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Surviving in Europe: geopolitics of biodiversity conservation illustrated by a proxy species *Viola uliginosa*

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Citation: Ranta, P., A. Jokinen, and S. Laaka-Lindberg. 2016. Surviving in Europe: geopolitics of biodiversity conservation illustrated by a proxy species *Viola uliginosa*. Ecosphere 7(9):e01401. 10.1002/ecs2.1401

Abstract. Building strategies for continental-scale conservation is challenging due to evolutionary and geopolitical problems. How do policy choices arise from this setting? In this study, we integrate ecological research with policy analysis to examine the problem field with a case study research. We use a violet species endemic to Europe, *Viola uliginosa*, as a proxy for a significant European Union (EU)–Russian biodiversity pattern and its conservation. The violet's core populations locate in Belarus, Ukraine, and Russia, and all populations in the EU are peripheral. The species is endangered in 12 EU member states and in decline in many places elsewhere. To analyze the choices of conservation, we gathered data on its ecology, distribution, and conservation mechanisms across Europe, putting additional emphasis on the EU enlargement and long-term site histories in Finland. We found that the survival of the species in the EU depends on the enlargement negotiations, conflicts between the EU biodiversity and agricultural policies, selection of the species to national Red Lists and the Habitats Directive, and contingent site histories depending on the conservation activities by civic actors and the member states. While the evolutionary aspect emphasizes the genetic differentiation potential of peripheral populations, the geopolitical aspect characterizes the EU as simultaneous spaces of a monotopia, borderlands, and polycentric development. We conclude that intersections between these geopolitical spaces can be used with evolutionary perspectives to identify local, European, and network-driven policy choices of conservation.

Key words: conservation by proxy; core and periphery hypothesis; endangered species; European Union; geopolitics; *Viola uliginosa*.

Received 7 June 2015; revised 28 December 2015; accepted 10 March 2016; final version received 29 May 2016. Corresponding Editor: G. Ziv.

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Introduction

In this study, we link ecology with geopolitics to analyze the challenges of biodiversity conservation over the geographic region of Europe. As usual in research of continental-scale conservation (Klein et al. 2009), we incorporate smaller scales as well. We focus on a distribution pattern of European fauna and flora that extends from the European Union (EU) to the Russian parts of eastern Europe or beyond. Examples of species of this group are the common hamster (*Cricetus cricetus*), the Siberian flying squirrel (*Pteromys volans*), and the violet *Viola uliginosa* (Airapetyants and Fokin 2003, Ziomek and Banastek 2007, Jokinen and Ranta 2012). This distribution pattern is recognized in the EU biodiversity policy. It is constituted by (1) core populations, typically located in the east or centered near the EU's eastern border, and (2) peripheral populations, dispersed remotely from the core. This is known as a core and periphery problem in conservation biology, which means that the populations in the core area may differ genetically from the peripheral and isolated populations (Safriel et al. 1994, Fraser 1999, Channell 2004, Hampe and Petit 2005, Leppig and White 2006, Eckert et al. 2008, Cassel-Lundhagen et al. 2009, Stadel 2009, Vakkari et al. 2009, Dudaniec et al. 2012, Cires et al. 2013).

Our research problem is defined as follows: "How are evolutionary and geopolitical perspectives accommodated in the EU conservation strategies for species with a core and periphery distribution?" We elaborate the problem by using the conservation status of *Viola uliginosa* (Besser) both within and outside the EU as a representative model case. This plant species is endemic to Europe and widely in decline. Belarus and Ukraine belong to its strongholds, and it has peripheral populations in several European countries. Additional research questions are as follows: (1) "What is the distribution of *V. uliginosa* over Europe and within single countries?" (2) "How is the EU with its member states enhancing the species' core populations and peripheral populations in terms of ecological, political, and climatic drivers?" (3) "What are the possible strategic solutions to the core and periphery conservation problem of this species?"

The evolutionary perspective of the core and periphery problem refers to the probability that environmental or climatic change may turn a peripheral population into a core population. Usually populations at the margin of a geographic range have been considered more vulnerable than central ones (Channell and Lomolino 2000, Hampe and Petit 2005, García et al. 2009), and they have often been neglected when planning conservation strategies or allocating resources for threatened species. However, populations at the periphery may be valuable from an evolutionary point of view (Lesica and Allendorf 1995, Leppig and White 2006, see also Eckert et al. 2008, Śniegula et al. 2014, Abeli et al. 2014). The conservation value depends on how much these peripheral populations differ from the core populations.

