Ukrainian Journal of Natural Sciences
№ 17
Український журнал природничих наук
№ 17

ISSN: 2786-6335 print
ISSN: 2786-6343 online

UDC 574.5+523.3
DOI https://doi.org/10.32782/naturaljournal.17.2026.27

PLANT COMMUNITIES OF THE *ARTEMISIETEA VULGARIS* IN SPONTANEOUS TERRAFORMING MODELS OF EXTRATERRESTRIAL ECOSYSTEMS

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The article is devoted to the study of the prospects for using plant communities of the class for terraforming isolated extraterrestrial ecosystems. The study aims to determine the functional role of Artemisietea vulgaris vegetation within spontaneous terraforming models of extraterrestrial ecosystems. In accordance with the aim, the following tasks were set: to analyze the ecological spectrum of the Artemisietea vulgaris class vegetation; to establish the place of the plant communities of the class in models of vegetation restoration dynamics on substrates lunar regolith simulants. The materials of the study were standard geobotanical descriptions, based on which the classification of plant communities and synphytoindication analysis were carried out. During the study, it was determined that the Artemisietea vulgaris class vegetation in the territory of Ukrainian Polissya belongs to 2 orders, 5 unions, and 20 associations according to the Brown-Blanquet system classification. The limitation of the plant communities of Artemisietea vulgaris to certain types of habitats is noticeable at the level of unions. Plant communities of the Agropyrion repentis union are adapted to distribution on disturbed substrates with a minimum amount of nutrients. Plant communities of the Arction lappae union are more common in places where anthropogenic accumulation of organic and mineral substances occurs in combination with disturbances that suppress natural vegetation. The least humid ecotopes with the highest continentality indicators are occupied by the vegetation of the Dauco-Melilotion and Onopordion acanthii unions. Plant communities of the Rorippo austriacae-Falcarion vulgaris union are ruderal forest edges and ecotonic with groups of nitrophiles of the Galio-Urticetea class. According to the data of the synphytoindication analysis, plant communities of the class are formed under conditions of predominance of anthropogenic dynamics over autogenic. The average indicators of the level of anthropogenic transformation range from 9.39 points (Rorippo austriacae-Falcarion vulgaris union) to 10.30 points (Dauco-Melilotion union), which corresponds to the eugemerob level of anthropotolerance. Modeling by synphytoindication indicators indicates that the vegetation of the Artemisietea vulgaris class can form both on completely disturbed substrates with rock outcrops and on arable land. The next stage of positive autogenic succession will be the stage of shrubs (Rhamno-Prunetea class) or young derived forests (Robinietea class). The course of successions is influenced by edaphic conditions, seed diaspora, and the level of anthropogenic transformation.

Key words: *invasive species, self-restoration of vegetation, space colonization, astroecology, ruderal communities.*

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РОСЛИННІ УГРУПОВАННЯ ARTEMISIETEA VULGARIS У МОДЕЛЯХ СПОНТАННОГО ТЕРАФОРМУВАННЯ ПОЗАЗЕМНИХ ЕКОСИСТЕМ

