

DIVERSITY OF BUTTERFLIES (Lepidoptera: Papilionoidea & Hesperioidea) IN PRESPA NATIONAL PARK (ALBANIA)

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1. Introduction

1.1 Literature review (present knowledge)

Due to the fact that Albania was a prohibited country during the communist regime, not much research has been carried out in the period after the Second World War up until the 1990s. The research done in that period was in a form of solemn visits of expeditions and notifications of Moucha (1963a, 1963b), Alberti (1965) and Popescu-Gorj (1971). Before this period there are several publications available that are presenting checklists of butterflies in Albania. The first one published is by Dr. Hans Rebel (Rebel, 1913) in which 89 species of butterflies have been listed for Albania. Later on, Rebel and Zerny (1931) provided much more comprehensive list publishing 167 butterfly species for the Albanian butterfly fauna.

The first local entomologist who published a list of butterfly species was Murraj (1972) who compiled an identification key for 93 species (Verovnik & Popović, 2013a). Later on, Misja and Kurrizi (1984) updated the already produced list of species and came up with 180 species. Several new findings for the country were added, including *Danaus chrysippus* (Linnaeus, 1758) (published also as new for Albania by Luquet and Misja (1989)), *Euphydryas maturna* (Linnaeus, 1758), *Satyrus actaea* (Esper, 1781) and *Pseudochazara mamurra* (Herrich-Schäffer, 1852) (Verovnik & Popović, 2013a).

After the 1990s the butterfly research in this country has slightly increased. Beshkov (1995) and Abadijev & Beshkov (1996) published three new species for the Albanian butterfly fauna: *Muschampia proto* (Ochsenheimer, 1808), *Hipparchia senthes* (Fruhstorfer, 1908) and *Hipparchia volgensis* (Mazochin-Porshnjakov, 1952), while Verovnik and Popović (2013b) reported as many during the survey in south-eastern Albania in July 2012: *Colias aurorina* Herrich-Schäffer, 1850, *Pieris balcana* Lorković, 1970 and *Apatura iris* (Linnaeus, 1758).

The Butterfly fauna of Albania was then summarized by Van Swaay & Warren in 1999 (Van Swaay and Warren 1999), but not during the last assessment of the European Red List of

Butterflies in 2010 (van Swaay et al., 2010). In the 1999 publication, a total of 173 butterfly species were listed as present in the country, among which *Euchloe penia* (Freyer, 1852), *Nymphalis vaualbum* ([Denis & Schiffermüller], 1775), *Hipparchia hermione* (Linnaeus, 1764) and *Pseudochazara cingovskii* (Gross, 1973) were important new additions. However, as none of these records was published separately, their inclusion should be regarded as questionable (Verovnik & Popović, 2013a). Fauna Europaea (<http://www.faunaeur.org>, 2012) list of 169 species for Albania has most probably several other omissions.

Finally, Verovnik & Popović (2013a) have summarized all the previous records of published data for Albania in their publication and came up with 196 species. Furthermore in their paper, 17 dubious species are discussed for possible mistakes in determination and need for further confirmation.

1.2 Conservation importance of the investigated group

The butterflies are one of the rare groups of insects in Europe that a great deal of conservation attention has been paid. One of the reasons for this is because butterflies and moths are declining in most of the countries throughout the continent. In order to stop the further decline, the UK Butterfly Conservation and the Dutch Butterfly Conservation started an initiative called Butterfly Conservation Europe in 2004. Furthermore, the establishment of Prime Butterfly Areas (PBA) in Europe designates the most important regions for butterflies in the continent. PBAs are a selection of important butterfly areas in Europe, focusing on target species that are conservation priorities. The PBA's support the identification and management of biodiversity hotspots, core areas of ecological networks, and professionals involved with everyday management of core areas (Van Swaay and Warren, 2003). Also, identification of these areas is in full co-ordination and supports other initiatives like Natura 2000, the Pan-European Ecological Network (PEEN), the Pan-European Biological and Landscape Diversity Strategy, the Emerald Network and the Bern Convention. Europe contains 576 butterfly species, one third of which are endemic for the continent. Out of these 576 butterfly species, 71 species (12 %) are considered threatened according to the new IUCN criteria. They comprise 19 globally threatened species and 52 threatened at the European level. With the above mention criteria for the selection of the target species that can be used for the selection of the PBA's, a total number of 34 butterfly species were chosen. Taking these species into consideration, there are 431 PBAs in Europe covering more than 21 million ha, which is 1,8% of the land area in Europe (van Swaay and Warren 2003).

