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RESEARCH ARTICLE

Floristic characteristics of some synanthropic plant communities of the Kobuleti lowland (Adjara, Georgia)

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Abstract

The materials of the field research of synanthropic vegetation in the territory of the Kobuleti in the 2016–2020 years are provided. In particular, 134 taxa belonging to 49 families and 97 genera were revealed in the three different plant communities (*Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei,* and *Cinnamomo glanduliferae-Cryptomerietum japonicae*) in the Kobuleti lowland. The community *Cryptomerietum japonicae* comprises 66 taxa, 33 of which are native, and 33 have an alien origin. Woody plants in *Cryptomerietum japonicae* are represented by 15 taxa. The community *Eucalyptetum-viminali-globulo-cinerei* comprises 91 taxa, 36 of which are native and 55 are alien. Woody plants in *Eucalyptetum-viminali-globulo-cinerei* are represented with 17 taxa, while the rest 74 taxa are herbaceous. In *Cinnamomo glanduliferae-Cryptomerietum japonicae* there are discovered 49 plant taxa, including 25 native and 24 aliens. In this community, 16 taxa are represented by woody plants and 33 taxa – by herbaceous ones.

Therefore, in the investigated region, 60 taxa (44.77 %) were found to be native and 74 taxa (55.23 %) alien. Among aliens, 31 taxa have East Asian origin, 16 taxa are from the Mediterranean, 13 taxa originated from Europe, ten taxa originated from North American, and four – originated from Australia.

Despite cuttings and artificial planting of alien representatives, some indigenous woody species (i.e., *Corylus avellana, Frangula alnus, Vaccinium arctostaphylos, Smilax excelsa, Quercus hartwissiana, Carpinus caucasica, Castanea sativa,* and *Hedera colchica*) still occur in this territory. Both native and alien taxa participate in the formation of the described landscape structure. Successional events have started in the Kolkheti Lowland in ancient times. It is a long-term process, which is still ongoing, as our observations confirmed it.

Keywords: synanthropic vegetation, native flora, alien flora, invasion, Adjara, Georgia

Authors' contributions: All four authors participated in expeditions and field studies. Irakli Mikeladze & Nani Gvarishvili performed plant descriptions, species identification, and detection of plant communities. Aleksandre Sharabidze took plant samples, prepared herbarium vouchers, and captured the photos. Gogita Shainidze worked on GIS and mapping. All authors discussed the results and contributed to the final manuscript. Irakli Mikeladze is the corresponding author; he wrote the manuscript in consultation with all four authors.

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Introduction

The transformation of the flora and vegetation is one of the significant challenges in the modern world related to human activity. The human disruption impact on the ecosystems promotes their response through the secondary autogenic succession. Such successions vary depending on specific anthropogenic influence on ecosystem and allow plant species with foreign origin invade and inhabit local plant communities (Kornaś, 1990; Richardson & Pyšek, 2006; Fudali, 2009; Opálková & Cimalová, 2012; Solomakha et al., 2012; Ziaja & Wójcik, 2015; Mikeladze, 2015; Kostryukova et al., 2017).

The influence of anthropogenic factors, irrational use of natural sources, and careless and abandoned agricultural lands have led to a remarkable transformation of flora and vegetation. Such transformation is reflected in the invasion of alien plant species in the disturbed habitats and syngeneic succession. This is a result of anthropogenic-induced invasion processes in the florogenesis that oppressed indigenous species, in particular, those 'shelters' (refugia) of which were destroyed (Ginkul, 1936; Mazurenko & Khokhriakov, 1972; Davitadze, 1980, 2001, 2002; Richardson et al., 2000; Richardson & Pyšek, 2006; Simberloff, 2013).

Active phytoinvasion is also an actual problem for the South Kolkhis (Adjara). Investigation of the transformed vegetation in the coastal Adjara lowland and foothills considered the principal targets for phytoinvasion in Kolkhis is highly relevant. To predict and monitor local vegetation transformations, it is essential to survey exiting plant communities in terms of restorative succession (consistent) change.

Material and methods

The research was carried in 2016–2020 in the Kobuleti lowland. The study territory is located in Georgia, in the floristic region of the Western Georgia-Kolkheti Lowland (Fig. 1). The object within the phytogeographical division belongs to the ancient Mediterranean and sub-Mediterranean regions (Gagnidze & Davitadze, 2000). The humid subtropical climate strongly determines local vegetation. The average annual temperature is 13.5 °C. The average temperature in January is 4.8 °C, and in July – 22.4 °C. Absolute minimum is −14 °C, and absolute maximum is +41 °C. The average precipitation is 2500–3000 mm per year. Autumn and winter are distinguished here by abundance.

In total, three plant communities were selected during the field expeditions using the route method. GPS coordinates were captured at the selected plots. Laboratory analysis, identification, and herbarization were carried at the the Institute of Phytopathology and Biodiversity in Kobuleti, Batumi Shota Rustaveli State University.