The geopolitical perspective refers to difficulties in conserving populations of fauna and flora across geopolitical units. In general, borders may complicate the conservation of species, and especially changes in borders, as do the propagation of new policies over old borders (Ellison 2014). This is why "geopolitical coordination" (Rodrigues and Gaston 2002) is often demanded by conservationists. Besides these factors, we take a further step in our analysis. The big issue is that possible solutions in biodiversity conservation are intertwined with the changing spatialities through which the EU is defining itself as a political actor. In previous research, this issue has been examined from the perspectives of institutional rebuilding (Fairbrass and Jordan 2001, Baker 2003, Evans et al. 2013, Kluvánková-Oravská et al. 2013), classification of nature (Waterton 2002), and geopolitics (Castree 2003). For us, biodiversity, its evolutionary and geopolitical weight, and the changing EU are co-constituted in policy making. Our aim in this study was to identify policy choices arising from these dynamics, instead of defining a "correct" way of conserving.

We confine the analysis to one species to make an efficient experiment, not in the formal scientific sense of the term but to gain better understanding of the mechanisms of a complicated policy problem. We first describe the research setting and then present our findings, focusing on the distribution and conservation status of *Viola uliginosa* over Europe, its site histories in Finland as a national example, and the significance of the eastern expansion of the EU for the conservation of this species. In the discussion, we focus on the core and periphery problem from the ecological, geopolitical, and evolutionary points of view. We conclude by defining the political spaces which we found as important in European biodiversity conservation, and how these political spaces relate to the ecological core and periphery problem and the emerging importance of peripheral populations in such species as *V. uliginosa*.

The Model Species, Data, and Methods

Viola uliginosa is a wetland species. Typical localities for the species comprise flooded meadows along slowly flowing rivers and streams, shores of rivers and lakes, and *Alnus glutinosa* swamps. The stronghold of the species is located in alluvial and moist lowland forests on both sides of the EU's eastern border (Mosyakin 1999, Khoruzhyk et al. 2005). *Viola uliginosa* is a perennial plant that flowers in early summer and produces seeds with high germination capacity at least in vitro conditions, indicating adaptation to rapid dispersal as a disturbance-dependent species of a seasonally changing (floods, etc.) environment. It has been proposed as a typical indicator species for Fennoscandian deciduous swamp woods (habitat code 9080; Kuris and Ruskule 2006).

We collected comprehensive data of *V. uliginosa* to gain an understanding of its overall distribution and conservation status in Europe (Jokinen and Ranta 2012, updated). These data are based on literature records and national red data books (Ingelög et al. 1993, Kotiranta et al. 1998, Zubakin and Tikhomirov 1998, Tzvelev 2000, Baryla and Kuta 2001, Sorokin 2002, Krupkina 2004, Gärdenfors 2005, Zarzycki and Szelag 2006, Rassi et al. 2010, Wind and Ejrnæs 2014, see also Bilz et al. 2011). The data on occurrence and conservation status in its distribution area in the Russian Federation are based on literature records (Botch 1999, Majevski 2006, Czerepanov 2007). Several red data books have been prepared of the Russian Federation that include *V. uliginosa* in the lists of threatened plants (Kotiranta et al. 1998, Zubakin and Tikhomirov 1998, Sorokin 2002, Krupkina 2004). The situation in the present localities of *V. uliginosa* in Finland is based on extensive fieldwork and checking specimens in botanical museums from the 1990s and continuous monitoring thereafter (Siitonen 1990, Ranta and Siitonen 2011, Jokinen and Ranta 2012).

Finally, the data and discussions on the conservation policies of the EU and its member states were obtained from the literature (Fairbrass and Jordan 2001, Coffrey and Richartz 2003, Heywood and Iriondo 2003, Callmander et al. 2005, Pärtel et al. 2005, Markandya and Chou 2009, Sharrock and Jones 2009, Similä et al. 2010, Cardoso 2012, Cole 2013, Hochkirch et al. 2013, Borgström and Kistenkas 2014, Hoorick 2014, Pe'er et al. 2014, Schoukens and Bastmeijer 2014) and official documents (Council of Europe 1979, European Council 1992, Kemppainen and Mäkelä 2002, Baltic Environmental Forum 2006, Kuris and Ruskule 2006, EEA 2012, European Commission 2012).