І. В. Хом'як

Стаття присвячена дослідженню перспектив використання рослинних угруповань класу для тераформування ізольованих позаземних екосистем. Метою дослідження є встановлення місця рослинності класу Artemisietea vulgaris у моделях спонтанного тераформування позаземних екосистем. Відповідно до мети було поставлено такі завдання: здійснити аналіз екологічного спектру рослинності класу Artemisietea vulgaris; встановити місце угруповань класу в моделях динаміки відновлення рослинності на субстратах аналогічних місячному реголіту. Матеріалами дослідження стали стандартні геоботанічні описи, на основі яких здійснювалася класифікація рослинних угруповань та синфітоіндикаційний аналіз. В ході дослідження встановлено, що Рослинність класу Artemisietea vulgaris на території Українського Полісся належить до 2 порядків, 5 союзів та 20 асоціацій згідно із класифікацією за системою Браун-Бланке. Приуроченість угруповань класу Artemisietea vulgaris до певних типів оселищ, помітна на рівні союзів. Рослинні угруповання союзу Agropyrion repentis пристосований до поширення на порушених субстратах із мінімальною кількістю поживних речовин. Рослинні угруповання союзу Arction lappae частіше зустрічається в місцях, де відбувається антропогенне накопичення органічних та мінеральних речовин в поєднанні із порушеннями, які пригнічують природну рослинність. Найменш зволожені екотопи із найвищими показниками континентальності займає рослинність союзів Dauco-Melilotion та Onopordion acanthii. Рослинні угруповання союзу Rorippo austriacae-Falcarion vulgaris є рудеральними узліссями та екотонним із угрупованнями нітрофілів класу Galio-Urticetea. За даними синфітоіндикаційного аналізу рослинні угруповання класу формуються в умовах переважання антропогенної динаміки над автогенною. Середні показники рівня антропогенної трансформації коливаються від 9,39 бала (союз Rorippo austriacae-Falcarion vulgaris) до 10,30 бала (союз Dauco-Melilotion), що відповідає еугемеробному рівню антропотолерантності. Моделювання за синфітоіндикаційним показниками вказує на те, що рослинність класу Artemisietea vulgaris може формуватися, як на повністю порушених субстратах із виходами гірських порід так і на ріллі. Наступною стадією позитивної автогенної сукцесії буде стадія чагарників (клас Rhamno-Prunetea) або молодих похідних лісів (клас Robinietea). На перебіг сукцесій впливають едафічні умови, насіннєва діаспора та рівень антропогенної трансформації.

Ключові слова: *інвазійні види, самовідновлення рослинності, колонізація космосу, астроекологія, рудеральні угруповання.*

Introduction

In the first quarter of the 21st century, humanity is experiencing a new era of space expansion (Ferl & Paul 2010). While in the middle of the 20th century this was driven by the political ambitions of countries that opposed each other in the Cold War, today new reasons and circumstances have emerged (Muszyński-Sulima, 2023). The desire to demonstrate one's technical and financial capabilities as part of ideological superiority has not disappeared (Wahl, 2025). However, more pragmatic goals have also been added to them. First of all, it is about gaining an advantage in control over territories and resources located beyond the borders of the Earth, as well as the technologies that will be used there. We are talking about reserves of Helium-3 (Zwierzyński et al., 2023) and rare chemical elements on the Moon (Przylibski et al., 2025) and asteroids (Trigo-Rodríguez et al., 2025), the placement of production facilities related to microgravity and vacuum, as well as communication and observation systems with permanent bases for their maintenance. All this can become a strategic advantage in the near future (Antony et al., 2025). As the course of the Russian-Ukrainian war shows, some aspects of this process create an undeniable advantage already today. The great powers of the world and their associations have joined the pursuit of leadership in space expansion. These projects are being implemented in the practical plane, both by large space agencies and many private companies (Antony et al., 2026).

All participants in the space race recognize that sooner or later, there will come a point when there will be a need for a permanent presence of people on space stations (Wamelink et al., 2014). This is now a prospect for the coming decades. As part of the «Artemis program», NASA plans not just a landing, but also the creation of a permanent infrastructure (Artemis Base Camp) after 2030. NASA plans rotational missions lasting from several weeks to months, with a gradual transition to a continuous stay (Angelopoulos, 2011). China (CNSA) and Russia (Roscosmos) plan to populate the International Lunar Research Station (ILRS) after 2035. ESA (European Space Agency) promotes the concept of a «Moon Village», which involves combining the efforts of different countries and private companies to create an open infrastructure for scientific research and commerce after 2030 (Heinicke, & Foing, 2021). Elon Musk's private company SpaceX, as part of the Starship HLS program, plans to create a lunar base «Alpha», which could appear as early as the first half of the 2030s, if the Starship tests are successful. We see from the geography and timing of the ambitious plans of different countries that humanity is dealing with a new wave of the space race, aimed primarily at the permanent presence of man beyond the Earth (Farrell et al., 2024).

