Far East this alliance represents warm and dry vegetation to the west of Lake Hanka and down to the Razdolnaya (Suifen) River and in the far south of the Russian Far East in the Tumen river basin. The communities include many species that occur near the northern limit of their distribution range, such as *Armeniaca mandshurica*, *Betula schmidtii*, *Epimedium koreanum*, *Pinus densiflora*, *Quercus dentata* and others. The alliance's area coincides with the regions of ancient civilizations. It shows evidence of ancient agriculture, especially in China and near Lake Hanka. The only remaning natural stands occur in Russia near the Russian-Chinese boundary.

42. Indigofero kirilowii-Quercetum mongolicae Ban, Takeda, Song, Nakagawa et Tan in Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 29 in Tables 5 and 6. **Diagnostic species:** *Adenophora triphylla*, *Ampelopsis brevipedunculata*, *Celastrus orbiculata*, *Clematis patens*, *Crataegus pinnatifida*, *Dendranthema indicum*, *Indigofera kirilowii*, *Iris ensata*, *Lilium buschianum*, *Pseudostellaria heterophylla.* **Diagnostic table:** Electronic appendix, Table 9.

This association occupies drier habitats in Liaodong peninsula, Liaonin, northeast China. It occurs on sites with a well expressed dry period in the growing season. The tree layer is relatively short (6–8 m) and includes one stratum dominated by *Quercus mongolica*. Lone species are *Betula davurica*, *Crataegus pinnatifida*, *Armeniaca mandshurica* and *Fraxinus rhynchophylla*. The shrub layer is sparse and contains lone shrubs of *Rhododendron mucronulatum* and *Lespedeza bicolor*. The herb layer covers only 20–30 % of stand area. It is represented by a complex of drier oak forest species: *Adenophora triphylla*, *Ampelopsis brevipedunculata*, *Celastrus orbiculata*, *Clematis patens*, *Dendranthema indicum*, *Indigofera kirilowii*, *Pseudostellaria heterophylla.*

43. Meehani urticifoliae-Quercetum mongolicae Ban, Takeda, Song, Nakagawa et Tan in Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 30 in Tables 5 and 6. **Diagnostic species:** *Actinidia polygama*, *Caulophyllum robustum*, *Epimedium koreanum*, *Juglans mandshurica*, *Meehania urticifolia*, *Rhamnus yoshinoi*, *Viola chaerophylloides.* **Diagnostic table:** Electronic appendix, Table 10.

This association occupies fresh and nutrient rich habitats in Liaodong peninsula, Liaonin and northeast China. The tree layer, 10–15 m high, includes one or more strata dominated by *Quercus mongolica* and *Q. aliena,* with a mix of *Acer mono*, *Fraxinus rhynchophylla*, *Juglans mandshurica*, *Kalopanax septemlobus*, *Tilia amurensis* and *T. mandshurica*. The shrub layer is well developed. It includes synusiae of *Acer pseudosieboldianum*, *Corylus mandshurica*, *Rhamnus yoshinoi* and lone shrubs of *Alangium platanifolium, Eleutherococcus senticocus*, *Euonymus alatus*, *Securinega suffru-*

ticosa and *Weigela florida*. The herb layer covers 50–60 % of stand area. It is generally represented by a complex of species, typical for the oak forests of *Corylo heterophyllae-Quercion mongolicae* (Table 4), with a mix of indicators of cold, fresh and moist conditions: *Caulophyllum robustum*, *Eleutherococcus senticocus*, *Neomolinia mandshurica*, *Phryma asiatica*, *Schisandra chinensis*, *Veratrum grandiflorum* and *Viola selkirkii,* characteristic for Tilio-Pinetalia; and indicators of warmer fresh and moist conditions: *Acer pseudosieboldianum*, *Ainsliaea acerifolia*, *Athyrium yokoscense*, *Smilax nipponica*, *Symplocos chinensis* and *Weigela florida*, characteristic for Aceri-Quercetalia mongolicae.