After preparing a distribution map for *V. uliginosa* and a summary of its conservation status, we analyzed the influence of conservation planning, policy implementation, and the eastern enlargement of the EU on the current situation

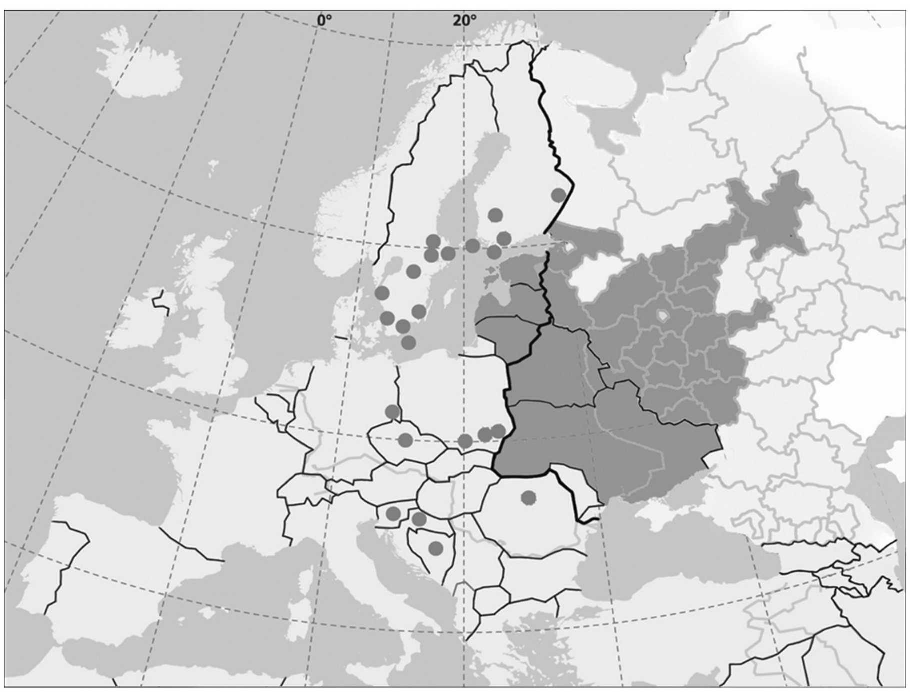

Fig. 1. The updated world distribution map of the European endemic *Viola uliginosa*. The core areas are colored dark gray, and the northern, western, and southern peripheral populations as dark gray circles (updated from Ranta and Siitonen 2011).

of this species in Europe. We also examined the history of the Finnish occurrences during 1851–2014 and their recent management (Jokinen and Ranta 2012, updated). Our primary analytical framework is based on the ecological core and periphery hypothesis (Lawton 1993, Munwes et al. 2010), scale analysis (Cash et al. 2006, Cohen and McCarthy 2014), and geopolitical research (Rumford 2006). Using a single-species approach, several types of data, and a combination of ecological research and policy analysis, we reached the idea of a multidimensional case study research (Yin 2003).

Results

The distribution of Viola uliginosa *and its national conservation status across Europe*

Viola uliginosa is a European endemic plant (Fig. 1). Within its core distribution around the geographic center of Europe, in Belarus, Ukraine, and Russia, the species is bound to riverine and alluvial habitats along the great European rivers: Dnieper, Don, and Volga. The core area of a species' distribution may be defined as a continuous range of the species with favorable conditions. It may be bound by a leading edge and rear edge of the fragmented part of the total distribution area (Hampe and Petit 2005). In the case of *V. uliginosa*, the distribution of a habitat specialist species cannot be continuous, although most suitable habitats are occupied in the core area. It is difficult to determine whether the populations in the EU represent the leading edge or rear end of the population. At both fragmented ends, genetic differentiation is usually higher than in the continuous core area (Safriel et al. 1994).

The localities in 12 EU countries can be regarded as northern, western, and southern outposts of the core distribution (Welk 2001: Fig. 1.2, Ludwig et al. 2007). All the localities of *V. uliginosa* are situated in the boreal or continental biogeographic zones (EEA 2012), the distribution thus extending widely outside of the EU. The core of the distribution area covers the Pripyat and Polesie wetlands in Belarus and Ukraine (Hughes 2003, Čížková et al. 2013). Contrary to their being considered "eastern" as a political term, these areas are biogeographically situated in Central Europe.

The northern edge of the range goes through Finland, where the northernmost population is located at Tohmajärvi, near the border of the Russian Federation (62°13′35″ N, 30°19′55″ E). The westernmost population is found in the province of Halland (Sweden), near Varberg (57°07″ N, 12°13′ E). The southern edge of the range is located in Croatia, at about 48° N.

Several populations are found in the Baltic countries (Zala 1992, Andrušaitis 2003, Kukk and Kull 2005) and Poland (Zając and Zając 2001, Krawczyk et al. 2008). In Sweden, about 130 localities are known, from the province of Scania in the south to the province of Hälsingland in the north. The Dalälven river valley is particularly rich in populations (ArtDatabanken 2010). In Denmark, the species only grows on Bornholm Island (Wind and Ejrnæs 2014), and the status there is considered as rare. The only remaining population in Germany survives in Eastern Saxony (Böhm and Stetzka 2003), with an estimated population of 700 individuals. In the Czech Republic, the presence of the species is doubtful (Grulich 2012). In the south, *V. uliginosa* grows in Slovenia (Jogan 2001, Zelnik 2004, 2005), Croatia (Nikolić 1997), and possibly in Romania (Sárkány-Kiss and Hamar 2002).