Both alien and native plants were surveyedwithin the selected plant communities. Different published sources were applied for the plant identification, including the identification manual of the Adjara flora (Dmitrieva, 1960, 1967, 1990), identification manuals of the Georgian flora (Keckhoveli, 1971–1984; Kutateladze, 1985; Gagnidze, 1987–2007; Gagnidze & Davitadze, 2000; Tarkhnishvili & Chaladze, 2013; Fischer et al., 2018) and recent contributions to the alien flora of Adjara (Davitadze, 2001, 2002; Kikodze et al., 2010; Sharabidze et al., 2018; Mikeladze et al., 2019). The taxonomy was verified following the online databases POWO (2021).

The vegetation descriptions (relevés) were made following the Braun-Blanquet approach (Mueller-Dombois & Elenberg, 1925; Poore, 1955; Müller & Schmetterer, 1974; Minnesota Department of Natural Resources, 2013). On the experimental plots, the relevés were made with fixed intervals. The constancy of all species was calculated as a percentage overall and separately for each relevé. Surveyed area size varied depending on the plant cover. In the case of tree plants, it was 400–500 m², while in case of mosses – 0.25–0.5 m². The projective cover was determined for each plant species in all areas using the seven-grade Braun-Blanquet scale: 5 – the species has 75–100 % projective cover, 4 – 50–75 %, 3 – 25–50 %, 2 – 5–25 %, 1 – 1–5 %, + – <5 % (sporadic or few individuals occur), r – single individual appears. The International Code of Phytosociological Nomenclature (Weber et al., 2000; Theurillat et al., 2020) and Sorensen's similarity index (Sørensen, 1948)

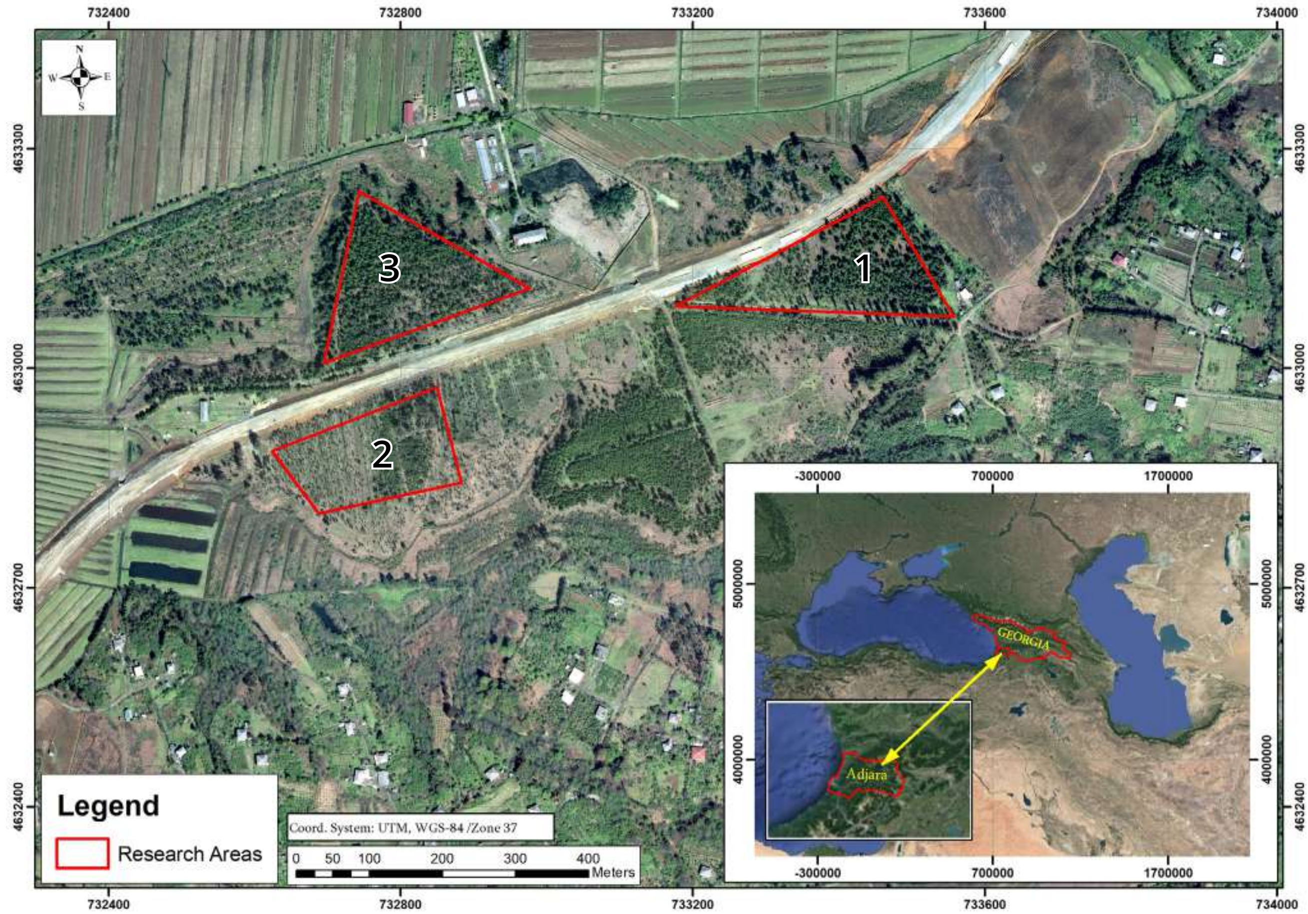

Figure 1. The location of the research areas (plant communities): **1** – *Cryptomerietum japonicae*; **2** – *Eucalyptetum-viminali-globulo-cinerei*; **3** – *Cinnamomo glanduliferae-Cryptomerietum japonicae.*

were applied for the formal naming of the investigated plant communities.