44. Gypsophyllo pacificae-Quercetum mongolicae Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 31 in Tables 5 and 6. **Diagnostic species:** *Leibnitzia anandria*, *Pulsatilla cernua*, *Syneilesis aconitifolia*, *Trommsdorffia ciliata.* **Diagnostic table:** Electronic appendix, Table 11.

This association occupies the driest regions of western Primorye (Russian Far East) and is likely to have its main range on the adjacent Chinese territory (Jilin and Heilungjian provinces). It occurs on sites with a well-expressed dry period in growing season. The tree layer is relatively short (10–15 m) and includes one stratum dominated by *Quercus dentata* and *Q. mongolica* with a mix of *Betula davurica* and *Fraxinus rhynchophylla*. Tree layer condition depends on the area's fire regime. The better sprouting ability of *Quercus dentata* leads to this species domination in areas with often fires. However, the higher drought tolerance of *Q. mongolica* leads to domination of this species in fire free territories. The shrub layer is sparse and contains lone shrubs of *Rhododendron mucronulatum* and *Lespedeza bicolor.* The herb layer covers only 20–30 % of stand area and is represented by a complex of drier oak forest species: *Gentiana scabra*, *Gypsophila pacifica*, *Hieracium virosum*, *Leibnitzia anandria*, *Platycodon grandiflorus*, *Pulsatilla cernua*, *Syneilesis aconitifolia*, *Thesium chinense*, *Trommsdorffia ciliata*, *Vicia subrotunda* and *Viola mandshurica*. The site conditions of this association appear to be suitable for *Pinus densiflora*, but there are no findings of this species in our data. The lack of *P. densiflora* is explained by the impact of frequent fires.

45. Sophoro flavescentis-Quercetum mongolicae Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 32 in Tables 5 and 6. **Diagnostic species:** *Adenophora verticillata*, *Allium senescens*, *Artemisia laciniata*, *A. rubripes*, *Arundinella hirta*, *Bupleurum komarovianum*, *Geranium sieboldii*, *Lathyrus quinquenervius*, *Lespedeza tomentosa*, *Polygonatum humile*, *Saussurea ussuriensis*, *Silene repens*, *Sophora flavescens*, *Viola patrinii.* **Diagnostic table:** Electronic appendix, Table 12.

The association is distributed in the lowlands of the southern part of Primorye region (Russian Far East), near the Lake Hanka and along the seacoast. Communities occur at moderately dry to fresh sites with a fire history. The single-stratum 15–18-m tree layer is dominated by *Quercus* *mongolica* with a mix of *Betula davurica* and *Tilia mandshurica*. The shrub layer is dominated mainly by *Corylus heterophylla* and *Lespedeza bicolor*. The herb layer is represented by a complex of oak forest forbs, such as *Adenophora pereskiifolia*, *Artemisia desertorum*, *A. gmelinii*, *Atractylodes ovata*, *Galium maximowiczii*, *Hieracium umbellatum*, *Iris uniflora*, *Lactuca raddeana*, *Lysimachia davurica*, *Patrinia scabiosifolia*, *Poa ochotensis*, *Potentilla fragarioides*, *Pteridium aquilinum*, *Sanguisorba officinalis*, *Sedum aizoon*, *Synurus deltoides*, *Veratrum maackii* and *Vicia unijuga*. The drier conditions are reflected by *Adenophora verticillata*, *Allium senescens*, *Artemisia laciniata*, *Arundinella hirta*, *Bupleurum komarovianum*, *Geranium sieboldii*, *Lathyrus quinquenervius*, *Lespedeza tomentosa*, *Polygonatum humile*, *Saussurea ussuriensis*, *Silene repens* and *Sophora flavescens*. Deep fire transformation resulted in the selection of fire-tolerant species that make up the oak forest floristic complex. Site ecological conditions potentially should favor to more mesic vegetation type. An invasion of mesic species, such as *Acer mono*, *Pinus koraiensis*, *Tilia amurensis*, has taken place where fires were not recurring during 8–10 years. We distinguished two subassociations: 44a, Sophoro flavescentis-Quercetum mongolicae typicum Krestov et al. subass. nov. hoc loco (nomenclatural type is same with the association) occupies wetter, and 44b, Sophoro flavescentis-Quercetum mongolicae arundinelletosum hirtae Krestov et al. subass. nov. hoc loco (nomenclatural type is relevé 33 in Tables 5 and 6, diagnostic table: electronic appendix, Table 13) occupies dryer well insolated sites.