Viola uliginosa is regarded as rare, near-threatened, vulnerable, endangered, or critically endangered in many parts of its range (Wraber and Skoberne 1989, Ingelög et al. 1993, Kotiranta et al. 1998, Lilleleht 1998, Tzvelev 2000, Baryla and Kuta 2001, Gärdenfors 2005, Zarzycki and Szelag 2006, Krawczyk et al. 2008, Rassi et al. 2010, Wind and Ejrnæs 2014), especially within the area of the EU.

Site histories in Finland

Viola uliginosa was described as a new species in 1809 (Besser 1809) in Poland near Cracow, and already in 1851, it was recorded from Finland (herbarium specimen in H). Since then, it has been found in 17 localities in southern Finland. All the occurrences have been well documented (Siitonen 1990, Ranta and Siitonen 2011, Jokinen and Ranta 2012). The number of extent populations was at its highest in 1942 with 14 localities (Fig. 2). Since then, several populations have been lost, and there are currently six populations remaining in Finland. Two of these six populations are abundant, consisting of thousands of plants.

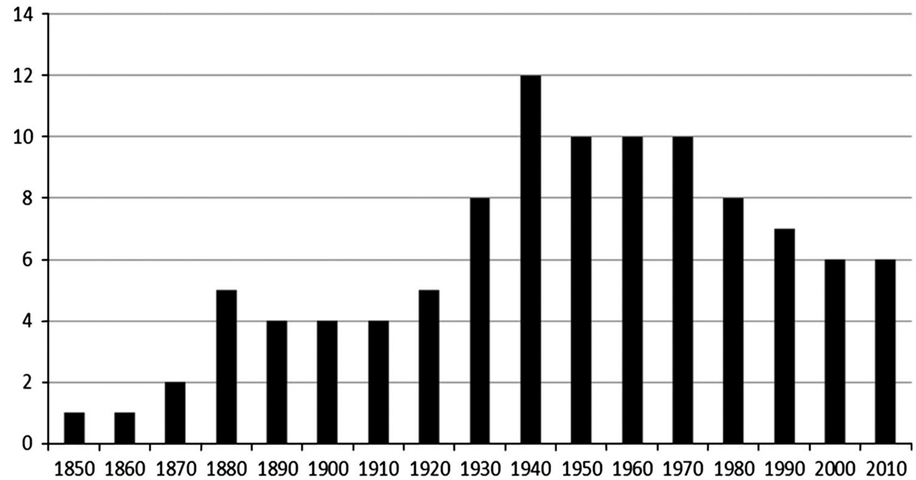

Fig. 2. The number of co-existing known populations of *Viola uliginosa* in 10-year periods since 1850 in Finland (Ranta and Siitonen 2011).

There is no obvious difference in vitality and persistence, such as shoot density and seed production between the northernmost and other localities of *V. uliginosa.* A 3-yr study of permanent plots in Hanko, southern Finland (Siitonen 1990), has shown that the flowering and seed production of *V. uliginosa* are of the same level, 50–80%, as that in Central Europe (Cieślak et al. 2006).

The former population localities from southeastern Finland have all been lost and the national distribution area has thus reduced during recent decades. One population has been replanted with seed material from the original locality via ex situ cultivation in EU LIFE+ project ESCAPE in Helsinki University (see www.luomus.fi/escape). *Viola uliginosa* was reintroduced in Tampere after 40 years of absence (Ranta 2015). An environmental NGO has monitored the southernmost locality in Finland for nearly 30 years and carried out habitat restoration. *Viola uliginosa* has been a protected species in Finland since 1952 and has now been under strict protection since 2005. It is currently classified as endangered (EN, Rassi et al. 2010) in Finland, with the threat assessment of A2ace, B2ab (i, ii, iii, iv, v) (Rassi et al. 2010, IUCN 2012, see also IUCN Standards and Petitions Subcommittee 2010). In Finland, the reduction in the population size has been at least 50% over 10 years and the area of occupancy is now less than 500 km², which fulfills the criteria. The distribution area is severely fragmented and continues to decline (e.g., in the number of mature individuals). Four of the six localities are now protected areas.

In Finland, *V. uliginosa* is additionally included on the ex situ conservation priority list (see www.luomus.fi/escape) of species whose conservation status might be best enhanced by the implementation of ex situ conservation methods (Ryttäri 2013, Ryttäri et al. 2013). Micropropagation of *V. uliginosa* may become a new tool in conservation (Slazak et al. 2014). Also transplantations may strengthen declining populations or reintroduce the species into formerly occupied sites when in situ methods alone have failed.