Results and discussion

In the immediate historical past, mixed subtropical and mixed broadleaf forests with the predominance of *Castanea sativa* Mill., *Fagus orientalis* Lipsky, *Quercus hartvisiana* Stev., *Tilia dasystyla* Steven subsp. *caucasica* (V. Engl.) Pigott, *Pterocarya fraxinifolia* (Poir.) Spach, and *Diospyros lotus* L. were common for Kolkhis Lowland. However, at the end of the XIX century and the beginning of the XX century, many drainage channels were constructed, and mentioned plants were cut down and replaced by artificial *Eucalyptus*, *Cryptomeria*, and *Cinamomum* plantations. *Eucalyptus* was introduced for cultivation in swampy areas in coastal Adjara as a remedy against swamps and malaria mosquitoes. In particular, *Eucalyptus globulus* Labill. was introduced in 1895, *E. viminalis* Labill. – in 1900, and *E. cinerea* F. Muell. ex Benth. – in 1912. *Cryptomeria japonica* was introduced in coastal Adjara at the beginning of the XX century. After that, it has undergone complete acclimatization, and today these plants actively bloom, produce fruits and self-seedlings. *Cinnamomum glanduliferum* (Wall.) Meisn. was introduced as an ornamental plant in 1900.

At the end of the XX century, plantations on the investigated territories were cut down again due to different reasons. In these degraded, empty, and abandoned areas, competition between the native and alien plant taxa started in certain plant groups, characterized by lower stability.

Considering the formation history, three formal plant communities were selected in the Kobuleti lowland for the investigation – *Cryptomerietum japonicae*, *Eucalyptetum-viminali-globulo-cinerei*, and *Cinnamomo glanduliferae-Cryptomerietum japonicae*.

Figure 2. *Cryptomerietum japonicae* community.

1. *Cryptomerietum japonicae*

The mentioned territory is located in the Kobuleti lowland, at 17–29 m a.s.l., between 37T 733176 m E, 4633084 m N; 37T 733460 m E, 4633233 m, N; 37T 733557 m E, 4633070 m N. Exposition is flatland with poorly developed soil (Figs. 1 & 2).

Sixty-six plant taxa were observed in the *Cryptomeria japonica* community, including 33 native and 33 aliens (Appendix). Woody plants are represented here by 15 taxa.

The main tree layer of the community is differentiated into sub-layers. The specimens of *Cryptomeria japonica* that survived deforestation dominate in the first sub-layer and reach 20–25 m of height. The second sub-layer is outlined with self-cropped undergrowth specimens and root sprouts located on the cut logs of *Cryptomeria japonica*, *Eucalyptus*, and *Cinamomum*.

Smilax excelsa L., *Lonicera japonica* Thunb., and *Hedera colchica* (K. Koch) K. Koch stand out among the vines, forming the second sub-forest layer.

The third, herbaceous, layer is poorly developed. The projective cover of grasses is about 30–35%. Among the leading species here are *Hydrocotyle ramiflora* Maxim., *Poa annua* L., *Kummerowia striata* (Thunb.) Schindl., *Trifolium diffusum* Ehrh., *Viola prionantha* Bunge, *V. reichenbachiana* Jord. ex Boreau, *Setaria faberi* R.A.W. Herrm., *Fragaria vesca* L., *Euphorbia falcata* L., *E. peplus* L., and *E. stricta* L. The fern *Pteridium tauricum* V.I. Krecz. ex Grossh. (= *Pteridium aquilinum* (L.) Kuhn) was also abundantly present here.

The soil surface is covered with different mosses, including *Calliergonella cuspidata* (Hedw.) Loeske, *Odontoschisma denudatum* (Mart.) Dumort., and *Polytrichum strictum* Menzies ex Brid.

Eight species (*Cryptomeria japonica*, *Frangula alnus* Mill., *Hedera colchica*, *Lespedeza bicolor* Turcz., *Lonicera japonica*, *Hydrocotyle ramiflora*, *H. vulgaris* L., and *Smilax excelsa*) are naturally renewed and engaged in the formation of the basic layer of the given plant community. The local flora elements (i.e., *Quercus hartwissiana* Steven, *Carpinus caucasica* Grossh. (= *Carpinus betulus* L.), and *Vaccinium arctostaphylos* L.) are represented by very few units due to shadowing created by

Figure 3. *Eucalyptetum-viminali-globulo-cinerei* community.

the main canopy on the one hand, and grazing by livestock animals on the other. Similarly, such alien species as *Cinnamomum camphora* (L.) J. Presl and *Ailanthus altissima* (Mill.) Swingle are poorly presented too.

The appearance of *Carpinus caucasica*, *Alnus glutinosa* (L.) Gaertn., *Corylus avellana* L., *Hedera colchica*, *Frangula alnus*, *Smilax excelsa*, and *Vaccinium arctostaphylos* characterizing the primary phytocoenoses, allows assuming that participation of these and many other native species will increase in the future.