46. Lycopo lucidi-Quercetum mongolicae Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 34 in Tables 5 and 6. **Diagnostic species:** *Maianthemum dilatatum*, *Angelica decursiva*, *Clinopodium chinense*, *Lathyrus komarovii*, *Lycopus lucidus*, *Lysimachia clethroides*, *Valeriana fauriei.* **Diagnostic table:** Electronic appendix, Table 14.

This association occurs on zonal sites in the oak forests belt in Primorye at altitudes that range from 10 to 500 m a.s.l. in the Sikhote-Alin mountain range in the maritime sector of the middle (cool) and northern (cold) temperate zone. It represents a core part of the secondary oak forests in the Russian Far East. The tree layer is dominated by *Quercus mongolica*. A less important but stable component is *Betula davurica*. Strata are not well expressed and the presence of *Maackia amurensis*, *Salix caprea*, *Ulmus japonica* is characteristic for the association. The shrub layer is poorly to well developed and represented by *Corylus heterophylla* and *Lespedeza bicolor*. The herb layer is dense and covers 80–90%. A fire tolerant, oak forest floristic core is characteristic. The mesic conditions of the sites are reflected by *Angelica decursiva*, *Clinopodium chinense*, *Kitagawia terebinthacea*, *Lathyrus komarovii*, *Lycopus lucidus*, *Lysimachia clethroides*, *Maianthemum dilatatum* and *Valeriana fauriei*. We distinguished three variants. Variant *Pedicularis spicata* characterized by *Anemonoides udensis*, *Cypripedium guttatum*, *Gentiana scabra*, *Pedicularis spicata*, *Ranunculus japonicus* and

Vicia cracca represents wetter and colder conditions usually on the sites with less frequent fires. Variant *Bistorta manshuriensis* (*Geranium eriostemon*, *Bistorta manshuriensis*) is characteristic of wetter and warmer site conditions and the variant typicum occupies mesic sloppy sites. As with the previous association, stopping fire drives the succession toward the formation of mixed forest stands with mesic nemoral shrubs and trees.

II-B-II. Dictamno dasycarpi-Quercion mongolicae Kim ex Krestov et al. all. nov. hoc loco

Diagnostic species: *Angelica cincta*, *Bupleurum longiradiatum*, *Carex reventa*, *Dictamnus dasycarpus*, *Fragaria orientalis*, *Geranium maximowiczii*, *Hemerocallis middendorffii*, *Lathyrus humilis*, *Polygonatum involucratum*, *Vicia amurensis*, *Vincetoxicum acuminatum*.

The alliance represents secondary *Quercus mongolica* forests of the Sikhote-Alin and along the middle part Amur River basin. Most of the associations have replaced the mixed broadleaved-coniferous forests belonging to Quercetea mongolicae because of the deep transformation of site conditions by frequent fires. Diagnostic species of this alliance include fire and drought tolerant mesic and xeromesic East Asian forest species well adapted to survive a drought period; these appeared in fire-degraded soils condition that have rapid drainage.