A total of 17 PBAs have been identified for Albania covering 34.504 hectares. The four target species which are representing the PBAs in Albania are: *Euphydryas aurinia*, *Lycaena ottomana*, *Maculinea arion* and *Parnassius apollo* (Misja, 2003). Prespa Lake is not part of the Prime Butterfly Areas in Albania.

2. Methodology

2.1 Sampling methods

We collected the butterfly specimens using entomological nets. Most of the “easily” recognisable species were released on site after the determination. Species which were more difficult to recognize were placed in a paper envelopes on which data on locality, habitat, date and altitude was recorded.

On each visited locality we spent from one to three hours. In the radius of ~500 m we randomly recorded species. We haven't used any transects for counting and abundance estimation.

The research took place from the end of May until end of September 2013 in four occasions: 23 of May, 22-26 of June, 22-24 July and 24-25 September.

2.2 Determination of species and their distribution areals

The species were determinate using the following literature: Scheider and Jaksic (1989); Abadjiev (1992, 1993, 1995); Pamperis (1997); Tolman (1997, 2009) and Lafranchis (2004). The nomenclature in the paper is according to Fauna Europaea (<http://www.faunaeur.org>).

3. Investigated area

The research took place in the Albanian side of Prespa region, an area covering 28.000 hectares. From 2000 this region is under protection and forming the Prespa National Park. We investigated two major biotopes during the research: mountain Galichica and shore habitats of Prespa Lake.

3.1 Localities & Habitats

In total, we visited 10 habitats in 11 different localities (Tab. 1). The habitats are divided into two main biotopes: mountain of Galichica and Prespa Lake (both small and great lake). Habitats which are up to 300 m from the shore and up to 950 m asl (the lakes are on the 850 m asl) belong to the habitats of the lake biotope. All the habitats above this altitude were placed under the mountain biotope.

Table 1. Localities and habitats in the investigated area

Biotopes	Localities	Habitats
Lake	1 Dlaboko, St. Marena	gravel shore
	2 Mal Grad	gravel shore
	3 Small Prespa Lake	clearing in oak forest
		ruderal habitat
		hill pasture
	4 v. Globochani	gravel shore
		ruderal habitat
5 v. Dolna Gorica	termophilus oak forest	
Mountian	6 v. Zrnovsko	gravel shore
		shrubland
	7 v. Tuminec	reedbed
	8 Lokva	meadow
		reedbed
	9 Pikina Voda	clearing in beech forest
		clearing in mixed forest
		reedbed
	10 Plaja e Pusit	high-mountain pasture
		high-mountain pasture
	11 Cerovska Lokva	reedbed

4. Results

Our aim of the study was to investigate the species richness and record the important butterfly species for conservation. Table 2 presents all 73 species (37% of the Albanian butterfly fauna (Verovnik & Popović 2013a)) detected during our study and their affiliation towards different habitats they live in. Most of the species (29) were found on the gravel shore close to the Prespa Lake, but also in termophilous oak forests (24) and clearings in beech forest (20). Locality-wise, most species were recorded on Galichica mountain (51), on the locality Pikina Voda (37) and on the high-mountain pastures close to Galichica's highest peak Plaja e Pusit (16 species). Lake habitats are represented with 47 species predominantly recorded on Small Prespa Lake (13 species), but also in the vicinity of the villages Dolna Gorica (13), Zrnovsko (12) and Globochani (11). Furthermore, 25 species were found in both mountain and lake habitats of the Prespa National Park.