2. *Eucalyptetum-viminali-globulo-cinerei*

The research area is flatland, within 9–18 m a.s.l. elevation, located between 37T 732624 m E, 4632886 m N; 37T 732849 m E, 4632974 m N; 37T 732687 m E, 4632801 m N; 37T 732882 m E, 4632843 m N. The inventory revealed vegetation with a dominance of *Eucalyptus viminalis*, *E. globulus*, and *E. cinerea* (Figs. 1 & 3). Taxonomic composition of this plant community differs from the community with the predominance of the *Cryptomeria japonica*.

According to the survey, there are 91 taxa in this community, including 36 native and 55 alien. Woody plants are represented there by 17 taxa, while the rest 74 taxa are herbaceous (Appendix).

The main vegetation layer of this community is differentiated into two sub-layers. The first sub-layer is formed by 20–30-meter-high *Eucalyptus cinerea*, *E. globulus*, and *E. viminalis*, which survived during the cuttings and dominate. *Cryptomeria japonica*, *Eucalyptus cinerea*, *E. globulus*, *E. viminalis*, *Cinnamomum glanduliferum*, *C. tenuifolium* (Makino) Sugim., *Vernicia fordii* (Hemsl.) Airy Shaw, *Frangula alnus* Mill., and *Acacia dealbata* Link are distributed in the second sub-layer. Only a few specimens of the indigenous species *Castanea sativa* are present there. The canopy of the main layer is dense, and this defines the specific composition and structure of underlying vegetation.

The second layer is presented by vines *Smilax excelsa*, *Lonicera japonica*, *Hedera colchica*, and *Persicaria perfoliata* (L.) H. Gross.

In this community, herbaceous cover (the third layer) is distributed quite unevenly. It is

Figure 4. *Cinnamomo glanduliferae-Cryptomerietum japonicae* community.

developed in open places, where it makes the high projective cover. Its composition is colorful with numerous indigenous and alien species. There occur *Paspalum thunbergia* Kunth, *P. distichum* L., *Persicaria thunbergii* (Siebold & Zucc.) H. Gross, *Cyperus esculentus* L., *C. longus* L. subsp. *longus*, *C. longus* subsp. *badius* (Desf.) Bonnier & Layens, *C. brevifolioides* Thieret & Delahouss., *Solidago virgaurea* L., *Ranunculus muricatus* L., *R. sceleratus* L. and many other taxa.

The soil surface is more or less covered with three species of mosses (*Calliergonella cuspidata*, *Odontoschisma denudatum*, and *Polytrichum strictum*) and the channels – with *Sphagnum cuspidatum* Ehrh. ex Hoffm.

Species creating the main cover in *Eucalyptetum-viminali-globulo-cinerei* community have weak natural renewal capacity. Their reproduction is mainly realized through self-seeding and root sprouts.

3. *Cinnamomo glanduliferae-Cryptomerietum japonicae*

The research area is flatland located at 13–15 m a.s.l. elevation, between 37T 732694 m E, 4633007 m N; 37T 732742 m E, 4633241 m N; 37T 732976 m E, 4633108 m N. The vegetation composition is not rich, with poorly developed herbaceous cover (Figs. 1 & 4). On the research plot, there are located drainage channels with developed cover of *Sphagnum palustre* L., various *Polygonum* species, *Microstegium vimineum* (Trin.) A. Camus, and *Juncus effusus* L.

Forty-nine plant taxa were registered in this community, including 25 native and 24 aliens. Among them, 16 taxa are represented by woody plants and 33 taxa – by herbaceous ones. In contrast to the mentioned above communities, here we observed native *Rhododendron ponticum* L. and invasive *Andropogon virginicus* L. (Appendix).

This plant community is differentiated into layers and sublayers. In the first layer, the 20–30-meter trees of *Eucalyptus cinerea* and *E. viminalis* form the first sub-layer. The second sub-layer is outlined at 10–20 m height and formed by *Cryptomeria japonica* and *Cinnamomum glanduliferum*. The third sub-layer is represented by the 4–8-meter-high root sprouts of *Cryptomeria japonica*, *Cinnamomum glanduliferum*, *Alnus glutinosa*, and *Eucalyptus* sp.

The second, sub-forestal, layer is unevenly developed, represented by shrubs of *Corylus avellana*, *Rhododendron ponticum*, *Frangula alnus* Mill. and other. Among the vines, here we observed *Smilax excelsa*, *Lonicera japonica*, and *Hedera colchica.*

Herbaceous cover (the third layer) is weakly developed, with poor species composition due to solid shadowing. Both indigenous and alien species were observed here.

Like in the previous community, the soil surface is more or less covered with mosses *Calliergonella cuspidata*, *Odontoschisma denudatum*, *Polytrichum strictum*, and *Sphagnum palustre*. Ferns are poorly represented by few units of *Thelypteris palustris* Schott, *Thelypteris limbosperma* (All.) H.P. Fuchs, and *Pteridium tauricum* (= *Pteridium aquilinum* (L.) Kuhn), which created unfordable groups.

The natural renewal of the trees creating the main cover is weak, and reproduction is realized chiefly through self-seeding and root sprouts.