Unlike previous waves of interest in space exploration, the current one is characterized by its focus on the permanent operation of maximally autonomous bases (Ellery, 2021). It will not be so much about scientific research as it will be about production and security. This will necessarily lead to the fact that such space bases will acquire the features of some types of terrestrial ecosystems, which will develop according to certain universal laws (Duri et al. 2022). First, to provide many materials for a large number of people, it will be more profitable to grow biomaterials directly on the territory of the base (Gibson, 1977). And second, the flow of people will increase significantly. This will most likely lead to an increase in the transfer of spontaneous biota to the station and the creation of more favorable conditions for its development (Zaets et al., 2011). Every living organism, including humans, is, in fact, a synusial ecosystem. On the one hand, this could create a number of unpleasant incidents, which we observe when moving biota both on the surface of our planet and on the International Space Station. On the other hand, we could use these processes to spontaneously terraform parts of isolated ecosystems of lunar bases (Kozyrovska et al., 2006). Such complexes of organisms could independently transform the regolith substrate into fertile soil, forming certain types of ecosystems on its surface (Keeter, 2025).

Observations of the restoration of disturbed substrates under conditions of significant anthropogenic pressure indicate that a model biosystem for studying such processes can be the vegetation of the class *Artemisietea vulgaris* Lohmeyer et al. in Tx. ex von Rochow 1951. On the one hand, it is one of the first to settle on completely soilless substrates, and at the same time, it feels good on cultivated soils (Chirilă et al., 2025). On the other hand, it withstands constant anthropogenic pressure well and is often a companion of human movements. And finally, it includes species that can be used for food, serve as technical or medicinal raw materials (Продромус ..., 2019).

The aim of the study is to establish the place of the *Artemisietea vulgaris* class vegetation in models of spontaneous terraforming of extraterrestrial ecosystems.

In accordance with the aim, the following tasks were set:

– to carry out an analysis of the ecological spectrum of the Artemisietea vulgaris class vegetation;

– to determine the position of the plant communities of the class in models of the dynamics of vegetation restoration on substrates similar to lunar regolith.

Materials and methods

The materials of the study are standard geobotanical descriptions made by the author on the territory of Ukrainian Polissya in the period from 2004 to 2024. The descriptions were made by the route-expedition method. The area of the plot is 1–4 m². The configuration of the plot was determined by the homogeneity of the physical and geographical characteristics of the substrate surface and the dominant vegetation cover. Most of the plots were square. Along roads, reservoirs, arable land, quarries and buildings, the plots were ribbon-shaped with a width of at least 0.5 m. (Якубенко та ін., 2018).

The collected standard geobotanical descriptions were used to classify plant groups (Hennekens, 2009). Vegetation classification was carried out according to the principles of ecological-floristic classification of the Swiss-French school of Braun-Blanquet (Braun-Blanquet, 1964). The vegetation prodrome of Ukraine for 2019 was used to isolate syntaxons and establish their hierarchical relationship (Дубина та ін. 2019). The names of plant species were used in accordance with the amendments given in the checklist for 1999 (Mosyakin & Fedoronchuk, 1999)

To characterize the factors of the settlement environment, methods of synphytoindication are used. For this purpose, the unified Didukh-Plyuta scale, the databases «ECODID» and «ECODBASE 5C», as well as the 18-point scale of anthropogenic transformation and the

21-point scale of the natural dynamics indicator were also used. The results of the synphytoindication analysis and the model of ecosystem dynamics were obtained using the computer software package «SIMAGRL 1.12» (Khomiak, at al., 2024b).

