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EXPEDITION REPORT

Expedition dates: 9 July – 11 August 2018

Report published: June 2019

Mountain ghosts: protecting snow leopards and other animals of the Tien Shan mountains of Kyrgyzstan

(as well as studying butterflies as indicators of climate change)

Cover photo courtesy of Noël van Bemmel

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Authors:

Volodymyr Tytar
I.I Schmalhausen Institute of Zoology
of the National Academy of Sciences of Ukraine

Amadeus DeKastle
Plateau Perspectives and American University of Central Asia

Matthias Hammer (editor)
Biosphere Expeditions

Abstract

This study was part of a continuing annual citizen science expedition to the Tien Shan Mountains (Kyrgyz Ala Too and Jumgal Too ranges), run by Biosphere Expeditions and NABU for the fifth consecutive year from 9 July to 11 August 2018, with the aim of surveying for snow leopard (*Panthera uncia*) and its prey species. Using a cell methodology developed for citizen scientist volunteer expeditions, 46 cells of 2x2 km were surveyed and six interviews with local people were conducted. Previous expeditions had indicated that snow leopard was present in the survey area and in 2018 the discovery of fresh signs of snow leopard presence, including successful camera trap recording, confirmed the presence of the cat as well as the importance of the study area as snow leopard habitat. The surveys also showed that the area's habitat is sufficiently varied and capable of sustaining a healthy prey base for the snow leopard. Potential prey species in the area are Siberian ibex, marmot and Himalayan snowcock; in 2018 there was no visual record of argali. Successful Maxent-directed field surveys identified wildlife areas promising for the development of a local network of protected areas. Poaching, overgrazing and other disturbances are serious issues that must be addressed in order to avoid habitat degradation and with it the loss of the snow leopard. Local people are by and large in favour of snow leopard presence and receptive to the creation of economic incentives based on intact nature and snow leopard presence. For this purpose, priority areas for the creation of protected areas are suggested alongside rationales to do so and changes in the law necessary to create effective protected areas. In 2017-2018 two local community members were trained in camera trapping techniques and extended the study season through the winter. Biosphere Expeditions and NABU will continue with the annual research expeditions to the area, seeking to conduct further surveys and continuing to involve local people, as well as continuing to identify and develop economic benefits and incentives to maintaining habitat health, and with it snow leopard presence. A butterfly study that proposes alpine vs. non-alpine species as indicators of climate change was continued for the fourth year running.

Резюме

Это исследование было частью продолжающейся ежегодной экспедиции в горы Тянь-Шаня (хребты Кыргыз Ала-Тоо и Джумгал Тоо), проводимой Биосферной Экспедицией и NABU пятый год подряд с 9 июля по 11 августа 2018 года, с целью исследования снежного барса (Panthera uncia) и потенциальных его жертв. Применив методику координатной сетки на карте, разработанной для проведения научно-практического исследования совместно с волонтерами, было исследовано, было обследовано 46 ячеек размером 2x2 км и было проведено шесть интервью с местными жителями. Предыдущие экспедиции указывали, что снежный барс присутствовал в районе съемки, и в 2018 году обнаружение свежих признаков присутствия снежного барса, включая успешную запись с камеры, подтвердило присутствие кошки, а также важность района исследования как среды обитания снежного барса. Обследования также показали, что среда обитания района достаточно разнообразна и способна поддерживать здоровую базу для пропитания снежного барса. Потенциальными видами-жертвами являются сибирский козерог, сурок и улар; в 2018 году не было никакой визуальной регистрации архара. В результате полевых исследований, подкрепленных созданием пространственных моделей в программе Maxent, были выявлены районы дикой природы, перспективные для развития локальной сети охраняемых территорий. Браконьерство, чрезмерный выпас скота и другие нарушения являются серьезными проблемами, которые необходимо решить, чтобы избежать деградации среды обитания и, как следствие, потери снежного барса. Местные жители в целом поддерживают присутствие снежного барса и восприимчивы к созданию экономических стимулов на основе нетронутой природы и присутствия снежного барса. Для этой цели предлагаются приоритетные участки для создания охраняемых объектов, но для этого нужны изменения в законодательстве, необходимые для создания эффективных охраняемых территорий и объектов. В 2017-2018 годах два члена местного сообщества были обучены методам использования камер-фотоловушек, чтобы можно было продлить полевой сезон до зимы. Биосферные экспедиции и NABU будут продолжать проводить ежегодные исследовательские экспедиции в этом районе, стремясь проводить дальнейшие исследования и продолжать привлекать местных жителей, а также продолжать выявлять и разрабатывать экономические выгоды и стимулы для поддержания здоровья среды обитания, а также присутствия снежного барса. , Исследование дневных бабочек, которое предлагает использование соотношения альпийских и не-альпийских видов в качестве индикатора изменения климата, продолжалось четвертый год подряд.

Корутунду

Бул изилдөө илбирсти (Panthera uncia) жана анын потенциалдуу тоют базасын изилдөө максатында, 5 жыл катары менен, 2019-жылдын июль айынын 9нан август айынын 11не чейин, Биосфералык экспедиция жана NABU тарабынан жыл сайын өткөрүлүүчү, Тянь-Шань тоолоруна (Кыргыз Ала-Тоо жана Жумгал тоо кыркалары) уюштурулган экспедициянын уландысынын бир бөлүгү болчу. Ыктыярчылар менен биргеликте илимий-практикалык изилдөөлөрдү жүргүзүү үчүн иштелип чыгарылган торчо карта методикасын пайдалануу менен бирге, көлөмү 2x2 км болгон 42 уяча текшерилип чыкты, изилденди жана жергиликтүү тургундар менен 6 интервью жүргүзүлдү. Мындан мурунку экспедиция, сүрөткө тартып алуу аймагында илбирстин бар экендигин белгилеген, 2018-жылы дагы илбирстин бар экендигинин жаңы белгилери табылган, камерага ийгиликтүү тартылып калынган маалымат, илбирстин бар экендигин, ошондой эле изилденүүчү райондун, илбирстин байырлаган жери катары чоң мааниге ээ экендигин аныктады. Текшерүүлөр, райондун жашоо чөйрөсү жетиштүү деңгээлде ар түрдүү жана илбирстин азыгы үчүн таза базаны түзүп бергенге жөндөмдүү экенин көргөздү. Илбирстин потенциалдуу тоют базасы болуп – сибирь тоо эчки-текеси, суур жана улар эсептелинет; 2018-жылы архарлар визуалдык жактан катталган эмес. Maxent программасында мейкиндик моделдерин түзүүгө көмөк көрсөткөн, талаа изилдөөлөрүнүн натыйжасында, коргоолуучу аймактын локалдык түйүнүнүн өнүгүүсү үчүн келечектүү болгон жапайы жаратылыш аныкталды. Браконьерчилик, малды чектен ашык жайуу жана башка укук бузуулар оор көйгөйлөр болуп эсептелинет, бул көйгөйлөрдү илбирстин жашоо чөйрөсүнүн деградация болуп кетүүсүн жана илбирстин жок болуп кетүүсүн алдын алуу үчүн чечүү зарыл. Жергиликтүү калктын жалпысынан илбирске болгон мамилеси канааттандыраарлык жана кол тийбеген жаратылыштын негизинде, экономикалык өбөлгөнүн түзүлүүсүнө жана илбирстин сакталышын колдошот. Бул максат үчүн, коргоолуучу обьектилерди түзүүгө приоритеттүү тилкелер сунушталынат, бирок бул үчүн эффективдүү коргоолуучу аймактарды жана обьектерди түзүүгө зарыл болгон мыйзамга өзгөртүүлөрдү киргизүү керек. 2017-2018-жылдары жергиликтүү коомдун эки мүчөсү, талаа мезгилин кышка чейин созууга, камера-фототузакты колдонуу методун үйрөнүшкөн. Биосфералык экспедиция жана NABU алдыдагы изилдөөлөрдү жүргүзүүгө жана жергиликтүү тургундарды өзүнө тартууга умтулуу менен бирге бул райондо жыл сайын изилдөө экспедицияларын уюштурууну уланта бермекчи. Ошондой эле илбирстин жашоо чөйрөсүнүн сак болушун жана илбирстин бар болуусун колдоо үчүн, экономикалык жактан пайда жана стимулду ачууну жана иштеп чыгууну улантат. Климаттын өзгөрүүсүнүн индикатору катары, альпылык жана альпылык эмес түрлөрүнүн байланышын сунуш кылган, күндүзгү көпөлөктөрдү изилдөө төртүнчү жылы катары менен улантылган.

Zusammenfassung

Diese Studie war Teil einer jährlichen Bürgerwissenschafts-Expedition in das Tien-Shan-Gebirge Kirgisiens (Ala-Too und Jumgal-Too Bergketten), durchgeführt im mittlerweile fünften Folgejahr von Biosphere Expeditions und dem NABU vom 9. Juli bis zum 11. August 2018. Das Expeditionsziel war es ein Gutachten über den Schneeleoparden (*Uncia uncia*) und dessen Beutetiere zu erstellen. Als Arbeitsgrundlage diente eine von Biosphere Expeditions entwickelte Zellenmethodik für Forschungsexpeditionen mit Bürgerwissenschaftlern, bei der 46 Zellen von 2x2 km Größe untersucht und sechs Interviews mit der einheimischen Bevölkerung durchgeführt wurden. Daten, die von den vier vorangegangenen Expeditionen gesammelt wurden, gaben Hinweise darauf, dass der Schneeleopard im Studiengebiet vorkommt. Die Expedition 2018 fand weitere frische Schneeleopardenspuren, fotografierte einen Schneeleoparden mittels einer Kamerafalle und bestätigte so das Vorkommen der Art im Studiengebiet. Die Forschungen zeigten auch, dass das Habitat im Studiengebiet variabel genug ist und gute Voraussetzungen für eine gesunde Beutetierpopulation vorliegen. Potenzielle Beutetiere sind der sibirische Steinbock, das Murmeltier und das Himalaya-Königshuhn; 2018 wurden keine Anzeichen auf Argali-Bergschafe gefunden. Mithilfe von Felduntersuchungen, basierend auf Maxent-Verbreitungsmodellen vorangeganger Expeditionen, identifizierte die Expedition Gebiete für ein Netzwerk lokaler Schutzgebiete. Wilderei, Überweidung und andere negative Einflüsse bleiben ernstzunehmende Störfaktoren, die angegangen werden müssen, um eine Verödung des Lebensraumes und das damit einhergehende Verschwinden des Schneeleoparden zu verhindern. Die Akzeptanz des Schneeleoparden bei der einheimischen Bevölkerung ist hoch und die Menschen sind sehr empfänglich dafür, ökonomische Massnahmen zu kreieren und umzusetzen, die auf beidem basieren: Einer intakten Natur und dem Schneeleopard in freier Wildbahn. Daher schlägt dieser Bericht Prioritätsgebiete zur Einrichtung von Schutzgebieten vor, liefert Begründungen dafür und thematisiert nötige Gesetzesänderungen, um Schutzgebiete ins Leben rufen zu können. 2017-2018 wurden auch zwei Einheimische an Kamerafallen ausgebildet, um den Studienzeitraum über den Winter auszudehnen und Menschen vor Ort weiter zu integrieren. Biosphere Expeditions und der NABU werden die alljährlichen Expeditionen ins Studiengebiet weiterführen, mit dem Ziel noch mehr Daten zu sammeln, die lokale Bevölkerung einzubeziehen und nach wirtschaftlichem Nutzen, sowie Massnahmen zu suchen, die einen intakten Lebensraum und damit einhergehend das Vorkommen von Schneeleoparden sichern. Eine Schmetterlingsstudie, die alpine und nicht-alpine Arten als Klimawandel-Indikatoren identifiziert, wurde im vierten Jahr fortgesetzt.

Contents

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this and other sections, which remain valid and relevant, are a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Expedition Review

M. Hammer (editor)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (biological or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This project report deals with an expedition to the Tien Shan mountains of Kyrgyzstan (Kyrgyz Ala-Too Range) that ran from 9 July to 11 August 2018 with the aim of surveying snow leopards as well as their prey species such as argali (a mountain sheep) and the Siberian ibex. The expedition also surveyed other animals such as marmots, birds, and small mammals, and worked with the local anti-poaching patrol “группы барс” (snow leopard group “Grupa Bars”) and other local people on capacity-building and incentive creation projects.