In total, 134 plant taxa distributed among 49 families and 97 genera were registered during the investigation. The most represented families by the taxa number are Asteraceae (19 taxa), Poaceae (15), Fabaceae (8), Polygonaceae (7), Rosaceae (7), Cyperaceae (6), Lamiaceae (5), Euphorbiaceae (5). Hence, these leading families comprise 72 taxa, which represent 53.73 % of the total observed.

Therophytes have a dominant position and are represented by 45 taxa (33.58 %). The second place belongs to phanerophytes with 29 taxa (21.64 %). Cryptophytes include 27 taxa (20.14 %), hemicryptophytes – 24 taxa (17.91 %), and chamaephytes – nine taxa (6.71 %).

Among the explored taxa, 60 (44.77%) are native and 74 (55.23 %) alien. Among the aliens, 31 taxa have East Asian, 16 – Mediterranean, 13 – European, ten – North American, and four – Australian origin.

The presence of the number of alien taxa that originated from East Asia is a result of several factors, including similar climatic conditions (i.e., high humidity and precipitations, favorable temperatures during the whole year, fertile soils, etc.). In addition, it reflects the history of the introduction and cultivation of mentioned taxa and associated weeds. The species of the Mediterranean and European origin are numerous too. This is also partly determined by the phytogeographic structure of the Adjara flora.

Among the investigated alien plants, three taxa are archaeophytes, 16 – kenophytes, 35 – neophytes, and 20 – euneophytes (invaded Adjara after 1950s). Among the non-native plants, there are 22 taxa highly expansive in seaside Adjara: *Acacia dealbata*, *Ailanthus altissima*, *Vernicia fordii*, *Ambrosia artemisiifolia* L., *Artemisia vulgaris* L., *Commelina communis* L., *Symphyotrichum graminifolium* (Spreng.) G.L. Nesom., *Cryptomeria japonica*, *Cyperus esculentus*, *Potentilla indica* (Andrews) Th. Wolf, *Erigeron annuus* (L.) Desf, *E. canadensis* L., *Cyperus brevifolioides*, *Microstegium japonicum* (Miq.) Koidz., *M. vimineum*, *Miscanthus sinensis* Andersson, *Paspalum paspalodes* Kunth, *Persicaria perfoliata*, *P. thunbergii*, *Brucea javanica* (L.) Merr., *Spiraea japonica* L. f., and *Sisyrinchium septentrionale* E.P. Bicknell.

In the investigated communities, apophytes are represented by 60 taxa. Their natural distribution habitats vary. Among them, 26 taxa (43.33 %) represent the moist meadows, so the study area corresponds to their natural habitat. Other 16 taxa (26.66 %) originated from forest habitats, 11 taxa (18.33 %) represent the ecological group of lowland sandy beaches, grasslands and shrub communities, and seven more taxa (11.66 %) belong to the ruderal and segetal ecological groups.

Conclusions

Described plant communities *Cryptomerietum japonicae*, *Eucalyptetum-viminali-globulo-cinerei*, and *Cinnamomo glanduliferae-Cryptomerietum japonicae* differ by taxonomic composition and number of native and alien taxa. In total, 134 plant taxa belonging to 49 families and 97 genera were registered in the research area. Among them, 60 (44.77 %) taxa are native, and 74 (55.23 %) – are aliens.

Because of the disposition of *Eucalyptus* leaves, in *Eucalyptetum-viminali-globulo-cinerei* community, the shadow is lower. This results in a higher number of taxa (36 native and

55 aliens). There are unfavorable conditions for plants spread in two other communities; hence their number is much lower (33 native and 33 alien taxa in *Cryptomerietum japonicae*, and 25 native and 22 alien taxa in *Cinnamomo glanduliferae-Cryptomerietum japonicae*).

Despite cuttings and artificial planting of alien representatives, some indigenous woody species (i.e., *Corylus avellana*, *Frangula alnus*, *Vaccinium arctostaphylos*, *Smilax excelsa*, *Quercus hartwissiana*, *Carpinus caucasica*, *Castanea sativa*, *Hedera colchica*, etc.) still occur in this territory. Both native and alien taxa participate in the formation of the described landscape structure. In all three communities, the *Lonicera japonica* wraps trees and shrubs, significantly inhibiting their development. Herbaceous vegetation mainly developed under the trees canopy and is induced by it. In glades, we observed *Miscanthus sinensis*, which restricts the penetration and growth of other competitors.

Successional events have started in the Kolkheti Lowland in ancient times. It is a long-term process, which is still ongoing, as our observations confirmed it. Not only woody plants take part in the creation of the secondary communities in this region. Here we also found secondary meadows and some other secondary communities that will be reported in further researches.

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Appendix. Taxonomic composition and projective cover in the studied plant communities. Taxa are provided following POWO (2021) database, indicating some widely applied synonyms in the brackets after the equals sign. Indices of the projective cover follow the seven-grade Braun-Blanquet scale (see Material and Methods section for details).