Due to the fact that this research begun in late spring, lack of species with spring time flight periods is expected (*Anthocharis gruneri*, *A. cardamines*, *A. damone*, *Tarucus balcanicus* etc.)

4.1 Species diversity

Table 2 shows the list of all the species recorded during the research period in the Albanian Prespa National Park. The species are presented by families and in an alphabetical order. Localities in which each species was recorded is given in the following column. The numbers stands for a code for the name of the locality which can be found in Table 1 and Fig. 1. Habitats in which butterflies were recorded are in the next 10 columns.

In total, we've encountered 24 species from the Nymphalidae family, 22 from Lycaenidae, 12 from Pieridae, 11 from Hesperidae and 3 from Papilionidae. During our study, we haven't discovered any species new to the Albanian butterfly fauna.

Table 2. List of species recorded in the investigated area by localities and habitats

No	Species	Localities (see Table 1 for codes)	Habitats									
			Gravel shore	ruderal habitat	hill pasture	Shrubland	thermophilous oak forest	clearing in beech forest	clearing in mixed forest	Reedbed	highmountain pasture	meadow
Hesperidae												
1	<i>Carcharodus alceae</i> (Esper 1780)	3, 5		+				+				
2	<i>Erynnis marloyi</i> (Boisduval 1834)	10										+
3	<i>Pyrgus armoricanus</i> (Oberthür 1910)	7									+	
4	<i>Pyrgus cinarae</i> (Rambur 1839)	5, 9						+		+		
5	<i>Pyrgus malvae</i> (Linnaeus 1758)	1	+									
6	<i>Pyrgus sidae</i> (Esper 1784)	9, 11							+		+	
7	<i>Spialia orbifer</i> (Hübner 1823)	5						+				
8	<i>Spialia phlomidis</i> (Herrich-Schäffer 1845)	4	+									
9	<i>Thymelicus acteon</i> (Rottemburg 1775)	4	+									
10	<i>Thymelicus lineola</i> (Ochsenheimer 1808)	9								+		
11	<i>Thymelicus sylvestris</i> (Poda 1761)	5						+				
Papilionidae												
12	<i>Iphiclides podalirius</i> (Linnaeus 1758)	6	+									
13	<i>Papilio machaon</i> Linnaeus 1758	1, 2, 10	+									+
14	<i>Parnassius apollo</i> (Linnaeus 1758)	9, 10							+			+
Pieridae												
15	<i>Aporia crataegi</i> (Linnaeus 1758)	4, 8	+								+	
16	<i>Colias alfacariensis</i> Ribbe 1905	6, 9	+					+	+			
17	<i>Colias croceus</i> (Fourcroy 1785)	1, 2, 3, 9, 11	+	+					+		+	

4.2 Important species

Fourteen species out of the 73 recorded in the region are considered to be of a conservation importance (Tab. 3). Several criteria served in this selection such as: presence of the species in any of the annexes of the European conventions and directives (Bern Convention, Habitat Directive, CITES etc.), distribution is restricted to Europe and occurrence of a species in any of the threatened category of the Albanian Red Data book.

Table 3. Conservation-important species found in the investigated area

Species	Bern Convention Annex II	Habitat Directive Annex II	Habitat Directive Annex IV	CITES Appendix II	CORINE biotopes	Distribution restricted to Europe	Global IUCN Red List of species	European Red List of Butterflies 2010	Red Data Book of Albania 2007
Fam. HESPERIIDAE									
1								LC	VU
2					+			LC	VU
3					+			LC	EN
4								LC	LR (nt)
5					+			NT	VU
Fam. PAPILIONIDAE									
6	+		+	+	+		VU	NT	CR
Fam. PIERIDAE									
7						+	LC	LC	
8								LC	VU
Fam. LYCAENIDAE									
9		+	+		+			NT	CR
10					+			LC	VU
Fam. NYMPHALIDAE									
11						+	LC	LC	
12								LC	VU
13					+			LC	VU
14					+	+	LC	LC	

Abbreviations: LC – least concern; NT – Near threatened; LR (nt) – lower risk (near threatened); VU – vulnerable; EN – endangered; CR – critically endangered.