The shifting context of conservation due to EU enlargement

Throughout its history, the EU has expanded toward the core populations of *V. uliginosa*. Six states (France, West Germany, Italy, Belgium, Luxembourg, and the Netherlands) established the European Coal and Steel Community in 1951, although this remained outside the distribution area of *V. uliginosa*. In 1973, when Denmark joined the European Community, the Danish island of Bornholm became the first locality of *V. uliginosa* within the European community. The reunification of Germany in 1990 brought an additional population to the Union from the former East Germany.

When Austria, Sweden, and Finland joined, in 1995, for the first time, countries with strong populations of *V. uliginosa* were within the Union, and this was much strengthened in 2004, when eight Central and Eastern European countries joined. Within the 28 member states, with the accession of Croatia, also the southern limit of the known distribution is now within the Union. In spite of the massive eastern enlargement of the EU, however, most of the core areas of *V. uliginosa* still remain outside of the Union (Fig. 1).

In 1992, the Treaty of Maastricht raised environmental conservation onto the agenda of the EU. Since then, the Habitats Directive (together with the Birds Directive) has been the cornerstone of European nature conservation policy (European Council 1992). It aims to protect natural and seminatural habitats and the wild fauna and flora. The EU member states report the status of species and habitats listed in the annexes (European Commission 2012, Hochkirch et al. 2013). For the species selected, *favorable conservation status* is the EU policy target to be reached (European Council 1992). In its biodiversity strategy, the EU follows the Aichi targets of halting biodiversity loss by 2020. Because biodiversity in Europe has been continuously in decline, some researchers have demanded fundamental revisions to the lists of species of interest for the Union and other Red Lists (Batáry et al. 2007, Davies et al. 2011, Cardoso 2012). Also, a new vision for the Natura 2000 network is called for to meet the Aichi targets (Hochkirch et al. 2013).

Thus far, *V. uliginosa* is not listed either in the annexes of the Habitats Directive nor mentioned in the annexes of the Bern Convention. The Bern Convention was established by the 47 countries of the Council of Europe (including the Russian Federation and Ukraine) to promote the conservation of wild flora and fauna, and their natural habitats (Council of Europe 1979).

Since the adoption of the Habitats Directive in 1992, the land area of the EU has increased from 2.4 to 4.3 million km², and the number of member states from 12 (1992) to 28 (2013). The Union has expanded into a new biogeographic zone, the boreal zone. Instead of complete revision, the annexes of the Habitats Directive have been amended each time a new member state has joined the Union (Evans et al. 2013). In 2004 and 2007, the candidate states proposed 307 plant taxa and 119 of them were accepted (39%; Evans et al. 2013: Table 3). *Viola uliginosa* was proposed for addition to Annex II by Poland, but it was not accepted (Evans et al. 2013: Appendix 1). The Habitats Directive is also implemented via the Natura 2000 network, and some of its 26,000 conservation areas provide habitat for *V. uliginosa*, in spite of the fact that it has not been a species of interest for the EU.

Discussion

Reasons for the rarity and decline of Viola uliginosa

In Estonia, eight qualitative conservation characteristics have been presented for the prioritization of plant species for conservation (Pärtel et al. 2005). *Viola uliginosa* can be linked to four of these: restricted global distribution (European endemic), restricted local distribution in all European countries, very rare habitat (swamp woods), and dependence upon local natural and human-induced disturbances (regeneration is favored by the suppression of competition due to local disturbances).

Threatened species may also have traits that make them sensitive to decline and extinction (Purvis et al. 2000). These traits include small range and endemism; for example, plants may be restricted to small areas, such as islands. Small range and endemism have inferred the greatest number of extinctions in the past centuries, and such species are predicted to suffer most from such global threats as climate change (Malcolm et al. 2006). Even though *V. uliginosa* is a European endemic species, the total range-map distribution of the species comprises several millions of square kilometers. Occupation of a large area may not, however, be sufficient to ensure species survival under such threats as climate warming.

Rarity itself is a complex biological and ecological set of conditions. Rare species are more prone to become endangered than common and widespread species (Gaston 1997). Understanding the factors responsible for species rarity is fundamentally important for their effective conservation (Hartley and Kunin 2003, Gabrielová et al. 2013). Rabinowitz (1981) and Rabinowitz et al. (1986) described already in the 1980s seven different types of species rarity based on species geographic range, habitat specificity, and population size. Rarity is also a scale-dependent concept. *Viola uliginosa* is not different from other species that are common in their core areas, but rare in the periphery. Rarity as such is not a cause of, though may often predispose toward, endangerment. Stochastic events may destroy several of the few existing localities, especially in the peripheral areas. For example in Finland, two populations of *V. uliginosa* were destroyed by railway construction, although the railway network in Finland is not dense by European standards. Such "bad luck" events may have a devastating effect on small fragmented populations. Some stochastic events have erratic consequences, such as the explosion of the nuclear power plant in Chernobyl in 1986, very close to the core areas of the species in Belarus and Ukraine. The many effects of the Chernobyl accident on ecology and biology are summarized in several publications (Geras'kin et al. 2008).