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
1	*Acacia dealbata* Link	Fabaceae	Australia		1	
2	*Acalypha australis* L.	Euphorbiaceae	East Asia	+		
3	*Ailanthus altissima* (Mill.) Swingle	Simaroubaceae	East Asia	1		
4	*Aira elegans* Willd. ex Roem. & Schult.	Poaceae	Mediterranean		+	
5	*Alisma plantago-aquatica* L.	Alismataceae	native		+	
6	*Alnus glutinosa* (L.) Gaertn.	Betulaceae	native	1		+
7	*Ambrosia artemisiifolia* L.	Asteraceae	North America	1	1	1
8	*Andropogon virginicus* L.	Poaceae	North America			+
9	*Artemisia vulgaris* L.	Asteraceae	Mediterranean	1	1	1
10	*Bellis perennis* L.	Asteraceae	Atl. Europe		+	
11	*Blechnum spicant* (L.) Roth.	Aspleniaceae	native	+		

Appendix. Continued.

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
12	*Brucea javanica* (L.) Merr. (= *Rhus javanica* L.)	Simaroubaceae	East Asia	+		
13	*Calliergonella cuspidata* (Hedw.) Loeske	Hypnaceae	native	2	2	2
14	*Capsella bursa-pastoris* (L.) Medik.	Brassicaceae	native		+	
15	*Cardamine hirsuta* L.	Brassicaceae	Atl. Europe		+	
16	*Carex remota* L.	Cyperaceae	native			+
17	*Carex riparia* Curt.	Cyperaceae	native		+	
18	*Carpinus caucasica* Grossh (= *Carpinus betulus* L.)	Betulaceae	native	+		
19	*Castanea sativa* Mill.	Fagaceae	native		r	
20	*Centaurium tenuiflorum* (Hoffmanns. & Link) Fritsch	Gentianaceae	native	+		
21	*Cichorium intybus* L.	Asteraceae	native		+	
22	*Cinnamomum camphora* (L.) J. Presl	Lauraceae	East Asia	+		
23	*Cinnamomum glanduliferum* (Wall.) Meisn.	Lauraceae	East Asia	1	1	3
24	*Cinnamomum tenuifolium* (Makino) Sugim. (= *Cinnamomum japonicum* Siebold ex Nakai)	Lauraceae	East Asia		+	+
25	*Commelina communis* L.	Commelinaceae	East Asia	1		1
26	*Corylus avellana* L.	Betulaceae	native	+	r	r
27	*Crepis setosa* Haller f.	Asteraceae	Mediterranean		+	
28	*Cryptomeria japonica* (Thunb. ex L. f.) D. Don.	Cupressaceae	East Asia	5	1	2
29	*Cyperus brevifolioides* Thieret & Delahouss. (= *Kyllinga gracillima* Miq.)	Cyperaceae	East Asia		+	
30	*Cyperus esculentus* L.	Cyperaceae	Mediterranean		+	
31	*Cyperus longus* L. subsp. *longus*	Cyperaceae	native		+	
32	*Cyperus longus* L. subsp. *badius* (Desf.) Bonnier & Layens (= *Cyperus badius* Desf.)	Cyperaceae	Mediterranean		+	
33	*Daucus carota* L.	Apiaceae	Atl. Europe		r	
34	*Erigeron annuus* (L.) Pers.	Asteraceae	North America	+	+	+
35	*Erigeron bonariensis* L.	Asteraceae	North America		+	
36	*Erigeron canadensis* L.	Asteraceae	North America	+	+	+
37	*Eucalyptus cinerea* F. Muell. ex Benth.	Myrtaceae	Australia		2	3
38	*Eucalyptus globulus* Labill.	Myrtaceae	Australia		2	1
39	*Eucalyptus viminalis* Labill.	Myrtaceae	Australia	1	2	3
40	*Euphorbia falcata* L.	Euphorbiaceae	native	+		
41	*Euphorbia peplus* L.	Euphorbiaceae	Mediterranean	+		

Appendix. Continued.

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
42	*Euphorbia stricta* L.	Euphorbiaceae	Mediterranean	+		
43	*Filago arvensis* L.	Asteraceae	native		+	
44	*Fragaria vesca* L.	Rosaceae	native	+		
45	*Frangula alnus* Mill.	Rhamnaceae	native	1	+	+
46	*Galinsoga parviflora* Cav.	Asteraceae	North America		+	
47	*Galinsoga quadriradiata* Ruiz & Pav. (= *Galinsoga ciliata* (Raf.) S.F. Blake)	Asteraceae	North America		+	
48	*Hedera colchica* (K. Koch) K. Koch.	Araliaceae	native	+	+	
49	*Helichrysum luteoalbum* (L.) Rchb. (= *Gnaphalium luteoalbum* L.)	Asteraceae	East Asia		+	
50	*Hydrangea febrifuga* (Lour.) Y. De Smet & Granados (= *Dichroa febrifuga* Lour.)	Hydrangeaceae	East Asia	+		
51	*Hydrocotyle ramiflora* Maxim.	Araliaceae	East Asia	1	1	+
52	*Hydrocotyle vulgaris* L.	Araliaceae	Europe	2	1	+
53	*Hypericum androsaemum* L.	Hypericaceae	native	+		
54	*Hypochaeris radicata* L. (= *Hypochaeris radiata* Falk.)	Asteraceae	native		+	
55	*Juncus effusus* L.	Juncaceae	native	1	+	+
56	*Juncus tenuis* Willd.	Juncaceae	native	1	+	
57	*Kummerowia striata* (Thunb.) Schindl. (= *Lespedeza striata* (Thunb.) Hook. & Arn.)	Fabaceae	East Asia	1	1	
58	*Lamium purpureum* L.	Lamiaceae	Europe		+	
59	*Leontodon hispidus* L.	Asteraceae	native	+		
60	*Lepidium campestre* (L.) W.T. Aiton	Brassicaceae	Mediterranean		+	
61	*Lespedeza bicolor* Turcz.	Fabaceae	East Asia	+		
62	*Leucojum aestivum* L.	Amaryllidaceae	native		+	
63	*Lobelia urens* L.	Campanulaceae	Europe		r	
64	*Logfia gallica* (L.) Coss. & Germ. (= *Filago gallica* L.)	Asteraceae	Europe		+	
65	*Lolium perenne* L.	Poaceae	Europe		+	
66	*Lolium rigidum* Gaudin.	Poaceae	Mediterranean		+	
67	*Lonicera japonica* Thunb.	Caprifoliaceae	East Asia	+	+	+
68	*Lotus palustris* Willd.	Fabaceae	Mediterranean		+	
69	*Lysimachia japonica* Thunb.	Primulaceae	East Asia	+		
70	*Lythrum salicaria* L.	Lythraceae	native		+	
71	*Mentha aquatica* L.	Lamiaceae	native	+		
72	*Mentha pulegium* L.	Lamiaceae	native	+		

