Forests of Japanese alder in the Russian Far East: the new association of the class Alnetea japonicae Miyawaki et al. 1977

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ABSTRACT

We describe the new association Lycopo lucidi–Alnetum japonicae Korznikov, Verkholat & Krestov 2021 ass. nov. of the Alnus japonica swamp forests of the coastal plains and river valleys in the south of the Primorye Territory of Russia. The association includes two subassociations: Lycopo lucidi–Alnetum japonicae typicum Korznikov, Verkholat & Krestov 2021 subass. nov. and the preliminary delineated Lycopo lucidi–Alnetum japonicae betuletosum davuricae subass. prov., developing on gently sloping foothills with a lateral inflow of moisture and is transitional to zonal broad-leaved forests of the class Querco–Alnion mongolicae Song ex Krestov et al. 2006. The association is classified to the alliance Fraxino–Alnion japonicae Miyawaki et al. 1977 described from Japan and belonging to the order Alnetalia japonicae Miyawaki et al. 1977 and the class Alnetea japonicae. We also validate the name of the association Stellario longifoliae–Alnetum japonicae Ohno in Miyawaki 1988 nom. inval. (art. 5) from Hokkaido Island, Northern Japan.

Keywords: vegetation, syntaxonomy, alder forest, swamp forest, Primorye Territory

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Alnus japonica (Thunb.) Steud (Japanese alder), in contrast to the widely distributed in the Russian Far East species Alnus hirsuta (S. Arg.) Turcz. ex Rupr. (Siberian alder), grows in the warmest areas of the region. The distribution of Alnus japonica marks the typical temperate bioclimatic zone in East Asia (Box & Fujiwara 2012). The whole range of the species corresponds to the area of the humid monsoon climate of the temperate zone of East Asia, stretching along the Pacific coast between 25 and 46°N. Outside Russia, Japanese alder is distributed in Korean Peninsula, Japanese Archipelago (including the Ryukyu Islands) and in China, from Jiangsu in the south to Jilin in the north, as well as in Taiwan (Li & Skvortsov 1999). In Russia, the species is known only in the south of the Primorye Territory, on Kunashir Island, and the southwestern tip of Sakhalin Island (no herbarium specimens). In the Primorye Territory, Alnus japonica occurs along the coast of the Sea of Japan from the border with the North Korea (the Khasan District of the Primorye Territory), to the Olga Bay (the Olga District) (Fig. 1). On the Khanka Lake Lowland, it forms hybrids with A. hirsuta, so the most typical plants of Alnus japonica are confined to the seacoast (Vorobyov 1968).

In the Russian Far East, alder forests occupy relatively small areas, do not have economic significance, and they were not usually considered in forest vegetation surveys and inventories (Ageenko 1969, Rosenberg & Vasiliev 1969). Forests of Alnus hirsuta were described comprehensively during the vegetation studies of some areas of the Russian Far East. The most informative descriptions of Alnus hirsuta swamp forests, based on relevé tables, are provided for Kamchatka by Tyulina (2001), Neshataeva & Kukuruzhin (2003) and Neshateaeva (2009), with less detail – for the Primorye Territory by Kolesnikov (1938, 1956), Doronina (1967), Zhudova (1967), Vasiliev et al. (1984), for the Sakhalin Island by Kabanov (1940) and for the Kuril Islands by Vorobyov (1963) and Barkalov (2009, 2002).

Forests of Alnus japonica are less often mentioned in the Russian geobotanical literature (Kolesnikov 1956, Zhudova 1967, Kurentsowa 1968, Krestov & Vorhkolat 2002). In the Primorye Territory, Alnus japonica forms locally distributed...
communities usually classified into the formation “Japanese alder groves” (Kolesnikov 1956). Kurentsova (1968) noted that, despite the absence of extensive masses, forests of Japanese alder, being interspersed with communities of other types, are a characteristic element of the vegetation of the south of Primorye Territory. Sochava (1946) considered *A. japonica* to be the most ancient relics on the region, and considered the communities with the dominance of this species as depleted derivatives of “syndraeae of hydrophilic formations of the Tertiary”, which were dominated by such taxa as *Taxodium* Rich.