The third trait affecting the vulnerability of rare species is specialization of habitat or to a narrow ecological niche. This trait applies to *V. uliginosa*, as a disturbance-dependent wetland species (Reier et al. 2005). It is highly susceptible to changes in habitat quality and regularity of flood pulses. For this reason, wetland species may easily become threatened (Smith et al. 2005). Habitat loss has also affected wetlands in particular in the past, as many wetlands have been drained for agricultural expansion or flood protection. Flooding is a natural disturbance, like fire, wind, or erosion. Furthermore, in Finland, the typical habitats of *V. uliginosa*, including flooded riparian meadows and *Alnus glutinosa* swamps, are considered to be threatened habitat types (see Raunio et al. 2008).

Conservation across changing borders

Biodiversity as such tells nothing without reference to scale. This is why biodiversity conservation is a policy field that creates new objects of governance through processes of rescaling (Cash et al. 2006, Kluvánková-Oravská et al. 2013, Cohen and McCarthy 2014). Our findings show constant rescaling when the EU and its member states define the conservation status of *V. uliginosa* and measures for its conservation. The practices of rescaling range from using seeds or genetics of single plant individuals to promoting site-specific conservation, to making national red data books and to relating the geopolitical border dynamics with conservation. These practices, carried out by institutions, scientific experts, NGOs, and many other bodies, help us identify geopolitical and evolutionary aspects of conservation and how they are balanced in different situations in policy making.

We found several indications that biodiversity conservation and the EU are co-constituted processes in the making. When the EU defines its biodiversity policy, it continuously defines itself as a political actor. As our findings show, this is reflected in difficulties the EU has with scales and borders in conservation (Christiansen et al. 2000). First, the problem of *V. uliginosa* in Europe is a challenge of scale, where the jurisdictional scale covers only a part of the spatial case, the total European distribution. The intergovernmental jurisdictional scale ends at the eastern border of the EU, but the core area of the distribution continues on the other side. The continent is divided by many national, political, and ideological boundaries, which makes it difficult to plan conservation strategy for the global population.

Secondly, national territories matter as well, because national borders do not limit the ecosystems and processes affecting biological diversity. A species may be rare on one side of the border, but common on the other side. Conservation planning uses geopolitical units, not biogeographic units, thus operating mainly on a national level. From a global point of view, this may affect the conservation relevance of the species (Rodrigues and Gaston 2002). The situation is more complicated when the geopolitical units and their borders change (Ellison 2014). Many changes have taken place in Europe during the last 25 years, including the unification of Germany in 1990, dissolution of the Soviet Union in 1991 and Yugoslavia in 1992. Russia, Estonia, Latvia, Lithuania, Belarus, Ukraine, Serbia, Montenegro, Slovenia, Macedonia, Croatia, Bosnia-Herzegovina, and Moldova are new European states, and most of these are in either core or peripheral habitats of *V. uliginosa*.

Thirdly, the successive eastern enlargements of the EU in 1995, 2004, 2007, and 2013 did not change national borders but signified propagation of new governance and policies over existing borders. The environmental effects of changing borders have been analyzed in several papers (Fairbrass and Jordan 2001, Baker 2003, Markandya and Chou 2009, Knorn et al. 2013). In the enlarged EU, the new agricultural policies in particular have had negative influence on biodiversity. In several Central and Eastern European (CEE) countries, joining has given rise to new conflicts between biodiversity conservation and economic activities. The CEE countries had rich biodiversity on extensively managed fields, forests, and meadows, which may be lost due to land-use intensification (Hartel et al. 2010, Kamp 2012, Dahlström et al. 2013). The whole agricultural policy of the EU has been questioned as unsustainable and diluted (Pe'er et al. 2014). We argue that the EU eastern border may be protective for species like *V. uliginosa*, which occur on both sides, as some potentially harmful policies will not spread to the core areas of the species. However, the core area countries may have difficulties and weaknesses in the implementation of biodiversity conservation (USAID 2007).

As we noted, during the accession negotiations in 2004 and 2007, *V. uliginosa* was proposed, but not accepted as a new species to the annexes of the Habitats Directive. There were no European red lists available for the selection of species for most of the groups of plants, so several sets of criteria were used (Evans et al. 2013). We interpret that the EU's identity building was present when these selection criteria were applied. This was obvious when Romania proposed species of the Black Sea that were rejected because of their uniqueness and "an overpresentation of endemics in one region" (Evans et al. 2013).