Results

The vegetation of the *Artemisietea vulgaris* class described during field research in the territory of Ukrainian Polissya belongs to 2 orders, 5 unions, and 20 associations according to the Brown-Blanquet classification system. Its syntaxonomic scheme looks like this: *Artemisietea vulgaris* Lohmeyer et al. ex von Rochow 1951: *Agropyretalia intermedio-repentis* T. Müller et Görs 1969: *Convolvulo arvensis-Agropyrion repentis* Görs 1967: *Agropyretum repentis* Felföldy 1942, *Elytrigio repentis-Lycietum barbarum* Kostylev in Solomakha et al. 1992, *Poo compressae-Tussilaginetum farfarae* R. Tx. 1931; *Onopordetalia acanthii* Br.-Bl. et Tx. ex Klika et Hadač 1944: *Arction lappae* R.Tx 1937: *Arctietum lappae* Felföldy 1942, *Arctio lappae-Artemisietum vulgaris* Oberd. ex Seybold et T. Müller 1972, *Balloto-Malvetum sylvestris* Gutte 1966, *Hyoscyamo nigri-Conietum maculati* Slavnić 1951, *Leonuro-Arctietum* Felföldy 1942, *Sambucetum ebuli* Felföldy 1942; *Dauco-Melilotion* Görs et Rostański et Gutte 1967: *Echio-Verbascetum* Sissingh 1950, *Berteroetum incanae* Sissingh et Tideman ex Sissingh 1950, *Dauco-Picridetum hieracioidis* Görs 1966, *Pastinaco sativae-Daucetum carotae* Kost. in V. Solomakha et al. 1992; *Onopordion acanthii* Br.-Bl et al. 1926: *Artemisio-Echinopsetum sphaerocephali* Eliáš 1979, *Balloto-Artemisietum absinthii* Schubert et Mahn 1959, *Carduo acanthoidis-Onopordetum acanthii* Soó ex Jarolímek et al. 1997, *Onopordetum acanthii* Br.-Bl 1926, *Potentillo argenteae-Artemisietum absinthii* Faliński 1965, *Tanaceto-Artemisietum vulgaris* Br.-Bl (1931) 1949; *Rorippo austriacae-Falcarion vulgaris* Levon 1997**:** *Beto trigynae-Urticetum dioicae* Levon 1997.

The limitation of these groups to certain types of habitats is clearly visible at the level of orders and alliances. The *Agropyrion repentis* union of the *Agropyretalia intermedio-repentis* order has low resistance to competitors but an original survival strategy on disturbed substrates with a minimum amount of nutrients. The dominant individuals of edificator species in the associations of this union are essentially clones with a high ability to vegetatively reproduce using the rhizome. One part of the individual can be found on a fertile substrate, where it has access to mineral salts but loses the competition for light. The second part of the clone is found on a disturbed substrate deprived of soil. Here, it has no competitors in the struggle for sunlight. It transfers the substances synthesized as a result of photosynthesis to the common rhizome system and, from there, receives most of the water and minerals. Such a strategy makes it a pioneer of disturbed moderately moist substrates poor in mineral nutrition elements.

Plant communities of the order *Onopordetalia acanthii* occupy substrates with fully or partially formed soil. Vegetation of the *Arctium lappae* union is more common in places where anthropogenic accumulation of organic and mineral substances occurs in combination with disturbances that suppress or destroy non-synanthropized vegetation. Usually, these places are suitable for the rapid reproduction of natural vegetation of higher stages of progressive autogenic succession. However, due to one-time or constant anthropogenic intervention, synanthropic species with a high degree of anthropotolerance gain an advantage here.

The vegetation of the *Dauco-Melilotion* union is adapted to exist on poorer soils with lower indicators of the long-term moisture regime. It can be observed on synatropized wastelands, in mining operations, and on dry meadows with a high level of anthropogenic pressure. The vegetation of the *Onopordion acanthii* union is found in even poorer areas. The *Rorippo austriacae-Falcarion* vulgaris union is close to it, which unites xeromesophilic ruderal vegetation of open and moderately shaded habitats. They occur along roadsides, around lawns, in front gardens, and on earth dumps. In the territory of Polissya, they are often associated with slopes of southern exposure along phanerophyte plantations.

Generalized observations of ecotopes occupied by vegetation of the *Artemisietea vulgaris* class are confirmed by the data of synphytoindication (Table 1). We see that the lowest indicators of the long-term moisture regime are observed in the unions of *Dauco-Melilotion* (10.30 points) and *Onopordion acanthii* (10.77 points). At the same time, these unions have the highest indicators of moisture variability – 7.09 and 7.13, respectively. This indicates that in such areas, optimal soil moisture occurs only during the period of precipitation. Other edaphic indicators are relatively the same. The exception is the environment in which the communities of *Rorippo austriacae-Falcarion vulgaris* union are found. Due to the fact that the vegetation of this alliance often represents ruderal forest edges, the content of available nitrogen and soil aeration have high values here. This makes such a vegetation union ecotonic with ruderal communities of nitrified nodules of the *Galio-Urticetea* class Passrge et Kopecký 1969 (Béguin, et al., 2025).