Expanding economic development of coastal plains and river valleys in the Northeast Asia has led to a reduction of alder swamps of *Alnus japonica* (Miyawaki et al. 1977, 1986, Miyawaki 1988, Ohno 1991, Fujita 1998, Lei & Ohno 2004, Kim & Lee 2017). Due to the relic nature and strong anthropogenic transformation, the remaining undisturbed and intact forest communities with the dominance of Japanese alder were proposed to be considered rare communities in the Primorye Territory (Krestov & Verkholat 2002).

This paper aims on evaluation of syntaxonomic position of *A. japonica* communities growing in the south of the Russian Far East in the system of floristic classification of vegetation in East Asia.

**MATERIAL AND METHODS**

This study is based on 11 original unpublished relevés of *Alnus japonica* forests made by V.P. Verkholat in the period from 1981 to 2001 and one previously published relevé by P.V. Krestov (Krestov & Verkholat 2002) in the continental part of range, and 1 original unpublished relevé by K.A. Korznikov from the Kunashir Island Southern Kunls. The relevés from mainland are made on plots of 20×20 m in size. Within the sample plots, all vascular plants species and their cover were recorded. The abundance of plants is estimated on a six-point cover scale: 5 – 76–100 %; 4 – 51–75 %; 3 – 26–50 %; 2 – 6–25 %; 1 – 1–5 %; + – <1 %.

The relevés were sorted in the JUICE 7.0 software (Tiáchy 2002). For differentiation of syntaxa, we used a combination of diagnostic species. The diagnostic species for the new association of Japanese alder forest included taxa with a constancy of more than 40%, with the exception of a number of species of hygrophilous tall grass, which are characteristic of floodplain and valley forests in the south of the Far East (“riparian species”).

In naming of the new syntaxa we followed the International Code of Phytosociological Nomenclature (Theurillat et al. 2021). The names of vascular plants are given according to the summary of Cherepanov (1995), with the exception of *Parasenecio bastatus* (L.) H. Koyama (= *Casadia bastata* L.). The distribution of *Alnus japonica* is shown after Sokolov et al. (1974), Nedoluzhko & Skvortsov (1996), Global Biodiversity Information Facility (GBIF), and our original field data.

**RESULTS**

After tabular processing, the described communities were classified into the new association *Lycopus lucidi–Alnetum japonicae* ass. nov., which includes two subassocations – *Lycopo lucidi–Alnetum japonicae* typicum subass. nov. and *Lycopo lucidi–Alnetum japonicae* betuletosum davuricae subass. nov.

*Lycopo lucidi–Alnetum japonicae* ass. nov. hoc loco

**Holotypus** – relevé 5 in the table 1.

**Synonyms:** “formation the groves of Japanese alder” (Kolesnikov 1956).

**Diagnostic species:** *Alnus japonica*, *Astilbe chinensis*, *Lycopus lucidis*, *Osmunda cinnamomea*, *Rhabdosia excisa*, *Sedum aizoon*.

**Dominant species:** *Alnus japonica* (tree layer), *Filipendula palmata* (herb layer).

**Structure.** The tree stands, from 8 to 20 m high, are single-, less often, two-layered. The average canopy cover is 60 %. The shrub layer is sparse; its cover is usually less than 1 %. The herb layer is well developed, consists of 2–3 sublayers, the total cover reaches 90–100 %. The upper herb sublayer is formed by tall herbs (*Astilbe chinensis*, *Filipendula palmata*, *Parasenecio bastatus*, *Urtica angustifolia*). The middle sublayer is formed mostly by graminoids (*Calamagrostis×longidiophii*, *Carex appendiculata*, *C. dipala*) and ferns (*Athryrium sinicum*, *Osmunda cinnamomea*). The third sublayer consists of forbs, the most noticeable are *Impatiens noli-tangere*, *Pilea mongolica*, *Truedum thunbergii*.