Appendix. Continued.

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
73	*Microsteg vimineum* (Trin.) A. Camus (= *Microstegium imberbe* (Nees ex Steud.) Tzvelev)	Poaceae	East Asia	1	1	+
74	*Microstegium japonicum* (Miq.) Koidz.	Poaceae	East Asia	1	1	
75	*Miscanthus sinensis* Andersson	Poaceae	East Asia	1	1	+
76	*Myosotis scorpioides* L. (= *Myosotis palustris* (L.) Nathh.)	Boraginaceae	native		+	
77	*Nasturtium officinale* (L) R. Br.	Brassicaceae	native		+	
78	*Nymphaea candida* C. Presl.	Nymphaeaceae	North America			r
79	*Odontoschisma denudatum* (Nees) Dumort.	Cephaloziaceae	native	2	2	2
80	*Osmunda regalis* L.	Osmundaceae	native	+		r
81	*Oxalis corniculata* L.	Oxalidaceae	North America		+	+
82	*Paspalum distichum* L. (= *Paspalum paspalodes* (Michx.) Scribn.)	Poaceae	East Asia		+	
83	*Paspalum thunbergii* Kunth	Poaceae	East Asia		+	
84	*Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) H. Deane (= *Perilla nankinensis* (Lour.) Decne.)	Lamiaceae	East Asia		+	
85	*Persicaria hydropiper* (L.) Delarbre (= *Polygonum hydropiper* L.)	Polygonaceae	native		+	+
86	*Persicaria maculosa* Gray. (= *Polygonum persicaria* L.)	Polygonaceae	native			+
87	*Persicaria perfoliata* (L.) H. Gross (= *Polygonum perfoliatum* L.)	Polygonaceae	East Asia		+	1
88	*Persicaria thunbergii* (Siebold & Zucc.) H. Gross (= *Polygonum thunbergii* Siebold & Zucc.)	Polygonaceae	East Asia		1	+
89	*Plantago major* L.	Plantaginaceae	native	+	+	+
90	*Poa annua* L.	Poaceae	Europe	1	1	1
91	*Poa compressa* L.	Poaceae	Europe	1		
92	*Poa pratensis* L.	Poaceae	native		+	1
93	*Polytrichum strictum* Menzies ex Brid.	Polytrichaceae	native	+	+	+
94	*Potentilla indica* (Andrews) Th. Wolf (*Duchesnea indica* (Andrews) Teschem.)	Rosaceae	East Asia		+	
95	*Prunella vulgaris* L.	Lamiaceae	native	+	+	
96	*Pseudognaphalium affine* (D. Don) Anderb. (= *Gnaphalium affine* D. Don.)	Asteraceae	East Asia		+	
97	*Pteridium aquilinum* (L.) Kuhn (= *Pteridium tauricum* V.I. Krecz. ex Grossh.)	Dennstaedtiaceae	native	1	1	1

Appendix. Continued.