For most microclimatic indicators, the unions of the class have relatively similar indicators (Table 2). The continentality indicators for the mesoxerophytic unions *Dauco-Melilotion* (9.04 points) and *Onopordion acanthii* (9.17 points) are clearly high. Due to its nodular status, the vegetation of the union has a clearly lower soil surface illumination – 6.56 points, while in other unions, its average values range from 7.36 to 7.56 points.

According to the synphytoindication analysis, plant communities of the class are formed under conditions of predominance of anthropogenic dynamics over autogenic (natural) (Table 3). The average indicators of the level of anthropogenic transformation range from 9.39 points (*Rorippo austriacae-Falcarion vulgaris* union) to 10.30 points (*Dauco-Melilotion* union). This corresponds to the euhemerobic level of anthropotolerance. In some cases, the level of anthropogenic transformation dropped to 7.32 points, which corresponds to mesohemerobia. In most unions, it rose above 11 points, which corresponds to the border between euhemerobia and polyhemerobia.

The average values of the natural dynamics index for most unions of the *Artemisietea vulgaris* class are slightly more than 4 points (4.46–4.97 points). Naturally, in the edge union *Rorippo austriacae-Falcarion vulgaris*, this index is almost twice as high and equals 7.34 points. Such values for the first case correspond to the stage of positive autogenic succession of grasses and wormwoods, for the second case, to the shrub-grass stage or forest edges and clearings. At the same time, we observe a significant amplitude of fluctuations in these indicators. The pioneer communities of the *Agropyrion repentis* union have the least value (2.75 points) and the largest ones of the *Arction lappae* union (9.69 points). The amplitude of fluctuations of the dynamics index varies from 0.44 points (the *Rorippo*

Table 1

Average values of edaphic environmental factors for unions of plant communities of the *Artemisietea vulgaris* class. Symbols: HD – long-term moisture regime, FH – moisture variability, RC – acidity, SL – general salt regime, CA – carbonate content, NT – available nitrogen content, AE – soil aeration

Unions of plant communities	**Indicators of environmental factors (in points according to the unified Didukh-Plyuta scale)**						
	HD	**FH**	**RC**	**SL**	**CA**	**NT**	**AE**
Agropyrion repentis	11.21	6.93	7.95	8.18	7.68	6.51	6.76
Arction lappae	11.05	6.80	7.82	7.55	6.96	6.52	6.46
Dauco-Melilotion	10.30	7.09	7.70	7.70	7.44	5.35	6.00
Onopordion acanthii	10.77	7.13	7.65	7.90	6.64	5.88	6.03
Rorippo austriacae-Falcarion vulgaris	12.02	6.44	8.0	7.55	6.47	8.33	8.09

Table 2

Average values of indicators of microclimatic environmental factors for unions of plant communities of the class *Artemisietea vulgaris*. Symbols: TM – thermalregime, OM – omboregime, KN – continentality, CR – cryoregime, LC – surface illumination

Unions of plant communities	**Indicators of environmental factors (in points according to the unified Didukh-Plyuta scale)**				
	TM	**OM**	**KN**	**CR**	**LC**
Agropyrion repentis	8.52	11.27	8.80	7.84	7.36
Arction lappae	8.58	12.16	8.80	8.32	7.45
Dauco-Melilotion	8.65	11.50	9.04	8.43	7.56
Onopordion acanthii	8.38	12.01	9.17	7.97	7.56
Rorippo austriacae-Falcarion vulgaris	8.48	12.25	8.47	8.36	6.56

austriacae-Falcarion vulgaris union) to 6.54 points (the *Arction lappae* union). The high amplitude of the natural dynamics index in the union is due to edaphic conditions close to the climacteric optimum. Due to this, woody vegetation is rapidly formed here, although the blocks of diagnostic species still belong to the class *Artemisietea vulgaris* and the union *Arction lappae*