Little is known about the status and distribution of the globally endangered snow leopard in the area, or about its interaction with prey animals such as the Tien Shan argali and Central Asian ibex, and its reliance on smaller prey such as marmots, ground squirrels and game birds. Biosphere Expeditions provides vital data on these factors, which can then be used in the formulation of management and protection plans. The expedition also worked with locals in an effort to build capacity, educate and involve local people in snow leopard conservation and generate income through responsible tourism activities.

1.2. Research area

Kyrgyzstan is a country located in Central Asia and is often referred to as the "Switzerland of Central Asia". Landlocked and mountainous, Kyrgyzstan is bordered by Kazakhstan to the north, Uzbekistan to the west, Tajikistan to the southwest and China to the east. Its capital and largest city is Bishkek. Kyrgyzstan is further from the sea than any other country in the world and all its rivers flow into closed drainage systems, which do not reach the sea. The mountainous region of the Tien Shan covers over 80% of the country, with the remainder made up of valleys and basins. The highest peak is Jengish Chokusu (Pik Pobedy) at 7,439 m and more than half of the country is above 2,500 metres. Steppe and alpine vegetation dominate the landscape; glaciers and permanent snow cover over 3% of the country’s total area. The climate in Kyrgyzstan is continental with a small amount of rainfall.

The Kyrgyz Ala-Too (Кыргыз Ала-Тоосу, also Kyrgyz Alatau, Kyrgyz Range) is a large range in the northern Tien Shan mountains. The range is situated just south of the capital city of Bishkek; the views from the city itself are stunning and form a backdrop unlike any other in the world. The Kyrgyz Ala-Too Range stretches for a total length of 454 km from the west end of Issyk-Kul to the town of Taraz in Kazakhstan. It runs in an east-west direction, separating into the Chuy, Kochkor, Suusamyr and Talas valleys. The western part of Kyrgyz Ala-Too serves as a natural border between Kyrgyzstan and Kazakhstan. The range's highest mountain is Alamyudyun Peak at 4,855 m.

Figure 1.2a. Map (wth study site) and flag of Kyrgyzstan.

An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations can be found at Google Maps.

The mountains are divided by several river valleys and there is a great variety of landscapes. There are hollows with semi-desert areas, alpine peaks, narrow river canyons and broad valleys, highland tundra and deep natural limestone gorges, open steppes, permanent snow and glaciers, tracts of forest, as well as a multitude of lakes, wild rivers and waterfalls. Forests of larch, cedar, spruce and pine (but very few deciduous trees) cover more than half of the mountain territory.

There are many threatened animal and plant species present in the area, a great number of them endemic, with a recent count showing at least 70 threatened mammal, 376 bird, 44 fish and 3,000 insect species.

The Kyrgyz people are descendants of several different nomadic Turkish ethnic groups in Central Asia and were first mentioned in writing in 201 BC. Kyrgyzstan is one of the active members of the Turkic Council and the TÜRKSOY community. Kyrgyzstan's history is one of Turkish, Mongol, and more recently Soviet and Russian domination. Independence from the Soviet Union was declared on 31 August 1991 and Kyrgyzstan became, and has stayed, a unitary parliamentary republic.

1.3. Dates

The project ran over a period of one month divided into two 13-day slots, each composed of a team of national and international citizen scientists, a professional scientist and an expedition leader. Group dates were:

9 - 21 July || 30 July - 11 August 2018

Team members could join for multiple groups (within the periods specified).

1.4. Local conditions & support

Expedition base

The expedition team worked from a mobile base camp, set up in various valleys on the southern side of Kyrgyz Ala-Too (see Fig 1.4a). Base camp consisted of an assortment of dome, shower and toilet tents, as well as mess, kitchen and work yurts (see Fig. 1.4a). All meals were prepared by the expedition cook; breakfast and dinner were provided at base and a lunch pack was supplied for each day spent in the field.

Figure 1.4a. Base camp with yurts and tents. There is also an expedition lorry for transporting the base camp and the expedition 4x4 vehicles.

Weather

The local climate is temperate continental with short, hot summers (during which the expedition took place) and prolonged, cold winters. Winter temperatures range from -9°C to -45°C, with summer temperatures ranging from +11°C to +35°C during the day. The base camp was situated in the mountains at an altitude of 3,000 m and as such the weather was very variable. Wind and rain showers occurred infrequently and higher up could turn into snowfall.

Field communications

The expedition had a satellite phone for emergency communications. There were also hand-held radios for groups working close together. There was generally no mobile phone network. The expedition leader posted a diary with multimedia content on Wordpress and excerpts of this were posted on Biosphere Expeditions' social media sites such as Facebook.

Transport & vehicles

Team members made their own way to Bishkek. From there onwards and back to Bishkek all transport was provided for the expedition team. A variety of 4x4 vehicles were rented from Almaz Alzhambaev of www.carforrent.kg. Local partner NABU also provided a 4x4 vehicle and a lorry (Fig. 1.4a). Horses were rented from local people as necessary.

Medical support and incidences

The expedition leaders were trained first aiders and the expedition carried a comprehensive medical kit. Further medical support was provided by the Public Foundation "Rescue in the mountains of Kyrgyzstan", small district hospitals in the town of Suusamyr and Kochkor (each 40 km from base camp), a large hospital in Kara-Balta and large public hospitals and private clinics in Bishkek (about 140 km and 200 km from camp respectively). Safety and emergency procedures were in place, but did not have to be invoked as there were no medical or other incidences.

All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation.

1.5. Expedition scientist

Volodymyr Tytar was born in 1951 and obtained his Master's Degree in Biology from Kiev State University. At that time he first experienced the Tien Shan mountains and wrote a term paper on the ecology of the brown bear. He then pursued a career as an invertebrate zoologist before shifting towards large mammals and management planning for nature conservation. As well as in Kyrgyzstan, he has worked with Biosphere Expeditions on wolves, vipers and jerboas on the Ukrainian Black Sea coast, on snow leopards in the nearby Altai mountains, and has been involved in surveying and conservation measures throughout his professional life.

1.6. Expedition leader

The expedition was led by Amadeus DeKastle, who has been living and working in Kyrgyzstan since 2009. Born in Germany and with a US passport, he holds a Master's degree in entomology from the University of Nebraska. He currently works with NGO Plateau Perspectives in environmental conservation with a number of citizen science research projects. He is also a part-time lecturer at the American University of Central Asia in the Environmental Management Department. In 2014, he found out about Biosphere Expeditions' work in Kyrgyzstan and signed up for a placement. After two years of volunteering with Biosphere Expeditions, he decided to jump in with both feet and joined the team in 2016.

1.7. Expedition team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of ages, nationalities and backgrounds. They were (in alphabetical order and with country of residence):

9 – 21 July 2018:

Peter Anderson-Barr (Australia), Jim Blomgren (USA), Sophie Cook (UK), Andreas Dank (Germany), Allycia Darst (USA), Marilyn Goodman (UK), Markus Guddat (Germany), Judith Harrison (UK), Stanley Johnson** (UK), Tristan Lehnert (USA), Ross Mattheis (USA), Holger May (Germany), Peter Thoem (Canada), Noël van Bemmel** (the Netherlands).

30 July – 11 August 2018:

Ralf Buerglin** (Germany), Christine Bühler-Traub (Switzerland), Rebecca Ellul** (UK), David Friend (USA), Kathrin Heckmann** (Germany), Hans Jorgensen (USA), Buyandelger Khishigzul* (Kyrgyzstan), Janice Moore (Canada), Bernadette Olderdissen** (Germany), Anette Prelle (Germany), Jo Jing Wuen Seetoh (Singapore), Jerred Seveyka (USA), Patricia Smith (Belgium).

Also our expedition cook throughout the expedition, Gulia Subanova and, on a rotational basis, members of NABU's anti-poaching patrol Grupa Bars: Bekbolot Uulu and Bek Seidaliev, all from Kyrgyzstan.

*local placement | **press

1.8. Partners

On this expedition our main partner was the German conservation organisation NABU (= Naturschutzbund = nature protection alliance). Founded in 1899, NABU is one of the oldest and largest environmental associations in Germany. The association encompasses more than 450,000 members and sponsors, who commit themselves to the conservation of threatened habitats, flora and fauna, and to climate protection and improving energy policy. In Kyrgyzstan, NABU, in cooperation with the Kyrgyz government, is implementing a programme to conserve the snow leopard through a twin approach of research and the prevention of illegal hunting and trade of the endangered species (see http://nabu.kg/wp/).

1.9. Acknowledgements

We are grateful to the expedition participants, who not only dedicated their spare time to helping but also, through their expedition contributions, funded the research. Thank you also to our partner organisation NABU, in particular the Grupa Bars (see section 1.7. for details), as well as Tolkunbek Asykulov and NABU's Bishkek office staff, and Britta Hennig. A big thank you also to Almaz Alzhambaev of www.carforrent.kg, who has helped us very much over and above the call of duty. Biosphere Expeditions would also like to thank members of the Friends of Biosphere Expeditions and all donors to a fundraising campaign for their support.

1.10. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given on the website.

1.11. Expedition budget

Each team member paid towards expedition costs a contribution of € 2,190 per person per 12-day slot. The contribution covered accommodation and meals, supervision and induction, special research equipment and all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs etc., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	€
Expedition contributions	45,812
Expenditure	
Expedition base includes all food & services	2,337
Transport includes hire cars, fuel, taxis in Kyrgyzstan	5,742
Equipment and hardware includes research materials & gear etc. purchased internationally & locally	2,022
Staff includes local and Biosphere Expeditions staff salaries and travel expenses	14,912
Administration includes miscellaneous fees & sundries	876
Team recruitment Tien Shan as estimated % of annual PR costs for Biosphere Expeditions	8,676
Income – Expenditure	**11,247**
Total percentage spent directly on project	**75%**

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this and other sections, which remain valid and relevant, are a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

2. Monitoring snow leopards and other species on the south side of the Kyrgyz Ala-Too mountain range in the Tien Shan mountains of Kygryzstan

Volodymyr Tytar
I.I Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine

2.1. Introduction

Background on the snow leopard

Snow leopard biology, distribution and its situation in Kyrgyzstan is described in Tytar & Hammer 2015, Tytar et al. 2016, Tytar et al. 2017, Tytar et al. 2018.

Figure 2.1.1a. Part of the snow leopard's range (brown) and range countries. Expedition study site in black ellipse.

In 2017 snow leopards were downgraded from Endangered to Vulnerable on the IUCN Red List (http://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T22732A50664030.en) in a decision that was highly controversial (Ale & Mishra 2018). The argument was that the global population is estimated to number more than 2,500 but fewer than 10,000 mature individuals, and there is an estimated and projected decline of at least 10% over three generations.

Snow leopards also currently appear in Appendix I of both CITES and the Convention on Conservation of Migratory Species of Wild Animals (CMS). Snow leopards are protected nationally over most of their range. However, in some countries the relevant legislation may not always be very effective.

Background on Kyrgyzstan and the Tien Shan, including environmental issues

Kyrgyzstan faces serious environmental problems. Among global environmental issues presently on the agenda are global climate change, ozone layer depletion, desertification and biodiversity loss. According to the Kyrgyz national Biodiversity Strategy and Action Plan, the threats to biodiversity are related to anthropogenic activity and include habitat loss and alteration, fragmentation of natural communities due to overuse, over-harvesting, direct mortality, introduction of non-native species, environmental pollution, and climate change. In Kyrgyzstan today, at least 10 percent of the nation's vertebrate species are endangered. In this context loss of habitat and species diversity due to overgrazing remains a severe problem. Overgrazing has resulted in erosion, proliferation of unpalatable plant species, and an overall reduction in pasture productivity (Fitzherbert 2000). While these developments adversely affect domestic animals residing on these lands, they also affect wild animals, particularly grazing animals, and lead to an overall reduction of wild plant species that are the preferred forage of both wild and domestic animals. In addition, uncertain land tenure and financial insecurity have caused many private farmers to concentrate their wealth in the traditional form - livestock - thus subjecting new land to the overgrazing problem.

2.2. Materials and methods

Kyrgyz Ala-Too study site

The Kyrgyz Ala-Too study site and the rationale for running the expedition there are described in Tytar & Hammer 2015, Tytar et al. 2016, Tytar et al. 2017, Tytar et al. 2018.

Table 2.2.1a. Numbers, density and area occupied by the snow leopard in various parts of the Tien Shan (excerpt from Koshkarev 1989). Ala-Archa is within the Kyrygz Ala-Too range. Note: the 1198 reference is the most recent available.