**Ecology.** The communities are confined to poorly drained lagoon-origin depressions behind the ancient dunes of the sea coasts. They occupy the lower parts of floodplains and near-surface areas in the lower reaches of rivers, wet deluvial aprons and gently-sloping valley boards. The soils are gleysoils, with a developed profile, the water table is high. The soil moisture regime is from wet to very wet. In the wetlands of the coastal plains, the association communities are surrounded by reed grass–wedge wet meadows (the class *Calamagrostietea longidiophii* Achtyamov 1985). In river valleys, swamp forests of *Alnus japonica* gradually changes into riverside communities of the class *Salicion sachalinensis* Ohba 1973, and on slopes of river valley boards and on deluvial
### Table 1. Relevés of *Lycopus lucidus–Alnetum japonicae* ass. nov. (A), *L. A. j. typicum* subass. nov. (B), and *L. A. j. betuletosum davuricae* subass. prov. (C). Species of tree and shrub layers indexed, herbs are not.

| Syntax | A | B | C | Median value |
|--------|---|---|---|-------------|
| Number of species | 100 | 100 | 100 |
| Tree layer height, m | 100 | 100 | 100 |
| Tree layer cover, % | 100 | 100 | 100 |
| Shrub layer cover, % | 100 | 100 | 100 |
| Herb layer cover, % | 100 | 100 | 100 |
| Number in database | 100 | 100 | 100 |

### Table 1. Continued.

| Syntax | A | B | C | Median value |
|--------|---|---|---|-------------|
| Running number | 100 | 100 | 100 |
| Species frequency, % | 100 | 100 | 100 |

### Diagnostic species of the L. A. j. typicum

| Species | A | B | C |
|---------|---|---|---|
| *Lycopus lucidus* | 100 | 100 | 100 |
| *Lycopus japonicus* | 100 | 100 | 100 |

### Diagnostic sp. comb. of the *Lycopus lucidus–Alnetum japonicae*

| Species | A | B | C |
|---------|---|---|---|
| *L. A. j. typicum* | 100 | 100 | 100 |

### Diagnostic sp. comb. of the *L. A. j. betuletosum davuricae*

| Species | A | B | C |
|---------|---|---|---|
| *L. A. j. betuletosum davuricae* | 100 | 100 | 100 |

### Accompanying species

| Species | A | B | C |
|---------|---|---|---|
| *Osmundo asiaticum* | 100 | 100 | 100 |

### Single records:

| Species | A | B | C |
|---------|---|---|---|
| *Calla palustris* | 100 | 100 | 100 |

### References

1. Corex gynantus, *E. phleoidesAlbumete puleare,* *V. m. frutaceous,* *C. fraxinoides* (1), *L. fruticus.*

2. *N. tangutica,* *A. dahurica* (1), *A. taito*, *A. taito.*

3. *T. fendleri,* *T. lipanica,* *T. maximowiczii.*

4. *G. fruticosum,* *A. taito,* *A. taito.*

5. *A. dahurica* (1), *A. taito,* *A. taito.*

6. *T. fendleri,* *T. lipanica,* *T. maximowiczii.*

7. *G. fruticosum,* *A. taito,* *A. taito.*

8. *G. fruticosum,* *A. taito,* *A. taito.*

9. *T. fendleri,* *T. lipanica,* *T. maximowiczii.*

10. *A. dahurica* (1), *A. taito,* *A. taito.*

11. *G. fruticosum,* *A. taito,* *A. taito.*

12. *T. fendleri,* *T. lipanica,* *T. maximowiczii.*
 aprons – into zonal forests of the class Quercetea mongolicae Song ex Krestov et al. 2006. The herbs and undergrowth of the forests are periodically burned out during regular ground fires, which are particularly frequent in the spring period near urbanized areas.