Such high maximum values of the natural dynamics index indicate that the next stage of succession with *Artemisietea vulgaris* class vegetation will be the stage of shrubs (*Rhamno-Prunetea* Rivas Goday et Borja Carbonell ex Tüxen 1962) and young derived forests (*Robinietea* Jurco class ex Hadac et Sofron 1980). Which communities will form here will depend on edaphic and orographic conditions, the level of anthropogenic transformation, and the seed diaspora or seed bank formed before the disturbance of the vegetation cover of this area.

Modeling by synphytoindicative indices indicates that the vegetation of the *Agropyrion repentis* union can form both on completely disturbed substrates with rock outcrops and on arable land. At low anthropogenic transformation indices, they will transition to classical meadows, and at high, to communities of their own class but with higher indices of natural dynamics. On rich, moderately moist soils, this will be a transition to the *Arction lappae* union. On dry or poor soils, a short-term transition to the *Dauco-Melilotion or Onopordion acanthii* union is possible. These alliances, depending on the presence of seed diaspora and the level of anthropogenic transformation, can transition to communities of the *Rhamno-Prunetea* class and young *Robinietea* class. If the level of anthropogenic transformation is high, then the probability of the formation of communities of the order *Chelidonio-Robinietalia pseudoacaciae* Jurko ex Hadač et Sofron 1980 (class *Robinietea*) increases. If there are secondary forests nearby and the level of anthropogenic transformation is low, then these will be communities of the order *Sambucetalia racemosae* Oberd. ex Doing 1962 (class *Robinietea*). In the territory of Polissya, shrub vegetation of the class *Rhamno-Prunetea* Rivas Goday et Borja Carbonell ex Tüxen 1962 is occasionally formed on the slopes of the southern exposure with gray forest soils.

Discussion

The plant communities of the class can play both positive and negative roles in isolated extraterrestrial ecosystems. They are resistant to suboptimal edaphic conditions, some of them are capable of vegetative propagation, which is important for microgravity conditions, and are highly productive in terms of phytomass and have high reproductive potential. Their seeds can remain viable for 5-10 years. Typical species of these groups germinate well on lunar regolith simulators. In some experiments with the cultivation of cultivated plants on a lunar regolith simulator, spontaneous penetration of individual representatives of the flora of this class was observed (Paul et al., 2022). Also, these species tolerate moderately strong anthropogenic impact well and are synanthropic companions of the movement of people and goods. On the

Table 3

Indicators of ecosystem dynamics for unions of plant communities of the class Artemisietea vulgaris. Symbols: HE – unified indicator of anthropogenic transformation of ecosystems, ST – indicator of natural ecosystem dynamics.

Unions of plant communities	**Indicators of ecosystem dynamics (in points according to the Didukh-Khomiak scale)**					
	HE			**ST**		
	average	**minimum**	**maximum**	**average**	**minimum**	**maximum**
Agropyrion repentis	10.06	8.82	11.28	4.57	2.75	7.95
Arction lappae	9.69	7.32	11.17	4.97	3.15	9.69
Dauco-Melilotion	10.30	8.71	11.40	4.46	3.28	5.71
Onopordion acanthii	9.76	7.90	11.25	4.76	3.70	7.16
Rorippo austriacae-Falcarion vulgaris	9.39	9.11	9.67	7.34	7.12	7.56

one hand, we will have a classes of ecosystem with several useful services for us, and on the other hand, the risks of introducing harmful weeds into crop plantations (Fackrell et al., 2024).