Range, river catchment area	Number of individuals	Average population density (per 100 km^2)	Area (in km^2)
Aksu	12-14	2.51	518
Sokoluk	6-8	3.25	216
Ala-Archa	7-9	2.40	334
Issyk-Ata	5-6	3.25	169

Methods & training of citizen scientist participants

Methods employed, sampling and data analysis techniques, as well as the training of international and local citizen scientist participants, were as described in Tytar & Hammer 2015, Tytar et al. 2016, Tytar et al. 2017, Tytar et al. 2018.

In line with the cell methodology used in the expedition surveys, the 2018 expedition covered cells Y15, Y16, Z16, AB16, AC16, AE16, AE20, AF16, AF20, AG15, AH15 and AI15.

In 2018 base camp was located close to the Suusamyr-Kochkor road approximately in the middle of the planned study area (42.359535^{o}N, 74.737829^{o}E, 3,002 m). From the base camp mostly one-day surveys, but also some two-day/one-night surveys were conducted to various portions of the Kyrgyz Ala-Too Range and to the neighbouring Jumgal Too Range on the opposite side of the West Karakol.

Nineteen digital Bushnell camera traps were set throughout the study area by the expedition. The results of the community monitoring group (see chapter 2.3.6. for an explanation of what this is), established in 2017 and working through the winter of 2017/2018 up to the arrival of the 2018 expedition, are covered below (Fig. 2.3.5b). The community monitoring group had the use of ten of those camera traps.

2.3. Results

Forty-six cells 2 x 2 km in size over an approximately 20 x 40 km area located in the southern Kyrgyz Ala-Too Range and neighboring Jumgal Too (Fig. 2.3a) were surveyed for snow leopard and sympatric medium and large-sized mammals and game birds from mid-July to August 2017. Surveys were conducted at an average elevation of 3619±31 m. above sea leavel (asl). Around half of the cells were resampled two to three times. Records of animals of interest were made in 32 cells; in 48% of them records were multiple (two to four). Individual survey teams ranged from four to eight citizen scientists and daily search efforts took from four to ten hours, depending largely on weather conditions and complexity of the terrain.

2.3.1. Snow leopard presence/absence survey

Snow leopard signs searched for during this study included: pugmarks (tracks), scrapes, faeces (scat), urination, rock scent spray and observations (including camera trapping).

Snow leopard records of the 2018 expedition are summarised in Table 2.3.1a; all records 2014 – 2018 are summarised in Appendix I.

Table 2.3.1a. Snow leopard records made by the 2018 expedition.

Date	Location (area)	Elevation (m)	Cell	Notes
11 July 2018	Sary Kol	?	AI19	Dead cub found by local herders, but there was no other evidence to corroborate this record.
16 July 2018	Chon Chikan	3743	AD16	Two sets of tracks: adult & juvenile
24 July 2018	Chon Chikan	3773	AD16	Camera trap record (two shots of the same animal) made at 21:10 (Fig. 2.3).

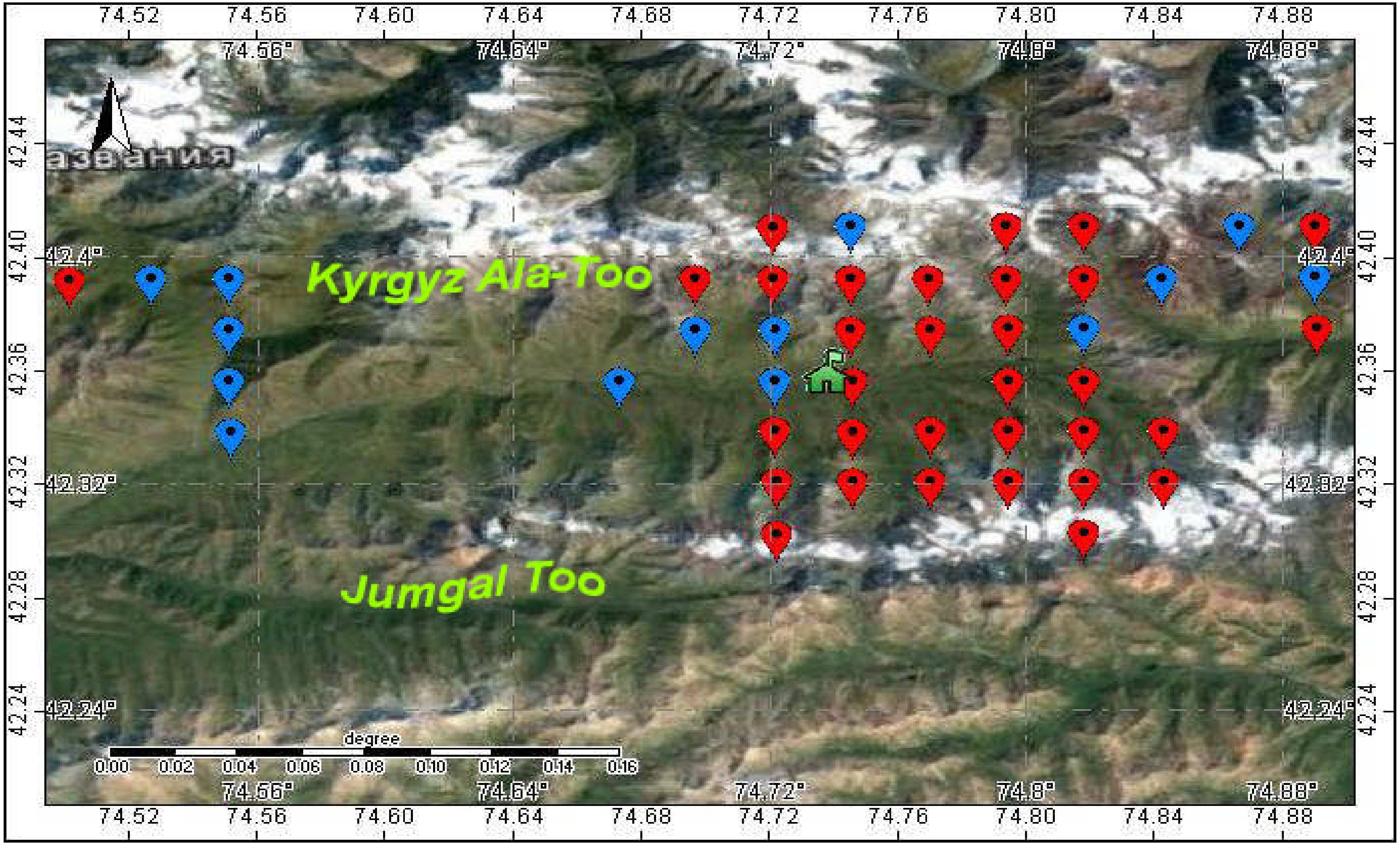

Figure 2.3a. Cells sampled in the research area. – base bamp (42.359535°N, 74.737829°E, 3,002 m).
Red markers indicate cells where records were made of animals of interest. Blue markers indicate cells where there were no such records

Figure 2.3b(1). Camera trap records (photo mode) of the snow leopard.

Figure 2.3b(2). Camera trap records (photo mode) of the snow leopard.

2.3.2. Threats to snow leopard presence

Over the course of the presence/absence survey, an account was taken of human-induced factors considered to threaten snow leopard presence in the area. Grazing activities turn out to be the most common and are widespread. In the early season, most of the grazing is confined to areas within the larger river valleys, foothills and lower portions of the side valleys. Later on in the summer (with the depletion of the pastures in the lowlands), herders move their livestock up the valleys and reach a height where they become a disturbing factor to snow leopards and/or their prey. By and large herds are not protected against predators and the use of guards dogs is rare. Livestock feeds more or less independently, and of course the impact on wild ungulates is not livestock alone.

Grazing pressure in the area has considerably reduced since the communist era. Many areas suitable for grazing have been abandoned by herders as they are no longer subsidised by the government. Today these areas are considered to be “empty”, but in the past two years numbers of private herders moving in are increasing.

Occasional horse droppings and car tracks found at higher altitudes indicate sporadic human presence over most of the area. Other signs of human presence and disturbance included bullet cases, hides, campfires and various items of rubbish left behind by visitors. Trekkers crossing remote mountain areas have been recorded, too.

2.3.3. Prey base survey

Signs of prey species during presence/absence surveys were found to be fairly abundant and widespread in a variety of terrains for some species (94 records) (Fig. 2.3.3a). Siberian ibex comprised 34% of these records (seven were made by camera traps). There were very few argali records (4%) and no sightings. Marmots were common at lower elevations (43% of the total number of recordings), whereas signs of Himalayan snowcock presence (19%) appeared at higher altitudes (these indications were mainly droppings left over from the winter season, but in eight cases there were camera trap records).

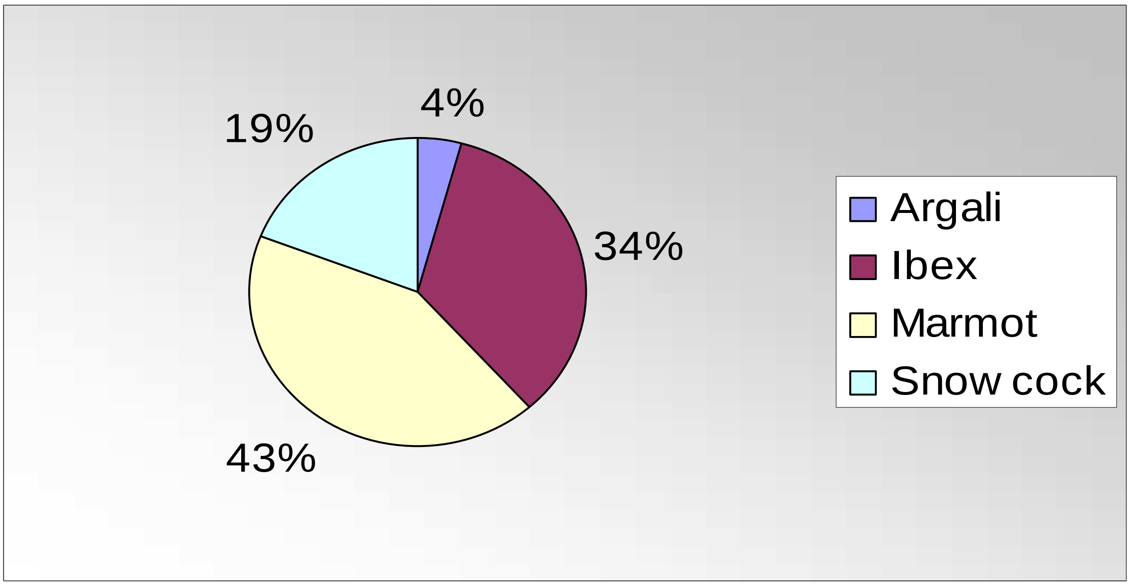

Figure 2.3.3a. Percentages of prey species (N=94).

2.3.4. Distribution modelling

Distribution modelling was conducted to ascertain potential areas of interest for future conservation planning. Input consisted of 107 georeferenced sightings and camera trap records of ibex collected in 2014-2018. From the 25 model runs used to model the distribution of Siberian ibex in the study area, the average AUC was 0.884, with little variation (SD=0.016), meaning 'good' model performance. Areas of predicted habitat suitability exceeding 50% are likely to represent the greatest interest for conservation planning and setting snow leopard research priorities (Fig. 2.3.4a, b, and Appendix II).

With one exception, most of the snow leopard records made in the study area (n=20, see Appendix I) fell within the 10 percentile training presence logistic threshold of 0.368, and there were two outliers when the 0.50 threshold was applied. One of them was a record made at the Karakol Pass, which the animal had used for crossing from one mountain range to the other.

Modelling indicates that areas most suitable for the snow leopard occur in the upper reaches of Ala-Archa (marked 1 on Fig. 2.3.4b), Chon Chikan (4), Jor Bulak (5), upper parts of Choloktor (6) and Issyk Ata (7). In the Jumgal Range, modelling indicates the upper parts and ridges of Kashka Tor and neighbouring areas to be highly suitable for ibex (8). Together these areas could become components of a wider ecological corridor connecting the Ala Archa National Park and wildlife areas located further to the east beyond the Karakol Pass.

In terms of conservation, top priority should be given to the Chon Chikan area, the upper reaches of Issyk Ata and the Kashka Tor area, where there have been multiple signs of snow leopard presence (see Appendix I). In addition, the Chon Chikan area should be earmarked as an important cultural heritage site, because of the wealth of rock art located there and as described in Tytar & Hammer 2015, Tytar et al. 2016, Tytar et al. 2017, Tytar et al. 2018.