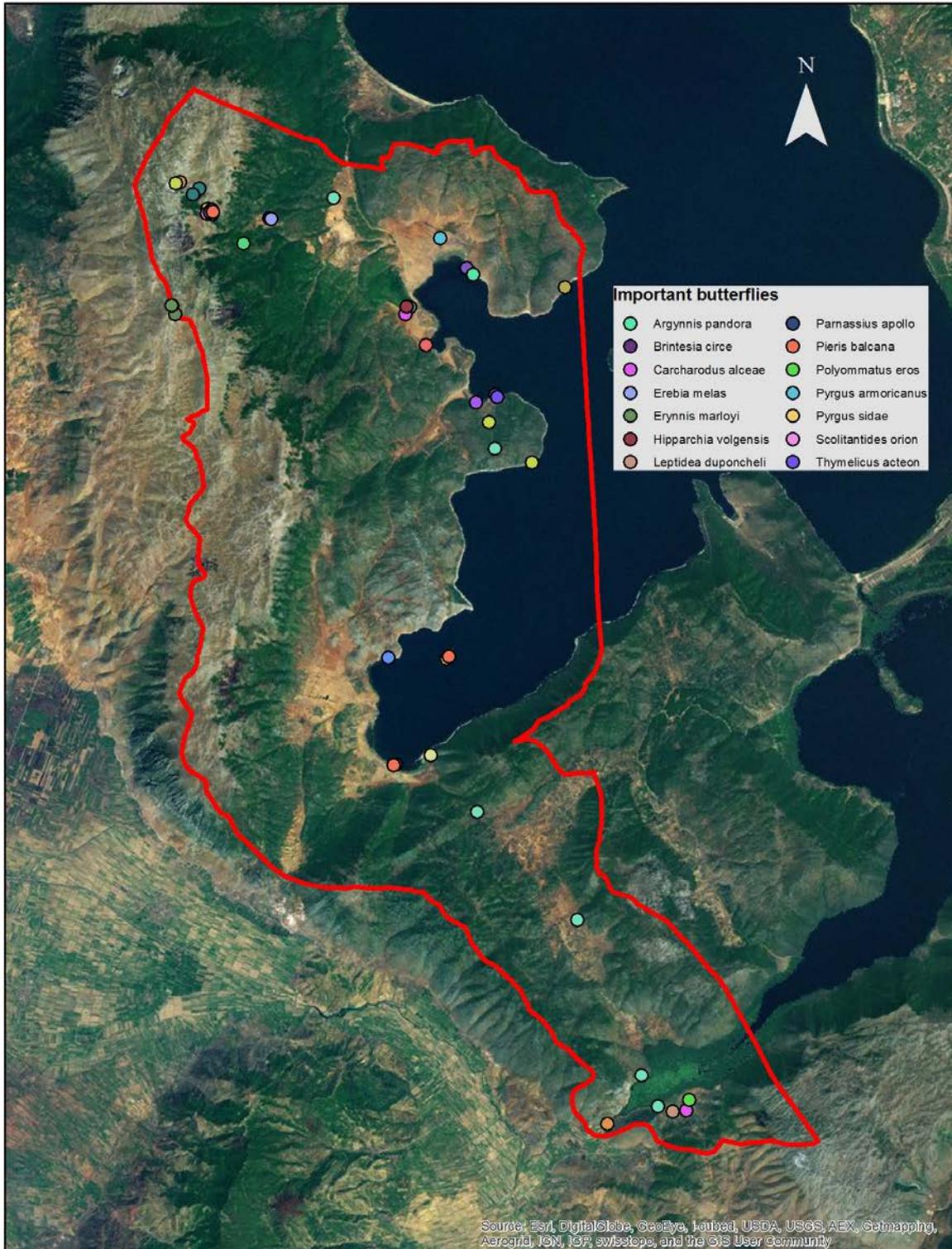


Figure 1. Important species of daily butterflies in Prespa National Park (Albania).