Finally, the European-wide red lists and maps are important tools of representation. In 2011, the European Commission published the first European Red List of vascular plants (Bilz et al. 2011). Although only eight percentage of Europe's flora was assessed in this first version, it shows that the EU is interested in the biodiversity of the whole geographic region of Europe. As the work goes on, more distribution patterns like that of *V. uliginosa* (Fig. 1) will be identified. Hence, it is probable that the core and periphery problem of conservation and its ecological, geopolitical, and evolutionary aspects we have analyzed in this study will come to the fore.

The evolutionary potential of peripheral populations

As we have shown, all the populations of *V. uliginosa* in the EU are peripheral. The core and periphery hypothesis predicts that populations located at the periphery of a species' range increasingly experience unfavorable ecological conditions. Finally, as species' ecological limits are reached, populations become spatially isolated and suffer fitness declines associated with the approaching edge of the range.

According to the old paradigm, peripheral populations do not merit special protection, primarily because they are often inviable and have low conservation value because of their low genetic diversity (Channell 2004). These arguments have been tested in several studies on a diverse range of taxa. In the literature reviewed by Channell (2004), 60% of the species covered showed no significant difference in their genetic diversity between core and peripheral populations. Some species may even persist better at the periphery of their range than near the core (Channell and Lomolino 2000). In conclusion, the general exclusion of peripheral populations is not scientifically justified (Shreeve et al. 1996, Fraser 1999, Leppig and White 2006, Eckert et al. 2008, Koprowski et al. 2008, Cassel-Lundhagen et al. 2009, Cires et al. 2013).

Peripheral populations raise a question concerning not only the evolutionary potential of *V. uliginosa* but also red lists and other means used in the conservation of local populations. The Red Lists of endangered species are usually prepared for global, regional, national, or local levels. In each red list, the assessment is exclusively based on the chosen spatial unit, and careful consideration is needed when applied to other level (IUCN Standards and Petitions Subcommittee 2010, Syfert et al. 2014). The red lists in our data follow national borders, but we also found cases that break the principle. For instance, Schnittler and Günther (1999) combined 13 red lists to assess the central European vascular plants requiring priority conservation measures. This is a new and innovative approach, but the included species were very selected by using strict criteria. The endangered species should be on four national red lists to qualify, but *V. uliginosa* appears only on two lists, and was excluded from the priority list. Another example is the new vascular plant red list for England (outside the distribution of *V. uliginosa*), in which the European edge of species range is noted (Stroh et al. 2014), but did not influence the evaluation of threat categories. However, the edge of range does not necessarily mean fragmentation.

A recommendable approach for making Red Lists is to take into account the global distribution of species, degree of threat, and the global responsibility of conservation in a given country or region (Welk 2001, 2002, Ludwig et al. 2007). This approach has direct implications for *V. uliginosa*, because it takes into account the genetic differentiation of peripheral populations. Welk (2001) specifies the point by stating that the German state of Sachsen-Anhalt has national and global responsibility for safeguarding the local population of *V. uliginosa* because of its high genetic differentiation potential. Consequently, *V. uliginosa* occupies the 22nd position in his ranking list of the conservation value of German vascular plants.

This approach may be valid in Finland as well. In face of the lack of genetic evidence, there is no apparent reason to believe that the northernmost locality of *V. uliginosa* in the world should be a case where it is important "to ensure that scarce resources were not spent on species that could not be recovered because they were limited by climate or habitat factors beyond human control" (Fraser 1999, see also Tullock et al. 2014). In comparison, another species at the edge of its range, the European white elm (*Ulmus laevis*) showed high genetic differentiation in marginal populations in southern Finland (Vakkari et al. 2009). Such peripheral populations of fauna and flora may have significant cultural values as well. In all, more genetic research of peripheral populations of *V. uliginosa* is needed. Thus far, low genetic variability has been reported at the *locus classicus* of this species in Rząska, near Cracow in Poland (Cieślak et al. 2006).

Considering the current situation, we claim that the peripheral populations of *V. uliginosa* at the edge of its distribution area are valuable for conservation because of their evolutionary potential. The high conservation value of this diminishing plant species should also be recognized at the EU level. At the northernmost part of its range, *V. uliginosa* may be included in the category of "leading-edge peripheral species." This term was coined in British Columbia and states that these species will be the first to populate habitats further north as the climate gets warmer (Pacific Institute for Climate Solutions 2012). The Finnish projects of ex situ conservation, habitat restoration and transplantation may become highly relevant also elsewhere in peripheral areas of the range of *V. uliginosa*. These practices entail multiactor networks and the engagement of interested citizens, which is a crucial element of the geopolitics of nature.