2.3.5. Outreach activities and interviews

Six interviews in different households were conducted within the local community. These activities reached adult herders: five men and one woman (aged between 20 and 57).

In most cases, livestock was of a mix of sheep, goats, cows, horses and other domestic animals such as donkeys, some poultry and a number of dogs (up to six). In all six households there were varying numbers of sheep (up to 600 heads) and horses (up to 92), dairy cows and bulls (up to 300), and goats (up to 150 heads).

In response to the question "Have you ever seen a snow leopard and/or sign of a snow leopard?" only one person said that he had seen a snow leopard, two had seen sign of snow leopard (pugmarks) and one (in fact, two brothers) claim to have seen the dead cub. Only one interviewee said he knows someone who has seen a snow leopard or a sign of the animal. Together these responses are evidence of the rareness of the species in the area, possibly exacerbated by its elusive character and the fact that herders rarely come into contact with the predator. Nevertheless, responses from local people indicate that snow leopard is present in the surveyed area and confirm its importance as a habitat for snow leopard.

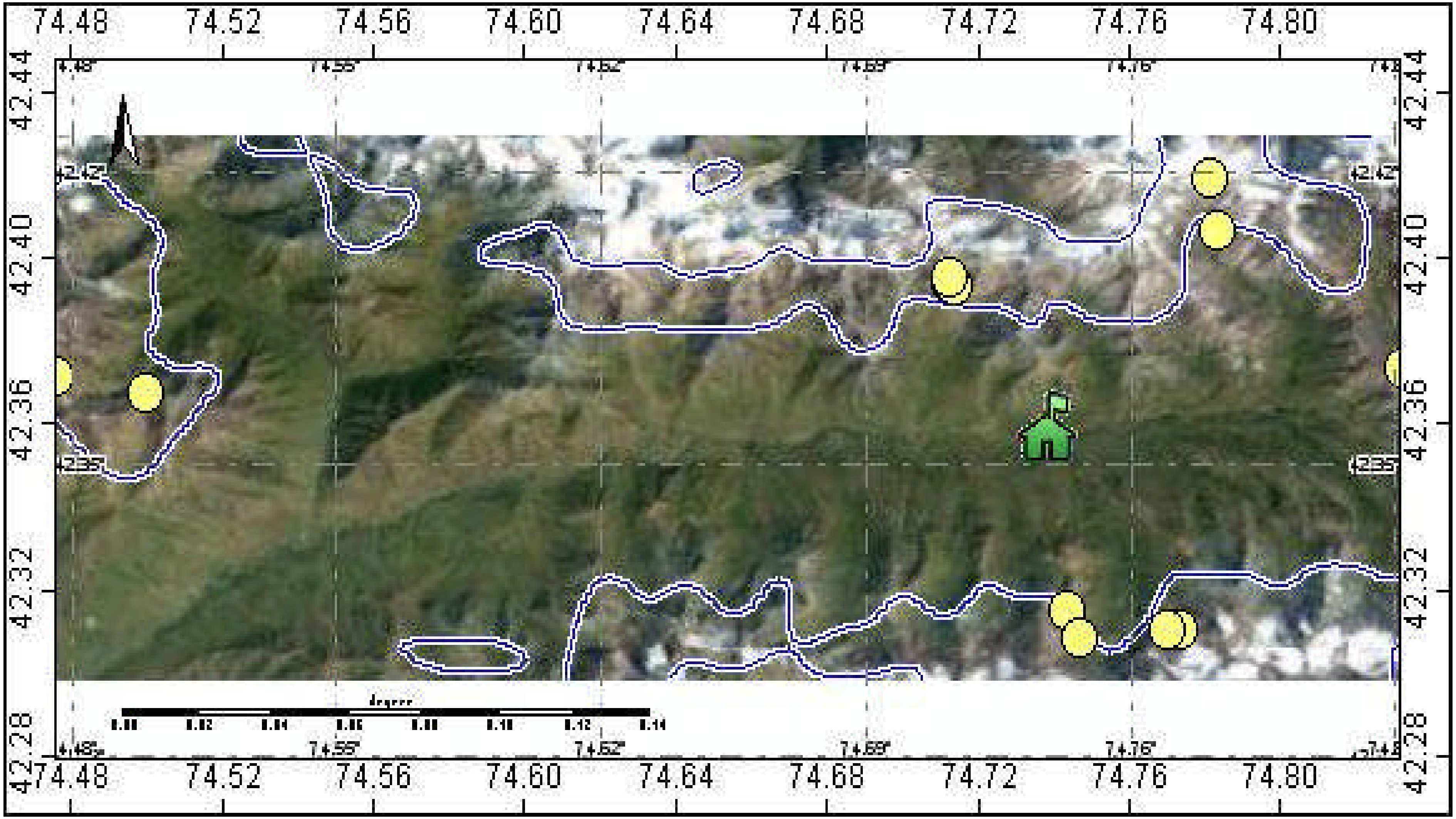

Figure 2.3.4a. Siberian ibex habitat suitability map. A contour line is drawn around areas of predicted probability of Siberian ibex occurrence exceeding 0.50; yellow circles indicate places where records were made of snow leopard presence.

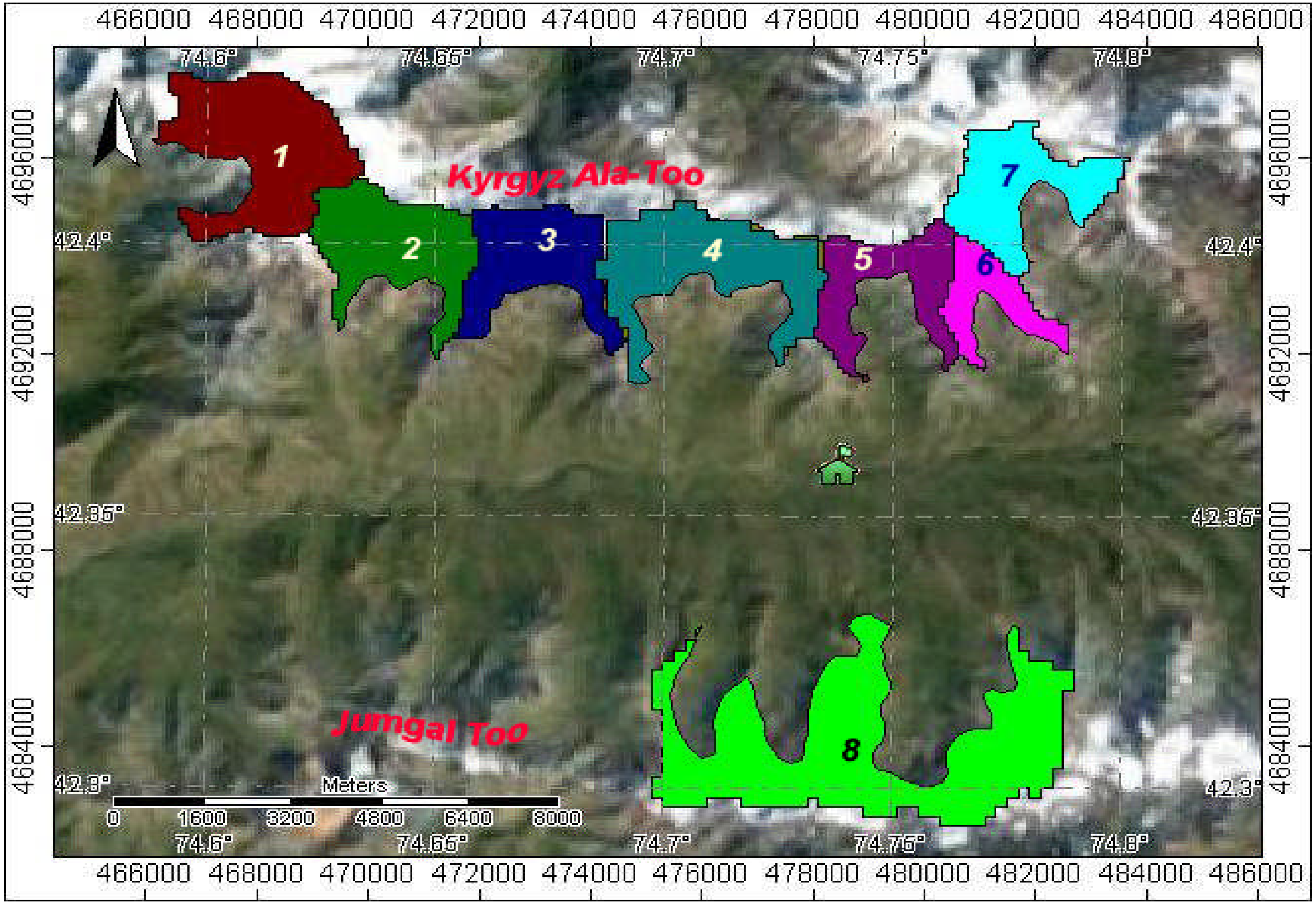

Figure 2.3.4b. Areas of interest for conservation planning and setting snow leopard research priorities in the upper West Karakol: upper reaches of Ala-Archa (1), Kuyke Bulak (2), Chaartash (3), Chon Chikan (4), Jor Bulak (5), upper Choloktor (6), upper Issyk Ata (7), upper parts and ridges of Kashka Tor and neighbouring areas (8).

When respondents were asked how they feel about the snow leopard, five of them (one did not respond) reported "liking" the animal (… "*our beauty*"…, …"*they are an important resource…"*). When asked about the snow leopard's impact on the area, four were fully in favour of the animal, whereas two were either in doubt or considered it to be detrimental by having in mind attacks on sheep. In terms of significance for the country, five responded (one did not respond) that the species was beneficial. All of the interviewees knew the snow leopard is under protection in Kyrgyzstan (the Red Data Book of the Republic was often mentioned) and appreciated the legal protection of the species. From these results, it is clear that there is a good basis in the area for developing nature conservation initiatives and developing community involvement.

Table 2.3.5a. Community assessment of the impact of snow leopards on wildlife and human/predator relations.

	Yes	No	Don't know
Do snow leopards reduce the number of large game animals such as ibex or argali?	1	1	2
Do snow leopards reduce the number of small animals such as marmots and snowcock in the area?	2	0	1
In areas where snow leopards live near livestock, do they feed on domestic animals?	2	2	0
Do snow leopards attack people?	2	3	0

In terms of community assessment of human/predator relations, two of the respondents said that snow leopards attack domestic animals when they live nearby (Table 2.3.5a), but claimed that this happened rarely. The impression from the questioning is that livestock depredation by the snow leopard in the area does not appear to be a major issue, because there "… *are too few*…", etc. As in previous years, much more blame for losses of domestic livestock was put on wolves: "…*wolves attack livestock*…", which are considered by locals to be the most serious threat to their livelihoods.

Interviewees had a varied response to the question upon the impact of snow leopards on populations of large game animals. It is not quite clear whether the respondents distiguish between "*reduce* populations" or "*feed* on populations". The person agreeing that snow leopards can reduce populations of large game animals was far from considering the snow leopard a threat to populations of prey species, because "…*snow leopards eat them*…" and "…*the real threat comes from wolves and poaching*". Once again the belief, widespread in Asia, that snow leopards feed exclusively on the blood of their prey was repeated: "… *only sucks blood of the victim…*".

Two of the respondents thought that snow leopards are able to reduce populations of small animals (such as marmots and snowcock). The others had no opinion on this issue.

Two of the interviewees believed that snow leopards can attack humans, but nobody has been a witness of such an attack, although some have heard such stories told by somebody else, or consider such attacks can happen if "…*the snow leopard is hungry*".

All of the interviewees found it a ‘good thing’ if snow leopards attracted more tourists to the region, because this could create more job opportunities and generate alternative means of income. Many would be ready to sell local products (meat, cheese, kumis, felt carpets etc.) and/or develop tourist-based businesses. Unfortunately, there is a fear amongst locals that business investments may lead to corruption and spark unfair competition with established travel companies.

2.3.6. Community monitoring group

In 2017 two male community members from a village in the study area (Don Alysh) were trained in the use of camera traps and trapping techniques in order to extend the study season throughout the winter months. The community members joined the expedition in July 2017 during a routine survey of the Jor Bulak site and helped to install two camera traps. Further training was subsequently provided by members of NABU and ten Bushnell camera traps were handed over to the community monitors with the task of setting and monitoring the cameras in a number pre-defined areas in the Kyrgyz Ala Too after the 2017 expedition.