**Distribution.** Along the coast of the Sea of Japan from the border with the North Korea (42.30°N) to the Olga Bay (43.70°N) (Primorye Territory). The well-developed and large forests are located on the territory of the Lazovsky Nature Reserve, in the basin of the Razdolnaya River (ex-Suifun). The extensive open forests of *Alnus japonica* formed after regular fires occur in the Khasan and Shkotovo districts.

The association includes two subassociations.

**Lycopo lucidi–Alnetum japonicae typicum** subass. nov. hoc loco

**Holotypus** – relevé 5 in table 1 (Fig. 2).

**Synonymy:** “formation of forested swamps with Japanese alder” (Zhudova 1967).

**Diagnostic species:** Carex appendiculata, Lycopus maackianus, Osmunda sensibilis, Pilsa mongolica, Sanguisorba parviflora, Thelypteris thelypteroides, Trillium thunbergii.

**Dominant species:** *Alnus japonica* (tree layer), Carex appendiculata, Impatiens noli-tangere, Trillium thunbergii (herb layer).

**Structure.** The stand is single-layered, less often consists of two layers, 15 m high. The canopy cover is 60 %. In addition to *Alnus japonica*, it may include Fraxinus mandshurica, rarely *Quercus mongolica*. Shrubs do not form a closed layer, and often completely lack. In the herb layer, tall herb species of the riparian floral complex (*Filipendula palmita*, *Parasenecio bastatus*, Urtica angustifolia) are usually abundant. Calamagrostis langsdorffii, Carex appendiculata, *C. dispalata*, and sometimes, Piraniastrum australis form closed patches. Among forbs, *Impatiens noli-tangere* and *Trillium thunbergii* have the dense cover. The synusia of tall herbs, gramnoids and hygromesophilic forbs are clearly pronounced. The synusial differentiation of herb layer reflect the conditions of uneven soil moisture and a hummocky surface.

**Ecology.** The communities of the subassociation are confined to the wettest habitats of the coastal plains and river valleys, with a high level of ground water and periodic stagnation of water above ground. *Carex appendiculata*, one of the species from the diagnostic combination with a high cover, is also a diagnostic species of the alliance of mesohydrophilic and hygrophylic floodplain meadows Carecix appendiculatae Achtyamov et al. 1985 (Achtyamov 1995). Despite being confined to wet ecotopes, communities are prone to the ground fires, which often occur during the dry spring period, when abundant litter and sparse undergrowth burn out.

**Distribution.** Corresponds to the range of the association.

**Lycopo lucidi–Alnetum japonicae betuletosum davuricae** subass. nov. prov.

The syntaxon is pre-allocated. The subassociation unites communities with the dominance of *Alnus japonica* on deluvial aprons, well moistened by lateral water inflow, but without stagnation. The stand is usually single-layered, dominated by *A. japonica*. Betula davurica, Maackia amurensis, and *Quercus mongolica* co-occurence. The height of the trees is 8–10 m; the canopy cover is 60 %. The shrub layer is open. In the species composition, there are species typical to *Lepidolea-Queretalia mongolicae* Krestov et al. 2006, which is explained by the transitional nature of the communities from the class *Alnetea japonicae* to the class of zonal forest vegetation *Quercetea mongolicae*.