The alliance Lespedezo-Quercion mongolicae Gumarova et al. ex Ermakov 2003 for the same vegetation must be rejected, because the association Artemisio keiskeanae-Quercetum mongolicae Gumarova et al. ex Ermakov chosen by Ermakov (2003) as a nomenclatural type of the alliance is the later homonym of the association Artemisio keiskeanae-Quercetum mongolicae Kim 1990.

47. Campanulo glomeratae-Quercetum mongolicae Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 35 in Tables 5 and 6. **Diagnostic species:** *Aconitum kirinense*, *Campanula glomerata*, *Chloranthus japonicus*, *Cimicifuga dahurica*, *Paeonia lactiflora*, *Serratula manshurica*, *Veratrum ussuriense.* **Diagnostic table:** Electronic appendix, Table 15.

This association occupies warmer sites with a short period of seasonal moisture deficit and with nutrient richer soils in the middle temperate zone. The communities are found on the southern spurs of the Sikhote-Alin mountain range at elevations from 10 to 400 m a.s.l. and on the western shore of Lake Hanka. Tree layer structure is simple. Main dominants are *Betula davurica* and *Quercus mongolica*. Stable components of the undercanopy strata are *Acer mono*, *Maackia amurensis* and *Ulmus japonica*. The shrub layer contains *Lespedeza bicolor* and, rarely, *Rosa davurica*. The herb layer is dense. It usually covers up to 90 % of stand area. The herb layer's dominants are species from the oak forest floristic complex. Warmer and nutrient richer site conditions are indicated by *Aconitum kirinense, Campanula glomerata*, *Chloranthus japonicus*, *Cimicifuga dahurica*, *Paeonia lactiflora*, *Serratula manshurica* and *Veratrum ussuriense*. Two subassociations were distinguished. 46a, Campanulo glomeratae-Quercetum mongolicae typicum (nomenclatural type is the same for association), characterized by the association's diagnostic complex, occurs across the range of association, while the 46b, Campanulo glomeratae-Quercetum mongolicae lathyretosum davidii (nomenclatural type relevé 36 in Tables 5 and 6; diagnostic table: electronic appendix, Table 16) is characterized by *Artemisia umbrosa*, *Carex longirostrata*, *Clematis mandschurica*, *Lathyrus davidii*, *Rabdosia glaucocalyx*, *Saussurea pulchella*, *Seseli seseloides*, *Veronicastrum sibiricum* and *Viola brachyceras* and occurs on somewhat warmer and drier sites in the south of association's range. Variant *Clematis mandshurica* occurs on drier and variant *Saussurea pulchella* on wetter sites. As in the previous association, the end of fire impact led to the the formation of mixed forest stands with mesic nemoral shrubs and trees.

48. Melico nutansi-Quercetum mongolicae Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 37 in Tables 5 and 6. **Diagnostic species:** *Campanula punctata*, *Galium platygalium*, *Melica nutans.* **Diagnostic table:** Electronic appendix, Table 17.

This association is restricted to drier sites with medium nutrient regime on very shallow and stony soils on moderate and steep cool slopes in the submaritime sector of the cool temperate zone. The communities are found on the western slopes of the middle Sikhote-Alin (Khor, Bikin and Iman River basins). The tree layer is dominated by *Quercus mongolica*, with a mix of *Betula davuricae.* At later successional stages, added to the dominants are *Acer mono*, *Pinus koraiensis* and *Tilia amurensis*, and a stratification of the tree layer may appear. The shrub layer is sparse. It includes lone individuals of *Euonymus pauciflora*, *Lespedeza bicolor*, *Philadelphus tenuifolius*. The herb layer is also sparse. The species from the oak forest complex dominate. However, a number of species characteristic for the mesic mixed forests, such as *Carex siderosticta*, *Milium effusum*, *Phryma asiatica* and *Thalictrum filamentosum* are also present.

49. Melampyro setacei-Quercetum mongolicae Krestov et al. ass. nov. hoc loco

Nomenclatural type: relevé 38 in Tables 5 and 6. **Diagnostic species:** *Geranium vlassovianum* and *Melampyrum setaceum.* **Diagnostic table:** Electronic appendix, Table 18.