Although more snow leopards were now captured on camera, valuable data were also collected on the species composition of this high altitude habitat and seasonal movements of animals, particularly Siberian ibex (Table 2.3.5b).

Table 2.3.5b. Community monitoring group camera trap results 2017/2018.

No.	Area	Dates of operation	Brief results
1	Jor Bulak	22 Aug 2017- 17 July 2018	Longest operating camera trap; four records of Siberian ibex and five of Himalayan snowcock; last appearance of ibex in 2017 was recorded on 10 October 2017 with reappearance on 1 July 2018.
2	Jor Bulak	21 Aug 2017 – 30 Sep 2017	Three stone marten records; camera trap fell down and was buried in snow.
3	Pitiy	16 Oct 2017 – 3 Dec 2017	Four Siberian ibex records, one record of stone marten and one of mountain hare.
4	Pitiy	16 Oct 2017 – 3 Dec 2017	Two Siberian ibex records.
5	Kegety	14 Oct 2017 – 6 Dec 2017	One record of stone marten.
6	Kegety	14 Oct 2017 – 6 Dec 2017	Two Siberian ibex records.
7	Kegety	14 Oct 2017 – 6 Dec 2017	Two Siberian ibex records; one record of Himalayan snowcock.
8	Kegety	14 Oct 2017 – 6 Dec 2017	One record of Siberian ibex.
9	Chep	15 Oct 2017 – 30 Nov 17	One record of stoat.
10	Chep	15 Oct 2017 – 30 Nov 17	Two records of stoat.

Liaising with local people will continue to play a key part in the expedition research agenda, in order to gather valuable data when the expedition is not in-country and to involve the local community in the research, including generating economic incentives. The community camera trapping programme should be repeated and extended.

2.3.7. Additional surveys

Evidence of other carnivores sharing snow leopard habitat was also recorded. These included the wolf (*Canis lupus*) and the red fox (*Vulpes vulpes*). Foxes are distributed all over the area, whereas definite wolf signs were found only in three places. Wolves are the major predators in the area causing losses to domestic livestock, therefore arousing deep concern amongst herders.

Camera trap studies commonly record numerous species besides the target species. However, few of these 'collateral' data are ever published. It may, however, provide important information about the biodiversity in the region and documentation of species thought to be locally extinct or absent (McCarthy et al. 2010). Besides Siberian ibex, the expedition made camera trap records of red fox, badger (*Meles meles*), stone marten (*Martes foina*, listed in the Red Data Book of Kyrgyzstan: VII category, Lower Risk/least concerned - LR/lc), marmot (*Marmota caudata*), as well as a number of bird species: the Himalayan snowcock (*Tetraogallus himalayensis*), commonly the red-billed chough (*Pyrrhocorax pyrrhocorax*), Güldenstädt's redstart (*Phoenicurus erythrogaster*) and the Alpine accentor (*Prunella collaris)*.

Birds are convenient indicators of biodiversity, at least at larger scales, and as monitors of environmental change (Furness & Greenwood 1993). One reason is that birds have long been popular with naturalists, amateur and professional, and consequently their taxonomy and distributions are well known. This year, the expedition recorded an inventory of 44 bird species (Appendix III). Three (the golden eagle, bearded vulture, and Egyptian vulture) are listed in the Kyrgyz Red Data Book; the Egyptian vulture was recorded for the first time. In close proximity of base camp for the first time bird species such as the Himalayan rubythroat and the red-headed bunting were recorded. Earlier, the rubythroat was met at lower altitudes, whereas the bunting species is new to the area. The appearance of these species could be linked with the short-term warming occurring in the area: from an average summer temperature of 8.07oC in 2016 to 8.25oC in 2018 (according to the Global Climate Monitor).

In addition to the biological surveys the expedition team continued to compile an extensive database of rock art in the study area. Ibex is most often depicted. Also shown are hunting scenes with humans and other animals, including red deer, a species now absent from the area. Canids are also depicted, but difficult to identify. Long, curved tails may indicate snow leopards. The two biggest clusters are at Sary-Kol and Chon-Chikan, both of which seem to comprise the most outstanding features of this important "cultural landscape". These are shown in in Fig. 2.3.7a and have been described in greater detail in Tytar et al. 2017. The combination of cultural and natural landscape in the area gives it added significance.

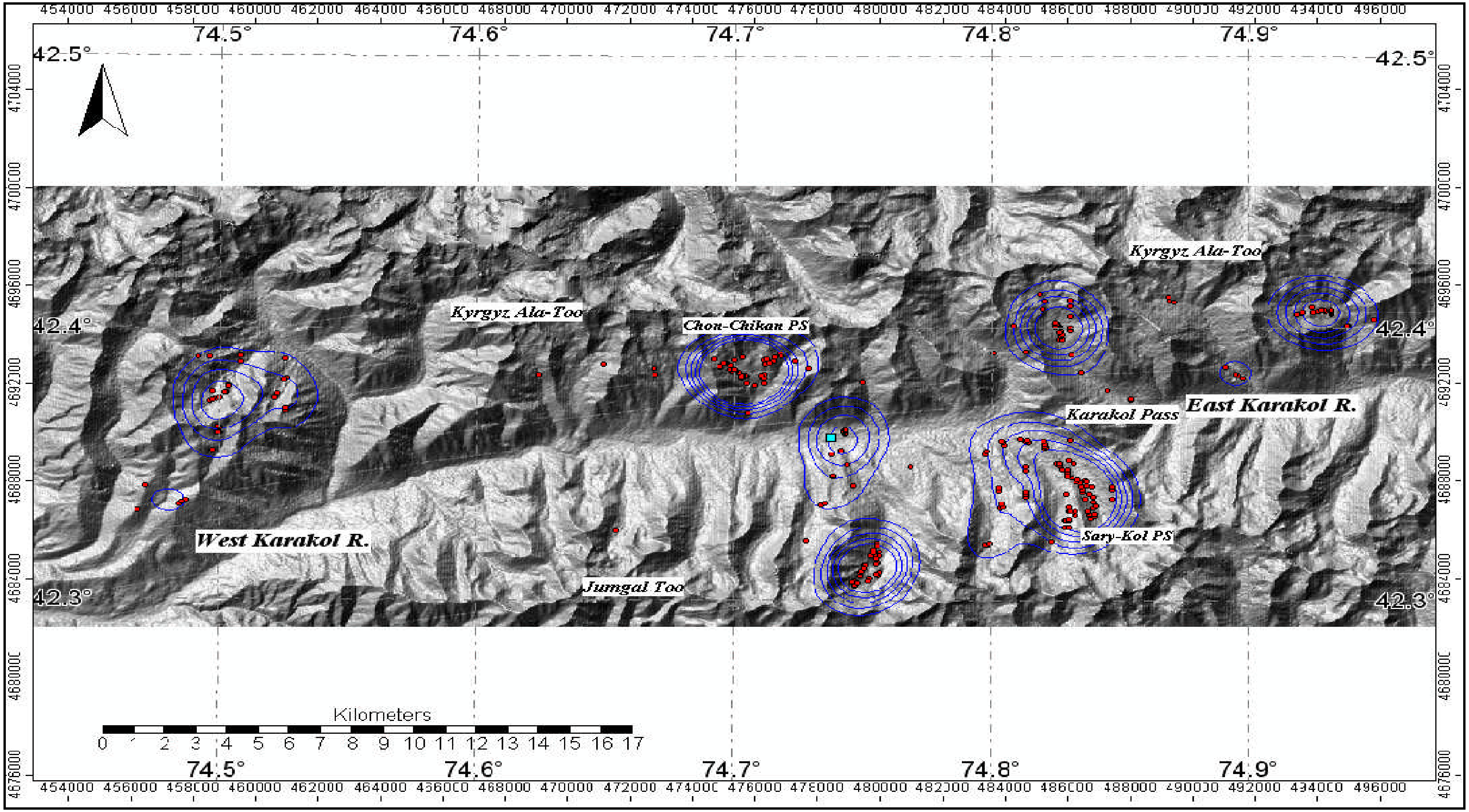

Figure 2.3.7a. Petroglyph sites in the study area: distribution (red circles – point data, turquoise square – base camp); Sary-Kol PS ("Sary-Kol Petroglyph Site"), Chon-Chikan PS ("Chon-Chikan Petroglyph Site").

2.4. Discussion and conclusions

On an expedition such as this, covering large areas of remote, rough and broken terrain, it is difficult to find signs of snow leopard and its primary prey species. Ungulates and carnivores favour higher grounds and are more dispersed during the summer season and snow leopard signs are harder to find.

Anecdotal evidence from local people in 2014 (Tytar & Hammer 2015) indicated that snow leopard was present in the area and confirmed the importance of the study area as a habitat for snow leopard. Subsequent sign surveys (Tytar et al. 2016, Tytar et al. 2017, Tytar et al. 2018) yielded further confirmation of snow leopard presence by discovering a total of 20 snow leopard signs (see Appendix I). The current expedition for the first time recorded snow leopard through camera-trapping.

The expedition has also shown that the habitat in the study area is sufficiently varied and capable of sustaining a healthy prey base for the snow leopard. However, relationships between the predator and prey species are very fragile, so any decline in the prey species may drive the snow leopard out of the area. Indeed, poaching and growing disturbance may be core factors driving animals out of the site, a notion well perceived by local stakeholders. As a priority recognised by NABU staff, improved anti-poaching control together with a temporary ban on hunting could have an immediate impact on halting the decline of prey species and, by inference, snow leopards.

Further research is needed to elucidate snow leopard numbers and distribution, and to monitor snow leopard and prey population trends in the survey area. Presence/absence surveys will need to be repeated in the coming years, using camera traps from the very beginning of the survey. Finding a trail and/or relic scrape(s) is a high priority. If either of these can be found, remote camera-trapping would be enhanced as a survey tool. These efforts can be guided by modelling exercises, showing places where basic requirements for Siberian ibex, upon which snow leopards rely on the most, are likely to be met.

With the end of a subsidised socialist economy a slow recovery of wildlife has occurred, but the current growth of the population in the country, competition for pasture grounds and development may nullify this positive trend and drive the snow leopard out of the area. Under these circumstances, there is an urgent need for research (population & life history parameters, threats), site protection and management through developing justifications for a local network of nature conservation areas, building upon areas which up to now we have prioritised.

Conservation planning to protect biodiversity can benefit from the results of the modelling: areas with predicted high habitat suitability for the Siberian ibex were in the first place considered for this purpose. Live observations and successful camera trap recordings of ibex and snow leopard have identified wildlife areas promising for developing a local network of protected areas (see Fig 2.3.4b). We propose that "wildlife sanctuaries" (zakazniks in Kyrgyz, borrowed from the old Soviet term) would be the most suitable category of protected area in this case, which could become components of a wider ecological corridor connecting the Ala Archa National Park and wildlife areas located further to the east beyond the Karakol Pass, such as the community-managed Shamshy Wildlife Reserve, which was once a hunting concession and is now a snow leopard sanctuary.

However, the current law on Specially Protected Natural Areas (SPNA) defines wildlife corridors, but it is not clear on how establishment of these corridors is to be initiated, who is responsible for managing these areas, and how they are to be managed. Moreover, wildlife sanctuaries are considered exclusively in terms of huntable "game" (and a bill banning hunting in all of Kyrgyzstan was narrowly defeated in 2017). Therefore the process of establishing wildlife-focused reserves is not clear and there should be significant amendments made to the current law to enable effective conservation planning in the area. Having said this, there are several community-based conservation programmes in Kyrgyzstan already, including those involving sacred sites (Samakov and Berkes 2017) and snow leopards (at Shamshy Wildlife Reserve). We therefore propose that a community-managed wildlife and cultural heritage conservation site is most appropriate for the study site.

As such, liaising with local people, who by and large have positive attitudes towards snow leopard presence in the area, will continue to play a key part in the research. Continued dialogue with herders is important, not only to find out what has happened in between expedition periods, but to involve them more fully in the research. For this purpose community members from the surrounding area were trained in camera trapping techniques in order to extend the study season and have been successful in continuing to monitor camera traps within the Kyrgyz Ala Too between expeditions. These activities should and will continue.

In terms of exploring possibilities of benefiting the local community, snow leopard research activities could be considered as a valuable tourist resource for generating income. The friendly attitude towards the snow leopard expressed by the majority of local people could be the key to the success of both research and community initiatives.