**Stellario longifoliae–Alnetum japonicae Ohno ex Korznikov, Verkholat & Krestov ass. nov.**

**Lectotypus hoc loco:** Miyawaki 1988, table 18, relevé No. 43 (printed as a separate attachment with page numbers).

The name of the association *Stellario longifoliae–Alnetum japonicae Ohno* was published in Miyawaki 1988 (p. 186) but there is no nomenclatural type relevé (art. 5; Theurillat et al. 2021) given in that publication. For this reason, we have designated here a lectotype from relevés published in the original diagnosis:

Korznikov found *A. japonica* forest stands (12 m high) belonging to this association in the southern part of Kunashir Island, at the valley of the Golovina River (43°76′09″N 145°49′36″E) in 2019. Plot number Kun45, area 100 m², species cover are given in percents: *Alnus japonica* (A1; 70), *A. japonica* (B; 2), *Hydrangea paniculata* (10), *Elymus sieboldiyanus* (3), Carex appendiculata (40), *Osmundastrum asiaticum* (40), *Lysichiton camtschatensis* (20), *Vitis* sp. (10), *Cirsium kamtschaticum* (7), *Thuja americana* (5), *Senecio canadensis* (3), *Filipendula glaberrima* (1), *Anglica genuflexa* (1), *Piraniastrum australis* (1), *Armonium sp.* (<1, and all following species), *Aconitum dyurans*, *Althaea densa*, *Calamagrostis langsdorffii*, *Geum macropylminus*, Impatiens noli-tangere, *Polygonatum muzimana*, *Sambucus nigelia*, *Sanguisorba triphylla*, *Sasa senakensis*, *Stéracus niphilus*, *Seneio nemorensis*, *Symphoricarpus venalis*, *Trillium camtschatensae*, *Trillium thunbergii*.

**Figure 2** Community of the *Lycopo lucidi–Alnetum japonicae typicum* Korznikov subass. nov. hoc loco, Primorsky Krai, Lazovsky Nature Reserve, Tachingouza Bay; photo by P.V. Krestov
Overview of the syntaxonomical diversity of the Alnus japonica forests

For the first time, for the Russian Far East, the syntaxonomic diversity of the Alnus japonica forests is described. The existing syntaxonomical system has been added with one new association characteristic of the northern part of the Japanese alder dominated forests on the continental part of their distribution. One association described from Japan was validated. A hierarchy of the modern syntaxonomical system of vegetation formed by Alnus japonica is represented in the following prodomus:

Class
Order
Alneta japonicae Miyawaki, K. Fujiwara et Mochizuki 1977
Alnetalia japonicae Miyawaki, K. Fujiwara et Mochizuki 1977
Fraxino mandshuricae–Alnion japonicae Miyawaki, K. Fujiwara et Mochizuki 1977

Lycopo lucidi–Alnetum japonicae

Korzin, Verkholt et Krestov ass. nov.
Lycopo lucidi–Alnetum japonicae typicum
Korzin, Verkholt et Krestov ass. nov.
Lycopo lucidi–Alnetum japonicae betuletosum davuricae
Stellario longifoliae–Alnetum japonicae

Ohno ex Korzin, Verkholt et Krestov ass. nov.

DISCUSSION

Position in phytosociological classification

A syntaxonomy of the Alnus japonica forests is well developed in Japan. Communities dominated by Japanese alder belong to the azonal vegetation class Alnetea japonicae Miyawaki et al. 1977 – the Asian vicariant of the class Alnetea glutinosae Br.-Bl. et Tx. ex Westhoff et al. 1946 (Mucina et al. 2016). The order Alnetalia japonicae Miyawaki et al. 1977 with the alliance Fraxino–Alnion japonicae Miyawaki et al. 1977 (Miyawaki et al. 1977, Fujiwara 1996) is subordinated to the class. The communities of the wetlands of Hokkaido and northern Honshu are sometimes considered to belong to the alliance Carici–Alnion Asano et al. 1969 (Vegetation... 1988, Ohno 1991, Fujiwa 1996).

Japanese phytosociologists include 8 associations and several unranked vegetation units ("Alnus japonicae gesellschaft") into the above listed syntaxa of higher rank. Two other associations of forests with A japonicae from southern Japan are classified as azonal vegetation. According to different authors, this is either the class of warm-temperate evergreen forests Camellieta japonicae Miyawaki et Obha 1963, or the class of temperate deciduous forests Fageta crenatae Miyawaki et al. 1964. (Okuda 1978, Fujiwara 1996, Lei & Ohno 2004).