The vast majority of characteristic species can be used for food or as biomedical supplements. Some of them are a source of fiber, starch, and nectar. For example, the vegetation of the Echio-Verbascetum association in terrestrial conditions can yield up to 200 kg of honey from one hectare. In conditions of limited diet and shortages of medical drugs, such plant communities can have a positive effect on the settlers of extraterrestrial bases. Proven therapeutic effects have medicines created on the basis of plant raw materials from *Artemisia absinthium* L., *Urtica dioica* L., *Tussilago farfara* L., *Melilotus officinalis* (L.) Lam., *Tanacetum vulgare* L., *Achillea millefolium* L., *Elymus repens* (L.) Gould. This allows us to obtain, at the same time, communities with high terraforming potential, which will independently transform the regolith into fertile soil, and at the same time, a source of a large number of substances necessary for the settlers.

Given that planetary terraforming will require a large amount of resources and energy, humanity will face a dilemma during space expansion (Khomiak et al., 2024a). It is an analogue of the “golden rule of mechanics”. We can populate the surface of the planet with the simplest extremophiles, and then its terraforming will stretch for tens or even hundreds of millions of years (Coleine et al., 2025). Or we can transfer huge resources to such a planet and use a large amount of energy to accelerate the terraforming process. In order to obtain such technologies, it is also necessary to spend a lot of time and resources. The way out of the situation is seen in the use of growing areas of partially isolated ecosystems. They will not only be comfortable for human communities to live and work, but also changes in the atmosphere and soil will occur. Carbon dioxide will constantly enter such ecosystems from the external environment, and oxygen will leave. In parallel, the transformation of regolith into fertile soil will occur. The higher the biomass productivity of such a system, the faster the rate of transformation of the planet into a habitable one for humans. However, creating conditions for such highly productive communities also requires time and resources. The *Artemisietea vulgaris* class community can independently carry out the preparatory mission without increased human assistance.

At the same time, they will carry the risk of contamination of plantations of cultivated species with many weeds. Since the use of herbicides in isolated ecosystems carries high risks, when planning the use of groups of this class for the first stage of terraforming, it is necessary to take into account the threats that they may carry. Also, along with groups of this class, invasive species transformers can penetrate. Some of them (*Ambrosia artemisiifolia* L., *Heracleum sosnowskyi* Manden and probably *Solidago canadensis* L.) may pose a threat to the development of natural ecosystems, human life, and health (Khomiak, 2025).

Conclusions

The vegetation of the *Artemisietea vulgaris* class in the territory of Ukrainian Polissya belongs to 2 orders, 5 unions, and 20 associations according to the Brown-Blanquet classification system.

The limitation of the *Artemisietea vulgaris* class communities to certain types of habitats is noticeable at the level of the unions. Plant groups of the *Agropyrion rep*entis union are adapted to spread on disturbed substrates with a minimum amount of nutrients. Plant groups of the *Arction lappae* union are more common in places where there is anthropogenic accumulation of organic and mineral substances in combination with disturbances that suppress natural vegetation. The least humid ecotopes with the highest continentality indicators are occupied by the vegetation of the *Dauco-Melilotion* and *Onopordion acanthii* unions. Plant groups of the *Rorippo austriacae-Falcarion vulgaris* union are ruderal forest edges and ecotonic with groups of nitrophiles of the *Galio-Urticetea* class.

According to the synphytoindication analysis, plant communities of the class are formed under conditions of predominance of anthropogenic dynamics over autogenic. The average indicators of the level of anthropogenic transformation range from 9.39 points (*Rorippo austriacae-Falcarion* vulgaris union) to 10.30 points (*Dauco-Melilotion* union), which corresponds to the euhemeric level of anthropotolerance.

Modeling by synphytoindication indicators indicates that the vegetation of the *Artemisietea vulgaris* class can form both on completely disturbed substrates with rock outcrops and on arable land. The next stage of positive autogenic succession will be the stage of shrubs (*Rhamno-Prunetea* class) or young derived forests (*Robinietea* class). The course of successions is influenced by edaphic conditions, seed diaspora, and the level of anthropogenic transformation.

Artemisietea vulgaris vegetation communities may provide a number of ecosystem services in isolated extraterrestrial settlements and for the first stages of terraforming on colonized planets.

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Дата першого надходження статті до видання: 27.03.2026
Дата прийняття статті до друку після рецензування: 30.04.2026
Дата публікації (оприлюднення) статті: 29.05.2026