Tasks for the 2019 expedition and 2019/2020 research season

The sixth annual citizen science expedition involving local people, community monitors, student placements, as well as international citizen science volunteers from around the world will take place between June and August 2019 and will continue to work in close co-operation with the Bishkek office of NABU and its "Grupa Bars", an anti-poaching and snow leopard ranger group, as well as the newly created community monitoring group, which will repeat surveys in the areas of Jor Bulak, Pitiy, Kegety and Chep outside expedition periods. Priority tasks of the expedition itself will be:

1. Continue to evaluate and map the current status of snow leopard populations in the Kyrgyz Ala Too range (including the neighboring Jumgal Too), concentrating efforts in areas predicted to be of good habitat suitability for both the snow leopard and its prey (coloured in shades of red on the map in Appendix II), with an emphasis on the Chon Chikan, Jor Bulak and Kashka Tor sites (numbered in Fig.2.3.4b as 4, 5 and 8, respectively), where the expeditions have found multiple signs of snow leopard presence (Appendix I).

2. With the data on wildlife petroglyphs and the cultural landscape gathered and forming fact-based arguments, explore avenues of establishing a community-managed wildlife and cultural heritage conservation site as described above in the area. For this purpose Biosphere Expeditions, which is not present in Kyrgyzstan all year, will continue to work closely with NABU, who have an office in Bishkek and are well networked in Kyrgyzstan, and seek their help in reaching decision-makers in government. In addition, Biosphere Expeditions will engage with other NGOs in Kyrgyzstan, such as the Snow Leopard Trust, which is closely involved in Shamshy Wildlife Reserve, to exchange experiences and ascertain the best way forward in creating a protected area in western Kyrgyz Alatoo.

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3. Butterflies of the West and East Karakol River Valleys, Kyrgyzstan, 2018

(Lepidoptera, Diurna)

Amadeus DeKastle
Plateau Perspectives and American University of Central Asia

3.1. Introduction

The West and East Karakol River Valleys are geographically very close to Bishkek, the capital city of Kyrgyzstan. However, due to various reasons, difficult access being one of them, this region is very poorly studied in regards to its ecology. In most available resources dealing with butterfly distributions, this is a blank spot on the map, and as such, warrants further study to fill in the gaps left unstudied. The larger study of butterfly ecology in the region was begun in 2015 alongside Biosphere Expeditions' ongoing snow leopard research. This report details the distributions and some conclusions about the data collected during the 2018 season. Due to the novel nature of this dataset, the data presented provide an abundance of information that enhances our understanding of the distribution of many of these butterflies. A simple analysis has been made between alpine and non-alpine butterfly species to determine if there is any significance between altitude and distribution, which could be used in the future to map possible altitudinal shifts with climate change in these species. Doing so could allow us to use them as indicators for climate change in future studies.

3.2. Materials and methods

Data were collected in the West and East Karakol river valleys (Fig. 3.2a) during the Biosphere Expeditions project during the summer of 2018 from July to August. Citizen scientists from around the world were present during two 12-day trips that the expedition took place over. Although the main duties of the expedition were not related to butterfly identification and distribution mapping, efforts were made by many members of the expedition to catalogue the butterflies seen. This was accomplished using a smartphone app, Lapis Guides, that includes various citizen science enabled field guides. The app essentially functions as a field guide, but allows users to submit valuable location and image data. Data were collected along the same transects used by the snow leopard study, spreading from approximately 2,800 to 4,050 metres above sea level.

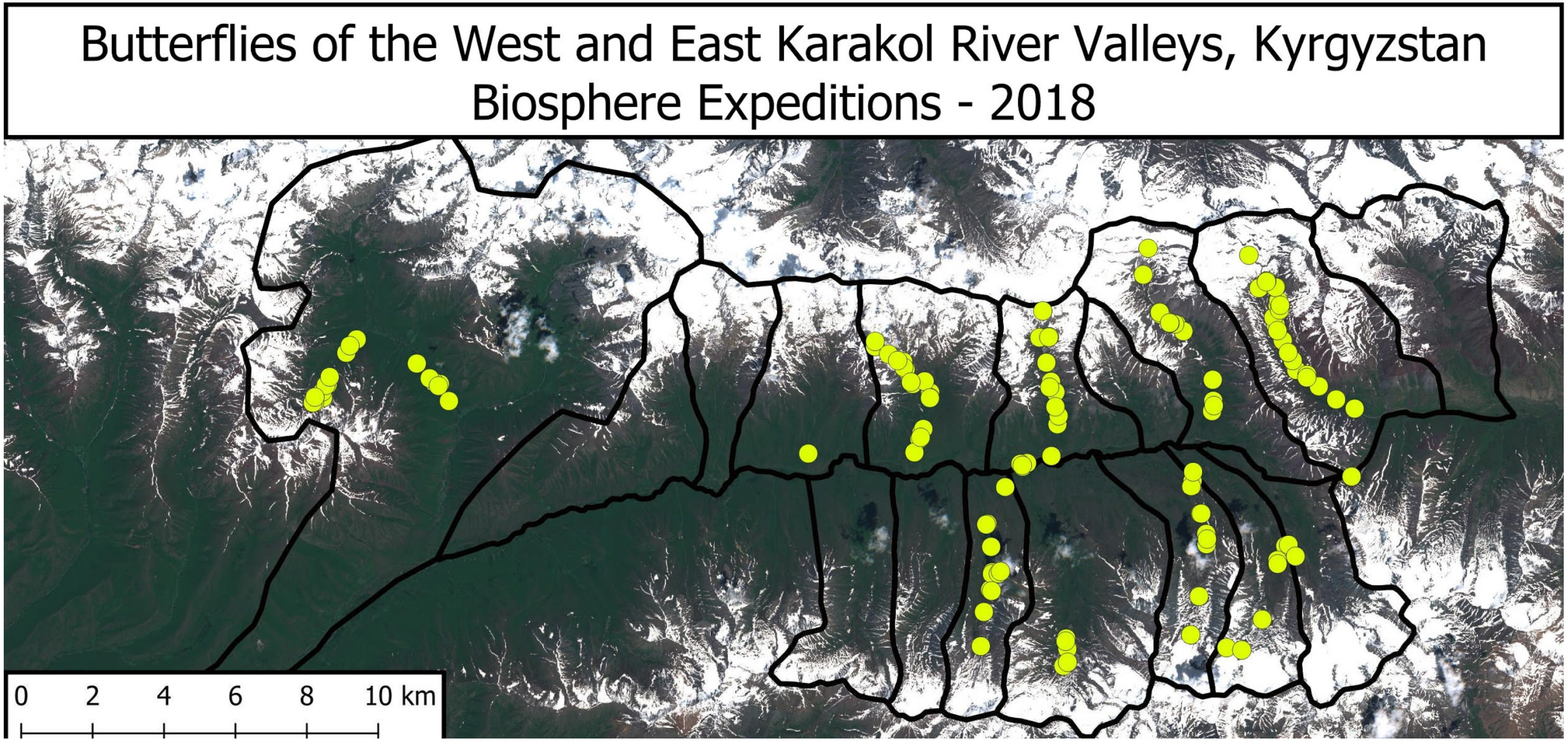


Figure 3.2a. Map of the West and East Karakol river valleys studied with data points for each butterfly observation.

3.3. Results

Throughout the expedition, 22 species were identified with 128 individual sightings (Table 3.3.a). Some of these species provide new location data absent in previous years' publications (Tytar et al. 2016, 2017, 2018). For example, sightings of both *Phengaris rebeli* and *Thymelicus lineola* provide new data on these species' distribution, as neither had been found here in previous years. Also, in 2017, one species (*Colias cocandica)* had only a single, doubtful sighting (Tytar et al. 2018), but this year, a positive identification was made proving that it is in fact present in the study area, albeit in low numbers.

Table 3.3a. Butterflies found by the expedition.

Family	Scientific name	Common name
Hesperiidae	*Muschampia kuenlunus*	No Common Name (NCN)
	Pyrgus malvae	Grizzled Skipper
	Thymelicus lineola	Essex Skipper
Lycaenidae	*Aricia agestis*	Brown Argus
	Cupido buddhista	Buddhist Blue
	Lycaena phlaeas	Small Copper
	Phengaris rebeli	Mountain Alcon Blue
Nymphalidae	*Aglais urticae*	Small Tortoiseshell
	Argynnis aglaja	Dark Green Fritillary
	Boloria generator	NCN
	Melitaea solona	NCN
Papillionidae	*Papilio machaon*	Old World Swallowtail
	Parnassius delphius	Banded Apollo
	Parnassius tianschanicus	Large Keeled Apollo
Pieridae	*Colias cocandica*	NCN
	Colias erate	Pale Clouded Yellow
	Pieris napi	Green Veined White
	Pontia callidice	Lofty Bath White
Satyridae	*Coenonympha caeca*	NCN
	Coenonympha sunbecca	NCN
	Erebia mopsos	NCN
	Erebia sokolovi	NCN

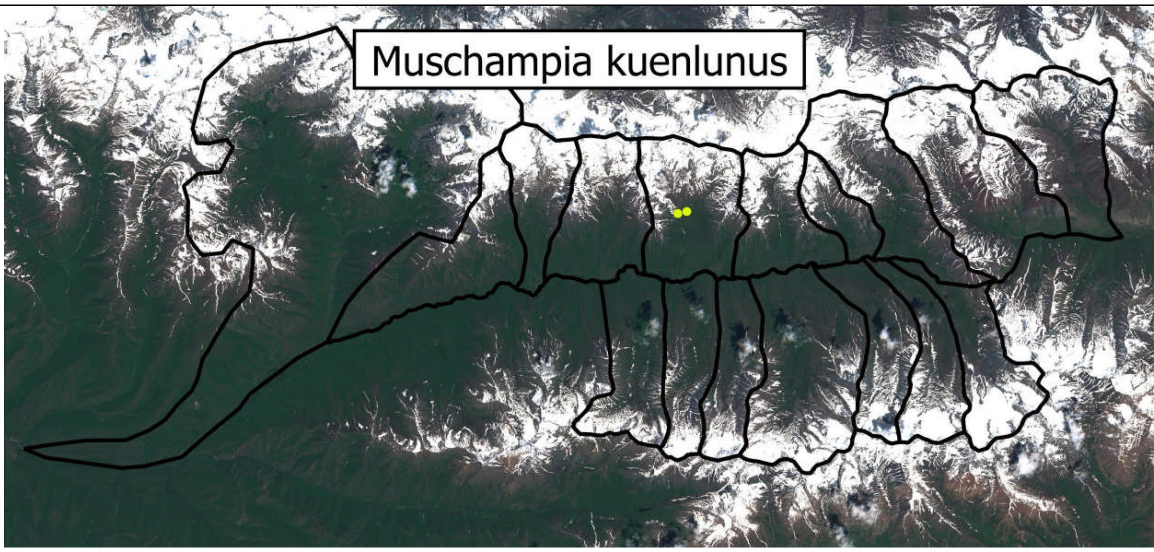
Species profiles

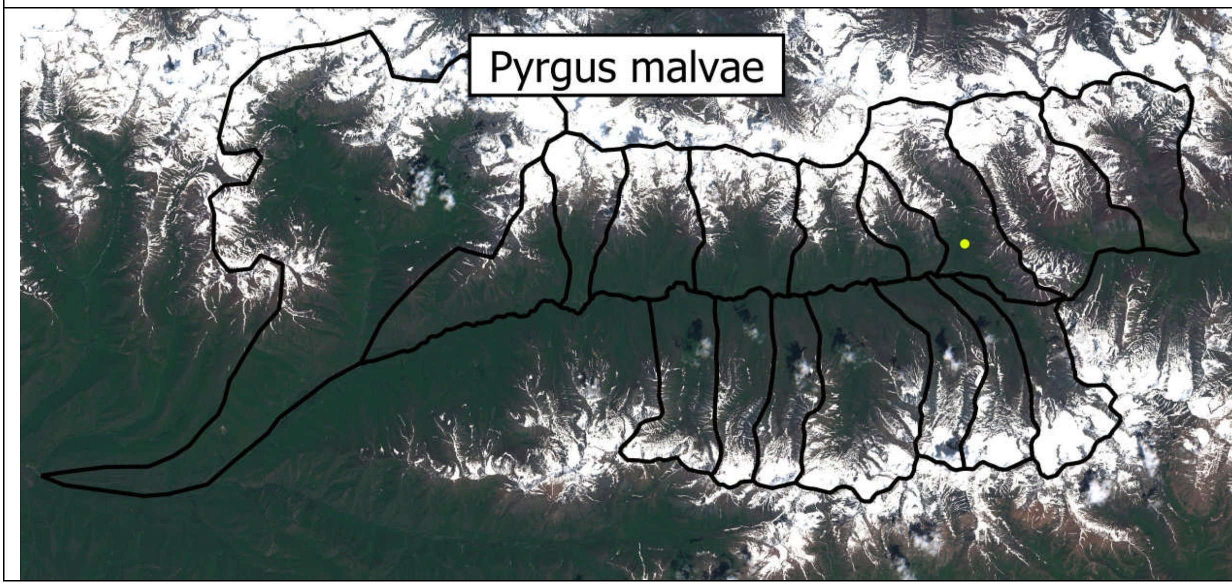
Species profiles include photographs, natural history and distribution maps for each species observed during the expedition. All photographs and maps are the property of the owner (unless otherwise noted) and only permitted for use outside this report with written permission.