We consider the new association Lycopo lucidi–Alnetum japonicae to belong the class Alnetea japonicae and to be subordinate to its order and alliance. It should be noted, that in Alnus japonica forests from Japan, species of valley forests (the union Ulmion davidianae Suz.-Tok. 1954, the order Fraxino-Ulmetalia Suz.-Tok. 1967, the class Fageta crenatae) present constantly and abundantly. At the same time, the absence of the “its own” species in the A. japonicae formation in the Primorye Territory was first noted by Kurentsova (1968). The belonging of the communities to the class Alnetea japonicae, therefore, can be determined by

Table 2. Diagnostic species frequencies (%) of Lycopo lucidi–Alnetum japonicae

| Association                        | A | B | C |
|------------------------------------|---|---|---|
| Number of relevés                  | 12| 20| 26|

Diagnostic species of the Lycopo lucidi–Alnetum japonicae

(Primorye Territory)

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Lycopus lucidus                | 92| 35| 27|
| Trisetum thunbergii            | 67| 65| 85|
| Carpinus cordata               | 67| 77|  
| Quercus serrata                | 58| 25| 69|
| Fraxinus mandshurica           | 58| 10| 42|
| Aiuthus ericoides              | 20| 81|  
| Thalictrum palustre            | 42|  
| Glyceria obtusa                | 42|  
| Aethusa rubripes               | 42|  
| Betula papyrifera              | 42|  
| Rabdosia excisa                | 42|  
| Lysimachia davurica            | 42| 62|  
| Osmodendrum atratum           | 42| 81|  
| Lonicera maackii               | 45|  
| Vitis davidii                  | 45|  
| 
| Diagnostic species of the Alnus–Fraxinetum mandshuricae

(Hokkaido, Japan)

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Lysichiton camtschaticus       | 75| 27|  
| Filipendula camtschatica       | 45| 19|  
| Lysimachia sibirica            | 45| 17|  
| Dryopteris tokoyensis          | 45| 12|  
| Equisetum arvense              | 8 | 40| 12|
| Carex pellitoideae             | 40|  
| Trillium camtschaticum         | 40|  
| 
| Diagnostic species of the Stellario longifoliae–Alnetum japonicae

(Hokkaido, Japan)

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Attytum sibericum              | 92| 38| 88|
| Spiranthes satafolia           | 15| 85|  
| Paratrichophyllum japonica     | 20| 81|  
| Equisetum fluviatile           | 20| 65|  
| Impatiens leontyi              | 10| 65|  
| Ulmus japonica                 | 20|  
| Stellaria longifolia           | 69|  
| Stellaria defendens            | 58|  
| Filipendula glutortermima      | 31|  
| 
| Diagnostic species of the Fraxino-Alnion japonicae

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Alnus japonica                 | 100| 95| 96|
| Hasta tricifolia               | 60| 69|  
| Vicia arvensia                 | 55| 31|  
| Carpinus nipponica             | 15| 38|  
| Carpinus ovata                 | 10| 42|  
| Stachys riederi var. japonica  | 20| 35|  
| Stellaria yegonmis             | 15| 31|  
| Galium tridium                 | 5 | 27|  
| Salix arctica                  | 10| 12|  
| 
| Diagnostic species of the Ulminum davidianae (temperate broad-leaved riparian forests of the insular part of Northeast Asia)