4.2.1 Global IUCN red list of species

The Global IUCN Red List of species has evaluated only four of the 73 species recorded during our research (Tab. 3). According to this list (<http://www.iucnredlist.org>), only the

Apollo butterfly (*Parnassius apollo*) is placed in one of the threatened categories (Vulnerable). On the other hand, the European Red List of Butterflies (Van Sway *et al.* 2010) has placed this species into near threatened category. In this publication, none of the 73 recorded species is placed in one of the threatened categories.

4.2.2 Albanian red list of species

According to the Albanian Red Data Book, there are 57 species belonging to the threatened category among which three species are listed as **Critically Endangered** (*Parnassius apollo*, *Polyommatus eroides* and *Melanargia russiae*), two as **Endangered** (*Pyrgus armoricanus* and *Maculinea arion*), while 52 are considered **Vulnerable**. Of these 57 species, we have encountered 11 in the investigated area and additional three species which are not in one of the threatened categories of the Red Data book of the country, but are considered important according to other directives and conventions (Tab. 3).

4.2.3 European legislation (Habitats Directive, Bern Convention)

Only two taxons met these criteria – *Parnassius apollo* and *Polyommatus eros eroides*. Note that in the Annexes 2 and 4 of the Habitat Directive, *Polyommatus eroides* is ranked in the level of species and not subspecies. According to Fauna Europaea (<http://www.faunaeur.org>), this taxon is now ranked in the sub-specific level.

In this report, we have also included the species listed under the Appendix II of the CITES convention as well as the species listed in the CORINE biotopes data bases (Tab. 3).

4.2.4 Endemic species

From the total list of recorded species, the distribution of only three species is restricted to the European Continent. Two of which (*Erebia melas* and *Pieris balcana*) are endemic to Balkan Peninsula. *Hipparchia volgensis* is distributed in South-East Europe.

4.2.5 Relict species

In our investigated area, glacial butterfly relicts were recorded in higher altitudes on mountain Galichica. Typical representatives of this group are: *Parnassius apollo*, *Erebia melas*, *Pyrgus sidae*, *Aglais urticae*, *Coenonympha leander*, *Lycaena tityrus* etc.

4.2.6 Rare species

Perhaps the only two species found in Prespa region during our research that can fall into this category are *Spialia phlomidis* and *Erynnis marloyi* – both relatively scarcely distributed butterflies in southern Balkans and Central Asia (Tolman, 1997). *Spialia phlomidis* is reported from the Macedonian side of Prespa, whereas *Erynnis marloyi* is present only in the central part of Macedonia, along river Vardar (Scheider & Jakshic, 1989).

4.2.7 Ecologically important species (keystone, umbrella, flagship species)

Lepidoptera, in particular butterflies, are the most frequent conservation targets amongst invertebrates. Butterflies are also one of the most numerous insects listed on schedules of protected species (New, 1997). As a consequence of this interest, detailed information is available on their distribution and ecology and on strategies to conserve and manage their habitats which lead to flagship taxa – taxa that can gain public sympathy for broader conservation needs (New, 1997).

The Apollo butterfly (*Parnassius apollo*) is one such case of a flagship taxon (Haslett, 2007). Alongside is the Large Blue (*Phengaris arion*) (Thomas, 1995) and Large Cooper (*Lycaena dispar*), which according to Scheider & Jakshic (1989) both can be found in the Prespa basin.