The geopolitical spaces of conservation

As our analysis has shown, conservation activities of *V. uliginosa* and the shifting context of conservation create complex situations across various scales and levels of governance all over Europe. This dynamics opens up different policy choices. It is notable that these policy choices do not only follow the traditional understanding of geopolitics based on national territories but rather they show the dynamics of novel geopolitical spaces in the EU, sometimes called postnational geopolitics (Bulkeley 2005, Scott 2009). It has been suggested that there are three categories of such geopolitical spaces (Rumford 2006), which is consistent with our findings. First, the Habitats Directive represents the EU as a *monotopia*, because it aims to harmonize the European space and its biodiversity. Shifting borders make this process incoherent. A broader demonstration is the red list of vascular plants over the whole geographic Europe published by the European Commission.

Secondly, our case study illustrates that the border between the EU and non-EU is not only a dividing line but also a *borderland*, which means a zone of exchange and connectivity (Rumford 2006). It remains to be seen whether the EU's Neighbourhood Policy (Scott 2009) or other policy mechanisms are effective in conserving European biodiversity on both sides of the EU eastern border. The green belt between Finland and Russia (Zmelik et al. 2011) provides an example of significant cross-border cooperation in biodiversity conservation. As we mentioned, near the core populations of *V. uliginosa*, the jurisdictional divide between the EU and non-EU may be not only negative. Although the EU has strong mechanisms of nature conservation, its agricultural policy has been destructive to biodiversity in eastern Europe (Hartel et al. 2010, Kamp 2012, Dahlström et al. 2013).

Thirdly, *polycentric development* characterizes the current EU in nonterritorial ways. This means that there are simultaneous active processes of conservation, both of which function bottom-up and as network processes, and some of these transfer species-specific know-how between localities. In our case, these processes include the definition of the evolutionary aspect of peripheral populations, the roles of cities and urban regions in biodiversity policy, symbolic and cultural meanings of local conservation of species, ex situ conservation, habitat restoration and transplantation, and the increasing role of citizens and NGOs in local, national, and international networks of conservation.

These three geopolitical spaces are simultaneous; therefore, conservation activities from different origins may intersect. For instance, cross-national civic or specialist networks may contact the borderland where the EU is defining new principles of conservation. Policy choices and also tensions and disputes may arise from these intersections.

Conclusions

Biodiversity has become one of the key elements in the new geopolitical world order (Castree 2003). At the same time, the ecological core and periphery problems over continental scales are becoming increasingly important in conservation research and biodiversity policy because of climate change and other reasons (Eckert et al. 2008, Abeli et al. 2014). The case of *Viola uliginosa* can be generalized as a core and periphery problem in contexts where biodiversity, climate change, and geopolitics are intertwined. More specifically, our analysis with this European endemic species shows how borders, ecological and genetic knowledge, rescaling, and geopolitics related to local activities shape biodiversity as it is defined and implemented across Europe.

The distribution pattern of *V. uliginosa* with core populations located near the EU eastern border and peripheral populations in the EU is similar to many other taxa in Europe. Novel geopolitical spaces called monotopia, borderland, and polycentric development help us understand the large-scale conservation problems of such species in the EU and across Europe. It is remarkable that these three European spaces are simultaneous, and they do not transfer neatly onto the surface area of the EU, and they are distinct from the territorial places and spaces of the nation-state (Rumford 2006). This threefold dynamism is in play when the EU defines itself as a political actor and at the same time defines its biodiversity policy, demonstrating that biodiversity and the EU are co-constitutive processes. Consequently, new policy opportunities open up constantly, and the rescaled governance must actively define and create its object of conservation, *V. uliginosa*, in new ways.

We conclude that the intersections of these three geopolitical spaces can be used with evolutionary perspectives to identify local, cross-European, and network-driven policy choices of conservation. In the current situation, when the object of governance is contested because of both science (unknown genetics of peripheral populations) and war (increased tension in Ukraine), it may be highly challenging to identify and exploit multiscale or multilevel opportunities in conservation (Cash et al. 2006). We consider that the value of peripheral populations of such species as *V. uliginosa* is increasing in Europe for the reasons of global environmental change. They have evolutionary potential, but making decisions exclusively on the basis of the science of genetics would be a one-sided political act. Peripheral populations may be valuable for many other reasons too, and local people and multiactor networks are needed when conservation policies are defined.

Acknowledgments

The authors thank Jari Niemelä and Pertti Uotila for comments and contributing toward the development of this work. Maiju Rekola, Panu Piirtola, and Mikko Siitonen helped in the field. A grant was obtained from Vanamo Society for field work. LIFE+2011 BIO/FI/917 ESCAPE project provided support for work of SLL and production of the distribution map.

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