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Fraxinus mandshurica           | 17| 70| 85|
| Impatiens sild-tangere         | 50| 35|  
| Paeonyprocopis revolus         | 35| 25|  
| Acer tataricum ssp. altaiense  | 15| 35|  
| Elagoborus uliginosus          | 5 | 35|  
| Syringa reticulata             | 8 | 10|  
| Magnolia kobus                 | 20|  
| V. laurinaefolia var. sibirica | 15|  
| Castanopsis tordatum           | 15|  
| Pachyandra terminalis          | 10|  
| Urtica platyclada              | 15|  
| Other frequent species

| Species                        | A | B | C |
|--------------------------------|---|---|---|
| Calamagrostis langsdorffii     | 30|  
| Phlogninae asitredt           | 25| 75|  
| Seneio cannabifolius           | 25| 58|  
| Manchuentum dilatatum         | 33| 50| 23|
| Cistanthus erioseus           | 8 | 30| 77|
| Lycopus uniflorus             | 8 | 30| 77|
| Sanguisorba trollifolius      | 8 | 65|  
| Urtica angustifolia            | 42|  
| Consolaria Reskii             | 33| 8|  
| Fimbripetalum radians         | 25| 5|  

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ecological relevance and phytosociological criteria, and not only by floristic composition (Table 2).

**Characteristics of *Alnus japonica* communities in the neighboring areas**

**(Japan.** The alder communities described in this study in the Primorye Territory floristically and ecologically are most similar to the communities of the associations *Alno-Fraxinetum mandshuricae* Miyawaki ex Haneda et al. 1970 (Honshu and Hokkaido Islands) and *Stelarietum longifoliae-Alnetum japonicae* Ohno in Miyawaki 1988 nom. inval. (Hokkaido) (Miyawaki et al. 1986, Miyawaki 1988) growing in northern Japan. The average height of the tree layer in those forests is about 20 m, the maximum – up to 30 m, canopy cover – 70%. The average cover of the shrub layer is 30%, in some communities, shrubs may be completely absent, or cover up to 90% of the sample area. On average, the cover of herbs is 90% (Miyawaki 1988). In addition to *Alnus japonica*, the species *Carex appendiculata, Lycopus lucidus, Onolea sensibilis, Osmundastrum asiaticum, Thelypteris phleoides* and *Truellum thunbergii* are common to both Japan and Primorye Territory communities. In *Alnus japonica* forests of insular sector, *Filipendula kamtschatica* replaces *Filipendula palmata*, grows *Lyzichtion camtschaticense*, and *Sphagnum renifolius* has much higher constancy.

**(Korea.** In the vegetation survey of North Korea (Kolbek & Jarolimek 2013), Japanese alder forests are mentioned, but their characteristics and species lists are not given. The *Viburnum opulus* var. *salicifolius-Alnus japonica* community is described from the territory of South Korea (Gyeongsangbuk-do Province, Kunwi County), confined to the swampy terraces of mountain river valleys (Kim & Lee 2017). The authors of the syntaxon provide the following list of diagnostic species: *Acer ginnala, Alnus japonica, Angelica gigas, Angelica decursiva, Lycopus lucidus, Viburnum opulus* var. *salicifolius*. The stand is two-layered, with a mix of *Fraxinus mandshurica, F. rhynchophylla, Maackia amurensis*, and *Quercus mongolica*. The maximum height of the trees is 16 m; the average canopy cover is 70%. The cover of the shrub layer is not less than 20%, herb layer – 90–100%. Among the species with high constancy, common with the forests of the southern Primorye Territory, are *Lycopus lucidus, Osmundastrum asiaticum* and *Truellum thunbergii*.

**(Northeast China.** In Jilin Province, Japanese alder forests are confined to moist, poorly drained areas of floodplains and river valleys. The height of the stands is 16–20 m; the canopy cover is 60–80%. In addition to alder, the stands may include the broad-leaved species: *Fraxinus mandshurica, Juglans mandshurica, Phellodendron amurense, Sorbus abifolia, Ulmus japonica*. The shrub layer is formed by *Sorbaria orthophylla, Salix integra*, and *S. gracilistyla*. The herb layer is closed, the set of main species includes mainly mesohydrophilic and hygrophilic species: *Adoxa moschatellina, Adenophora triphylla, Agrimony pilosa, Artemisia selengensis, Aruncus dioicus, Asitile clusianus, Bistorta officinalis, Caltha palustris, Carex microptera, Carex siderosticta, Circaea lutetiana, Filipendula palmata, Herbulaeum dissectum, Menispernum dauricum, Rubus saxatilis, Sanguisorba officinalis, Sium suave* (Qian et al. 2003).