This association occupies the driest sites in the range, with a medium to rich nutrient regime on the ridges and adjacent steep warm slopes in the submaritime sector of the cool temperate zone. The communities are found on the western slopes of the middle and the southern Sikhote-Alin (Khor, Bikin and Iman River basins, Livadiyskiy range). The tree layer is dominated by *Quercus mongolica* with a mix of *Pinus koraiensis*. The shrub layer is sparse. It includes singular individuals of *Lespedeza bicolor.* The herb layer is moderately developed and covers 30–50 % of a stand area. Species from the oak forest complex, such as *Artemisia stolonifera*, *Carex lanceolata*, *C. reventa*, *Doellingeria scabra* are most abundant. The presence of

Geranium vlassovianum and *Melampyrum setaceum* is characteristic for the association.

50. Lespedezo bicoloris-Quercetum mongolicae Kim ex Krestov et al. ass. nov. hoc loco
Nomenclatural type: relevé 39 in Tables 5 and 6. **Diagnostic species:** *Artemisia keiskeana*, *Atractylodes ovata*, *Carex lanceolata*, *Dictamnus dasycarpus*, *Doellingeria scabra*, *Iris uniflora*, *Kitagawia terebinthacea*, *Lespedeza bicolor*, *Melampyrum roseum, Potentilla fragarioides*, *Sedum aizoon*, *Spodiopogon sibiricus.* **Synonyms:** Lathyro humilis-Quercetum mongolicae Gumarova 1993 nom. ined.; *Carex lanceolata-Quercus mongolica* comm. (You et al. 2001). The association Artemisio keiskeanae-Quercetum mongolicae Gumarova et al. ex Ermakov 2003 must be rejected as the later homonym of Artemisio keiskeanae-Quercetum mongolicae Kim 1990.

This association occupies mesic sites with medium to rich nutrient regime that are on gentle to moderately steep, warm slopes in the submaritime sector of the cool and cold temperate zone. The communities are found on the western slopes of the southern Sikhote-Alin. The three or two stratum tree layer is dominated by *Quercus mongolica* with a mix of *Betula costata*, *Pinus koraiensis*, *Tilia amurensis* on less managed sites. In the later successional stages, *Acer mandshuricum*, *A. tegmentosum*, *Kalopanax septemlobus* and *Ulmus laciniata* can be found in the undercanopy stratum. Abundant sprouts of *Ulmus japonica* and *Ligustrina amurensis* are frequent in the lower tree stratum. The shrub layer is sparse. It includes singular individuals of *Acer barbinerve*, *Corylus mandshurica*, *Deutzia amurensis, Eleutherococcus senticocus*, *Euonymus maximowicziana* and *Philadelphus tenuifolius*. The herb layer is well developed, it covers 50–80 % of a stand area. The species from the oak forest complex, such as *Artemisia stolonifera*, *Astilbe chinensis*, *Carex reventa*, *Doellingeria scabra*, *Veronicastrum sibiricum* are most abundant. The presence of species *Bupleurum longiradiatum*, *Dictamnus dasycarpus*, *Fragaria orientalis*, *Geranium maximowiczii*, *Hemerocallis middendorffii*, *Lathyrus humilis*, *Polygonatum involucratum*, *Vicia amurensis*, *Vincetoxicum acuminatum* are characteristic for the association. We distinguished two subassociations: 50a, Lespedezo bicoloris-Quercetum mongolicae saussuretosum odontolepis Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type is relevé 40 in Tables 5 and 6) occupies dryer sites in northeast China, and 50b, Lespedezo bicoloris-Quercetum mongolicae ulmetosum japonicae Kim ex Krestov et al. subass. nov. hoc loco (nomenclatural type is same with the association) occupies wetter well insolated sites in the Russian Far East.

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