Hesperiidae

Muschampia kuenlunus			
Flight time	June to August	Elevation (m)	1500-3300
Habitat	Meadows and steppes		
Food plants	Nothing mentioned in the literature		
Life cycle	Univoltine		

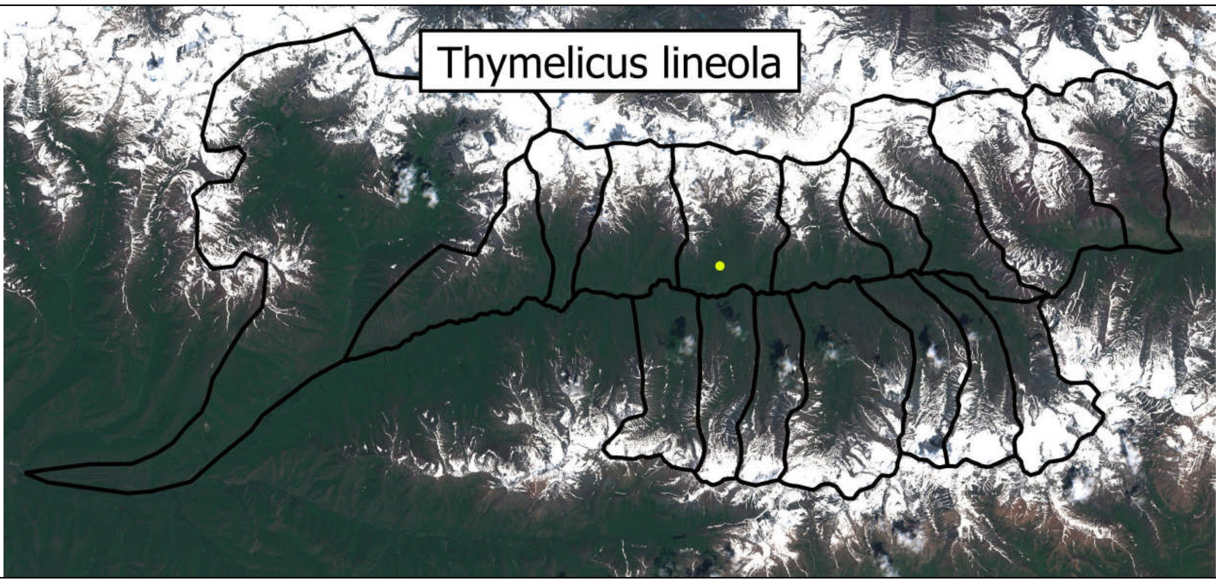
Photo Courtesy of Brian Oram - 2017



Pyrgus malvae - Grizzled Skipper			
Flight time	May to early July	Elevation (m)	1000-3000
Habitat	Forest clearings, mountainous meadows, steppes		
Food plants	*Potentilla spp.* (cinquefoil) and *Rosa spp.* (wild rose)		
Life cycle	Eggs laid singly on host plant. Species overwinters as an egg. Likely univoltine.		
			
Photo Courtesy of Charles J. Sharp - 2015			
			

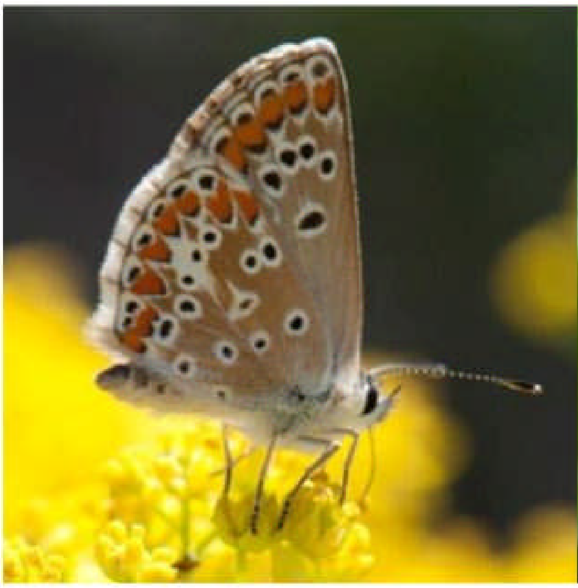
Thymelicus lineola - Essex Skipper			
Flight time	May to August	Elevation (m)	Up to 2600
Habitat	Clay and Stony Gorges and Cultivated Areas		
Food plants	*Brachypodium spp.*		
Life cycle	Univoltine and overwinters as an egg.		

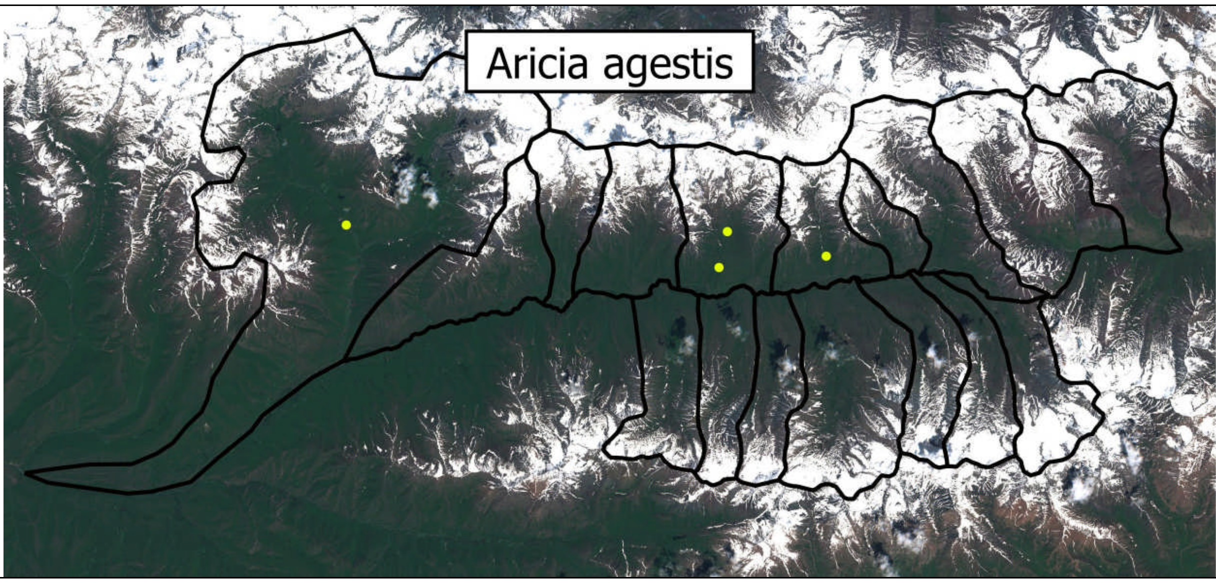
Photo Courtesy of Gail Hampshire - 2014



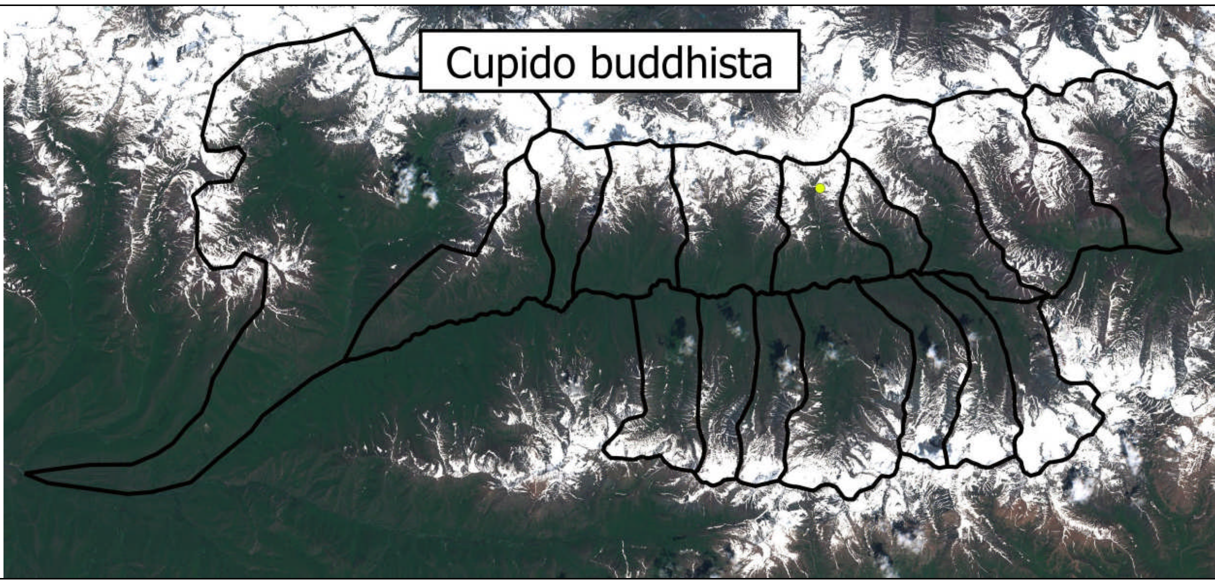
Lycaenidae

Aricia agestis - Brown Argus			
Flight time	May to September	Elevation (m)	1700-3800
Habitat	Dry meadows or steppe areas		
Food plants	*Erodium spp.* (storksbill) and *Geranium spp.* (cranesbill)		
Life cycle	Eggs are laid singly. Species overwinters as larva and pupates in the spring. Univoltine or bivoltine		

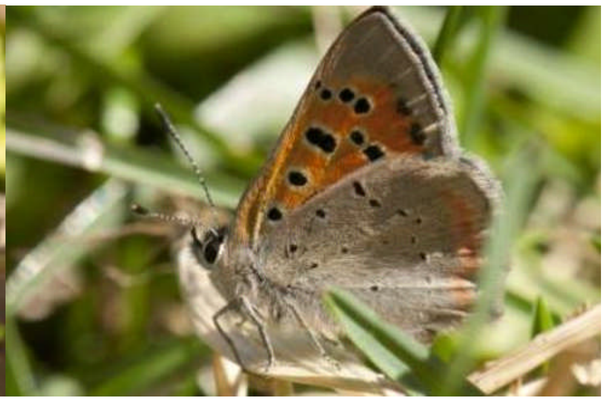


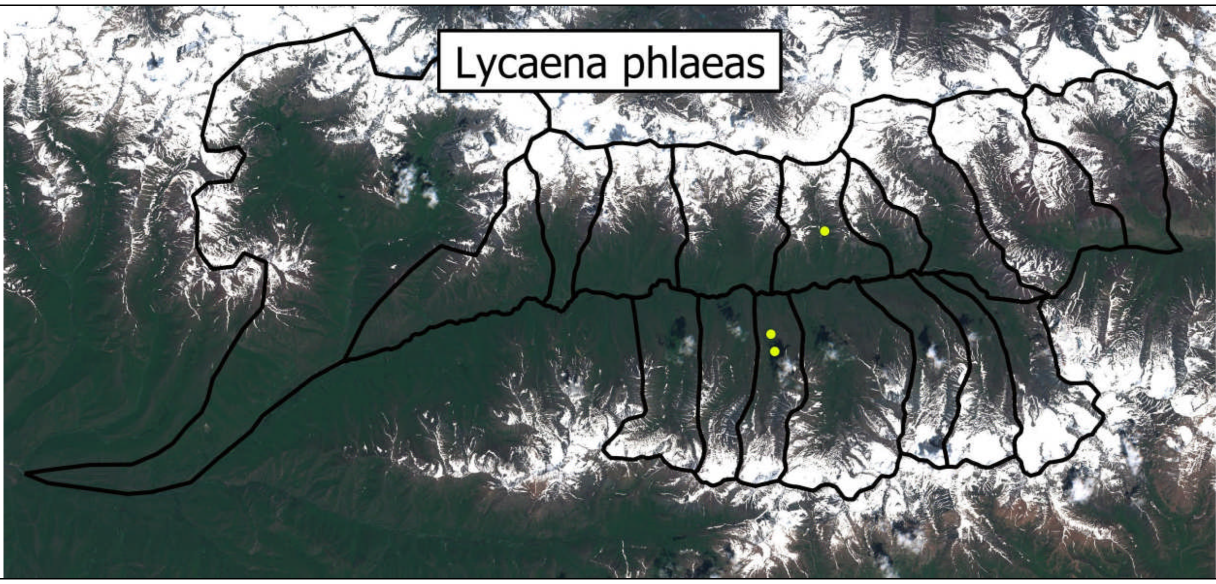


Cupido buddhista — Buddhist Blue			
Flight time	June to September	Elevation (m)	2300-3400
Habitat	Alpine biomes with lots of herbaceous plants		
Food plants	*Oxytropis spp.* (locoweed)		
Life cycle	Nothing mentioned in the literature		