4.3 Important localities for the investigated group

The locality with most records (37 species) is Pikina Voda (see map in Chapter 9). This locality is located on the mountain Galichica at around 1500 m asl. One of the reasons for a high diversity of butterflies is the variety of habitats. Only on this locality we were able to record the species in four different habitats types: clearings in beech forests, clearing in mixed forest, reedbed and high-mountain pastures (Tab. 1). The second-most species-abundant locality is the surroundings of the highest peak on Galichica Mt. - Plaja e Pusit (16 species). High-altitude species typical for this vegetation were recorded here (*Boloria graeca*, *Coenonympha leander*, *Polyommatus eros*, *Aglais urticae*, *Erebia melas*, *Parnassius apollo* etc.). The most species-rich localities in the lower part of the investigated area, close to the Prespa Lake, are the vicinities of the villages Dolna Gorica (13 species), Globochani (11), as well as the Small Prespa Lake (13) and Dlaboko, St. Marena (11), where species like *Spialia phlomides*, *Thymelicus acteon* and *Satyrium ilicis* can be found.

4.4 Important habitats for the investigated group

Most of the butterfly species can be found in a variety of habitats. However, all of them are restricted in their movements depending on the distribution of their larva host plant. In our investigated area, majority of the species (29) were found on the gravel shores close to the Prespa Lakes. Typical species for this type of habitat are: *Aporia crategi*, *Polyommatus daphnis*, *Carcaharodus alceae*, *Pyrgus malvae*, but also in thermophilous oak forests (24) and clearings in beech forest (20). Moreover, the high-mountain pastures of Galichica Mt. in the higher altitude (up to 2200 m asl) are also rich with species diversity.

4.5 Comparison with the fauna of adjacent areas (e.g. Galichica in MK)

According to distribution grid map of Scheider & Jakshic (1989), a total of 124 butterfly species are expected to be found on the Macedonian side of Prespa including mountain Galichica. Krpač et al. (2011) published a staggering 166 species present in the Macedonian

Galichica National Park. During the author's research on the Macedonian side of Prespa Lake and mountain Galichica, a total of 122 species were recorded (unpublished data). For the period of our research we have not been able to find any new species that are not listed in Krpač et al. (2011). However, there are seven species which we did record but were not part of the author's study of the Macedonian side of Prespa in the past several years. These species are: *Apatura iris*, *Erynnis marloyi*, *Leptidea duponcheli*, *Plebejus argyrognomon*, *Polygonia egea*, *Spialia phlomidis* and *Thymelicus acteon*.

5. Threats

Drainage of the wetlands for obtaining arable land near the Small Prespa Lake will have an impact on species typical for these types of habitats such as the Large Cooper (*Lycaena dispar*). This butterfly was not encountered during our research, but was recorded on Stenjsko Blato, Macedonia, a couple of kilometres away from the Macedonian-Albanian border. It is highly expected that this species will be present in the Albanian side of Prespa Lake.

Intensive livestock breeding both goat grazing in the shrub-land on the lower altitudes and sheep grazing in the high-mountain pastures will have negative impact on the Larval Host Plants of the Apollo butterfly (*Sedum album*) and the Eros blue (*Oxytropis campestris*, *O. halleri*).

Intensive logging in the past and present Albania has shrunk the natural distribution of the broadleaf forest. Even though this trend has been reduced in the recent times, forested areas with clearings are very important habitats type for butterflies.

As the Prespa national Park becomes more popular, the threat of modern tourism may also negatively influence some butterfly populations in terms of: over collection of species, pollution and disturbance.

Although still done in a traditional manner, modern agriculture implies usage of pesticides and other means which will have great deal of impact on the overall invertebrate fauna (Bozinovska & Melovski, 2010; Arsovski et al., 2009).

6. Measures for protection

6.1 Direct protection of species

According to the Albanian Red Data Book, threat of extinction are facing *Parnassius apollo* and *Polyommatus eros eroides* both Critically Endangered. Protection of these species is in a form of habitat protection (See chapter 6.2).

6.2 Habitats protection

Both species, the Apollo butterfly and the Eros blue dwell on limestone high-mountain pastures on higher altitudes. In order to preserve their habitats, a special designation for strictly protected zones in the National Park with a focus on higher zone of mountain Galichica and swampy habitats near the Small Prespa Lake must be established. A strict protection and ban of livestock breeding activities in the higher altitudes should come into force.

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