**(Sakhalin and the Kurils Islands.** On Kunashir Island, *Alnus japonica* is quite common, growing in the valleys of rivers and streams, along the shores of lakes and in swamps with *Picea glehnii* (Barkalov 2002, 2009). Vorobyov (1963) mentioned *Alnus japonica* communities (“in the swamp, small groups”), but did not give more information. The floristic composition of these communities is close to both associations from Hokkaido *Alno-Fraxinetum mandshuricae* and *Stelarietum longifoliae-Alnetum japonicae* and include species from diagnostic combinations of Japanese associations: *Filipendula glaberrima, Lysichiton camtschaticens, Sphagnum renifolius, Trillum camtschaticente*. On Sakhalin, Japanese alder is extremely rare (Nedoluzhko & Skvortsov 1996). We have never found this species in natural communities and in herbarium collections from Sakhalin. The available information about the ecology and communities of *Alnus japonica* in the insular part of the Russian Far East is sketchy. Apparently, this species does not take a significant part in the composition of the vegetation cover and individual communities.

**(Primorye Territory.** In the Lazovsky Nature Reserve (43°N 133.9°E), Zhudova (1968) allocated forests of Japanese alder in the formation “swamps dominated by *Alnus japonica*”. Communities of this formation occur along the bottoms of small shallow valleys of watercourses without a developed channel, with steep banks and along the edges of peatlands, at the places where springs emerge. The height of the stands is 12–15 m, the undergrowth – 3–5 m. There are no shrubs. In the herb layer, *Calamagrostis langdorffii, Carex esquima, Naumurajra thyrsiflora, Phragmites australis, Rubia jessoensis, Sanguisorba parviflora, Truellum thunbergii* are abundant. We consider the communities described by Zhudova (1968) to belong to the association *Lycepo lucidi–Alnetum japonicae*.

Zhudova also pointed out that under conditions of greater moisture, *Alnus japonica* forms shrubby communities with *Carex schmidtii*, heather shrubs (*Ledum halepense, Vaccinium uliginosum*) and a cover of *Sphagnum* mosses. She assigned them to a group of “shrubby bogs” formations. Similar communities with stunted thickets of *Alnus japonica* are known for bog massifs of northern Japan (Shinsho 1982, Fujita 1998). In our opinion, such communities should be positioned as part of the syntaxa of non-forest bog vegetation.

**Conclusion**

Swampy and moist forests of *Alnus japonica* are formed in the warmest areas of the southern part of the Russian Far East, where this species is located near the northern border of its range. Communities dominated by Japanese alder are assigned to the new association *Lycepo lucidi–Alnetum japonicae*, which we consider to belong to the alliance *Fraxino mandshuricae–Alnetum japonicae*, the order *Alnetalia japonicae*, the class *Alnetea japonicae*. Currently, the association occurs on small area, as its habitats have been transformed during the anthropogenic transformations of river valleys and coastal plains. Forests belonging to the subassociation *Lycepo lucidi–Alnetum japonicae typicum* are confined to highly moist, poorly drained habitats of river floodplains and coastal plains. On the gently sloping terrains with a strong lateral inflow of water, slightly different communities are formed in composition and structure, which we refer to the preliminary revealed the subassociation *Lycepo lucidi–Alnetea japonicae*.}
The Lycopo luzidi–Alnetum japonicae – new association in the Alnetea japonicae in Russia

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