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
98	*Pteris cretica* L.	Pteridaceae	native	+		
99	*Quercus hartwissiana* Steven.	Fagaceae	native	+		
100	*Ranunculus muricatus* L.	Ranunculaceae	Mediterranean		+	
101	*Ranunculus sceleratus* L.	Ranunculaceae	Europe		+	
102	*Rhododendron luteum* Sweet.	Ericaceae	native		r	r
103	*Rhododendron ponticum* L.	Ericaceae	native			r
104	*Rubus caesius* L.	Rosaceae	native	+		
105	*Rubus creticus* Tourn. ex L. (= *Rubus sanguineus* Friv.)	Rosaceae	native		+	+
106	*Rubus hirtus* Waldst. & Kit.	Rosaceae	native		+	+
107	*Rubus serpens* Weihe ex Lej. & Courtois	Rosaceae	native	+		
108	*Rumex acetosella* L.	Polygonaceae	native	+		
109	*Rumex acetosella* L. subsp. *acetoselloides* (Balansa) Den Nijs (= *Rumex acetoselloides* Balansa)	Polygonaceae	native			+
110	*Rumex pulcher* L.	Polygonaceae	native		+	
111	*Sambucus ebulus* L.	Adoxaceae	native		+	
112	*Senecio sylvaticus* L.	Asteraceae	native	+		
113	*Senecio vulgaris* L.	Asteraceae	Europe	+	+	+
114	*Setaria faberi* R.A.W. Herrm	Poaceae	Mediterranean	+	+	
115	*Setaria intermedia* Roem. & Schult.	Poaceae	East Asia	+	+	
116	*Sisyrinchium septentrionale* E.P. Bicknell	Iridaceae	North America		+	
117	*Smilax excelsa* L.	Smilacaceae	native	1	+	+
118	*Sphagnum cuspidatum* Ehrh. ex Hoffm.	Sphagnaceae	native		1	
119	*Sphagnum palustre* L.	Sphagnaceae	native			+
120	*Spiraea japonica* L. f.	Rosaceae	East Asia	1	1	+
121	*Sporobolus fertilis* (Steud.) Clayton	Poaceae	East Asia		+	
122	*Symphyotrichum graminifolium* (Spreng.) G.L. Nesom. (= *Conyzanthus graminifolius* (Spreng.) Tamamsch.)	Asteraceae	Mediterranean		+	
123	*Thelypteris limbosperma* (All.) H.P. Fuchs (= *Thelypteris oreopteris* (Sw.) Sloss.)	Aspleniaceae	native	+		+
124	*Thelypteris palustris* Schott.	Aspleniaceae	native			+
125	*Trifolium diffusum* Ehrh.	Fabaceae	Mediterranean	+		
126	*Trifolium echinatum* Bieb.	Fabaceae	Mediterranean	+		
127	*Typha angustifolia* L.	Typhaceae	native		+	

Appendix. Continued.

Nr	Taxon	Family	Origin	Indices of the projective cover at the investigated areas		
				1	2	3
128	*Vaccinium arctostaphylos* L.	Ericaceae	native	+	r	r
129	*Verbascum blattaria* L.	Scrophulariaceae	native	+		
130	*Vernicia fordii* (Hemsl.) Airy Shaw (= *Aleurites fordii* Hemsl.)	Euphorbiaceae	East Asia		+	
131	*Vicia lathyroides* L.	Fabaceae	Mediterranean		+	
132	*Vicia sativa* L.	Fabaceae	Europe		+	
133	*Viola prionantha* Bunge.	Violaceae	East Asia	+		
134	*Viola reichenbachiana* Jord. ex Boreau.	Violaceae	native	+		+

Флористична характеристика деяких синантропних рослинних угруповань низовини Кобулеті (Аджарія, Грузія)

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Представлено матеріали польових досліджень синантропної рослинності на території Кобулеті, що здійснювалися протягом 2016–2020 років. Зокрема, на території низовини Кобулеті, в межах трьох різних рослинних угруповань (*Cryptomerietum japonicae, Eucalyptetum-viminali-globulo-cinerei* та *Cinnamomo glanduliferae-Cryptomerietum japonicae*) було виявлено 134 таксони, що належать до 49 родин і 97 родів. Рослинне угруповання *Cryptomerietum japonicae* налічує 66 таксонів, з-посеред яких 33 є місцевими, а інші 33 – адвентивними. Деревні рослини в угрупованні *Cryptomerietum japonicae* представлені 15 таксонами. Рослинне угруповання *Eucalyptetum-viminali-globulo-cinerei* налічує 91 таксон, з-посеред яких 36 є місцевими і 55 мають адвентивне походження. Деревні рослини у складі угруповання *Eucalyptetum-viminali-globulo-cinerei* представлені 17 таксонами, в той час як решта 74 таксони представляють трав'яні рослини. В угрупованні *Cinnamomo glanduliferae-Cryptomerietum japonicae* виявлено 49 таксонів рослин, включаючи 25 місцевих і 24 адвентивних. При цьому, в рослинному угрупованні *Cinnamomo glanduliferae-Cryptomerietum japonicae* 16 таксонів представлено деревними рослинами і 33 таксони – трав'яними.

Таким чином, було виявлено, що на дослідженій території, 60 таксонів (44.77 %) є місцевими і 74 таксони (55.23 %) мають чужорідне походження. Серед адвентивних рослин, 31 таксон походить зі Східної Азії, 16 таксонів походять з Середземномор'я, 13 таксонів походять з Європи, десять таксонів походять з Північної Америки і чотири таксони – з Австралії.

Не зважаючи на вирубки та штучні насадження чужорідних представників, деякі з локальних деревних видів (зокрема, *Corylus avellana, Frangula alnus, Vaccinium arctostaphylos, Smilax excelsa, Quercus hartwissiana, Carpinus caucasica, Castanea sativa, Hedera colchica*) все ще представлені на дослідженій території. При цьому, як місцеві, так і адвентивні види беруть участь у формуванні структури описаного ландшафту. Сукцесійні зміни у долині Колхеті розпочалися ще у давні часи. Це довготривалий процес, який, як показали наші дослідження, все ще триває.

Ключові слова: синантропна рослинність, природна флора, адвентивна флора, інвазія, Аджарія, Грузія