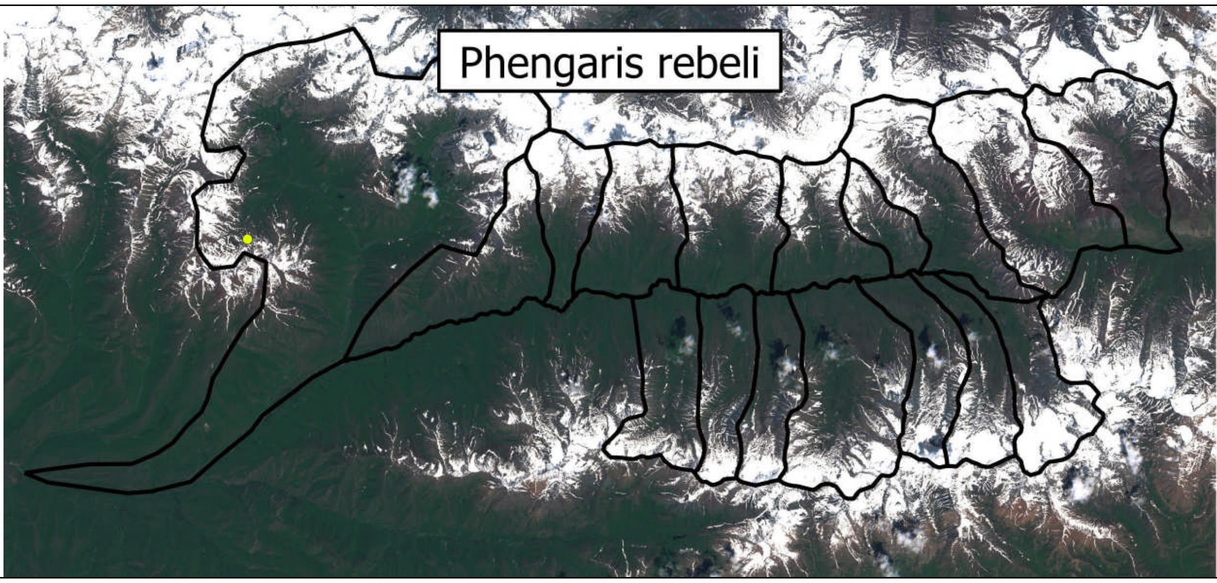
Lycaena phlaeas - Small Copper			
Flight time	June to August	Elevation (m)	Up to 4500
Habitat	Meadows in lowlands and mountains		
Food plants	*Rumex spp.* (Sorrel)		
Life cycle	Multivoltine. Overwinters as a larva, likely tended by ants.		





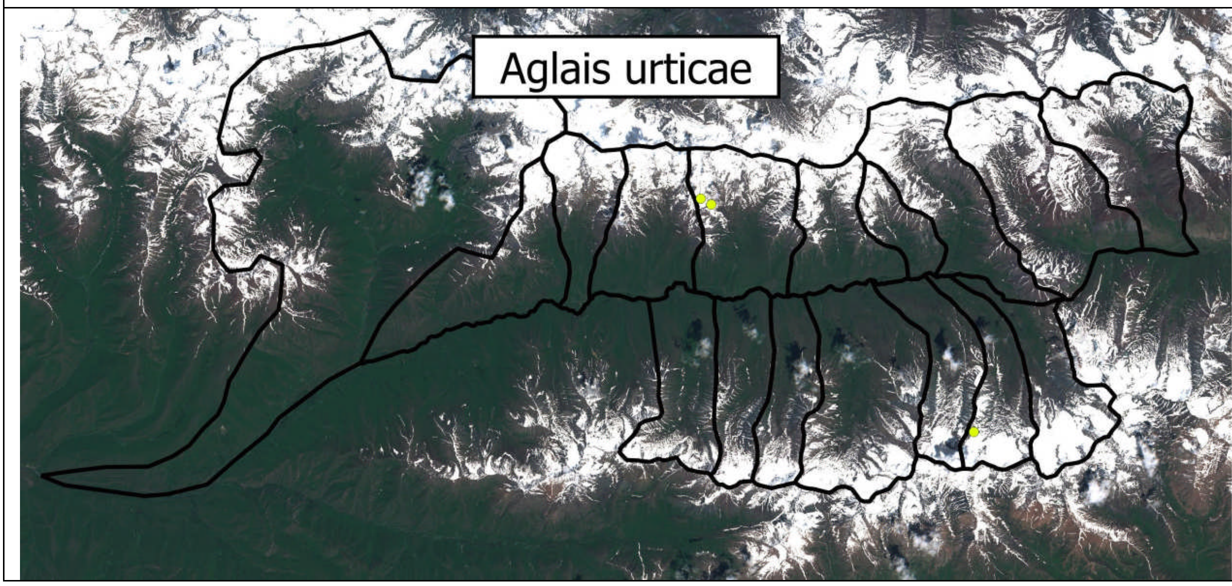
Phengaris rebeli - Mountain Alcon Blue			
Flight time	June to August	Elevation (m)	1500-2000
Habitat	West and North facing meadowy slopes		
Food plants	*Gentiana spp.*		
Life cycle	Hibernates as a larva. Pupation occurs within the nest of ants.		

Photo Courtesy of Carsten Siegel - 2015



Nymphalidae

Aglais urticae — Small Tortoiseshell			
Flight time	April to September	Elevation (m)	up to 4000
Habitat	Open areas and mountain gorges with a high density of the host plant		
Food plants	*Urtica spp.* (stinging nettle)		
Life cycle	Adults overwinter in a state of hibernation begun around October. They emerge during early spring		



Argynnis aglaja — Dark Green Fritillary			
Flight time	June to August	Elevation (m)	up to 4200
Habitat	Meadow areas in mountainous and subalpine biomes		
Food plants	*Violaceae spp.*(violets) and *Polygonaceae spp.* (buckwheats)		
Life cycle	Species overwinters as a small larva		

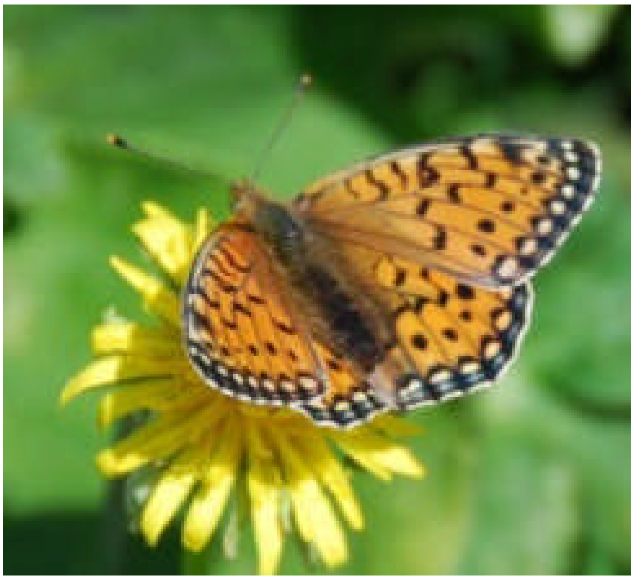
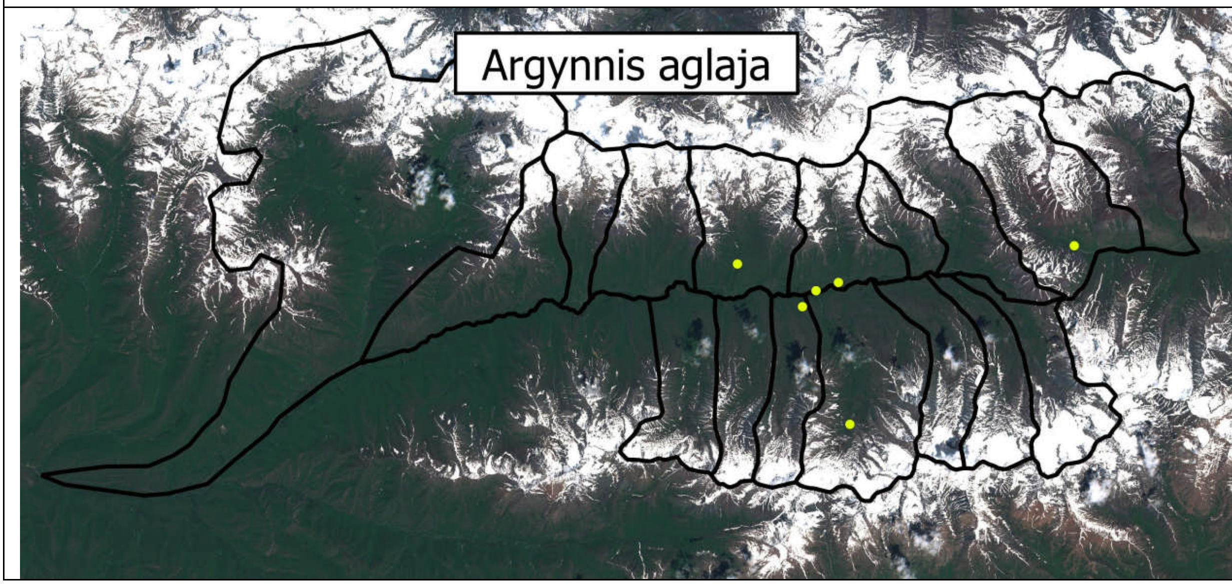
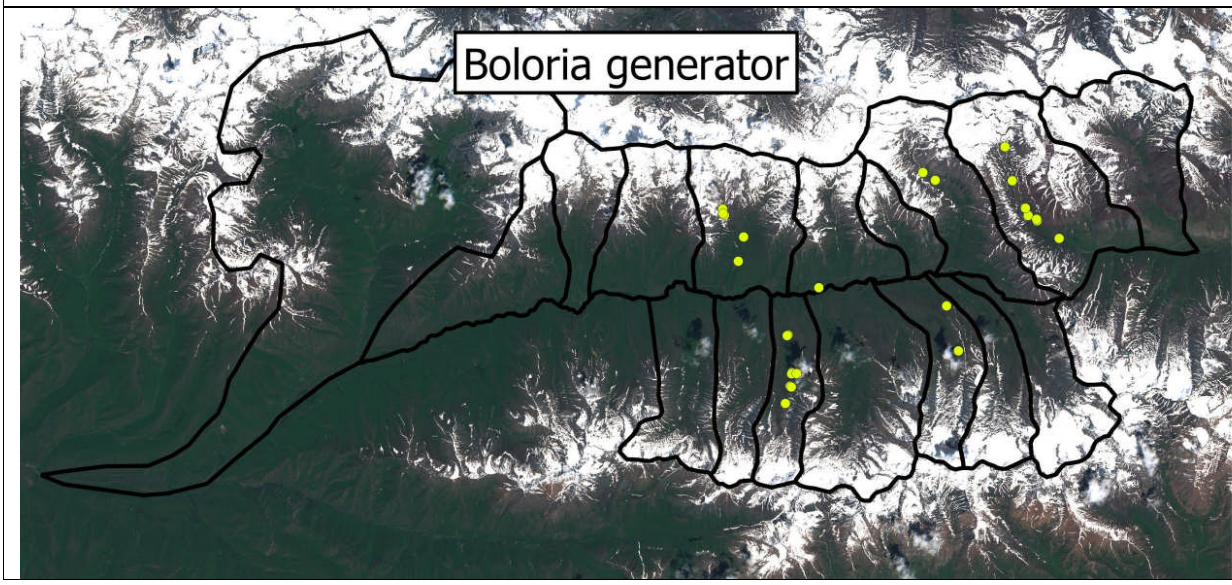


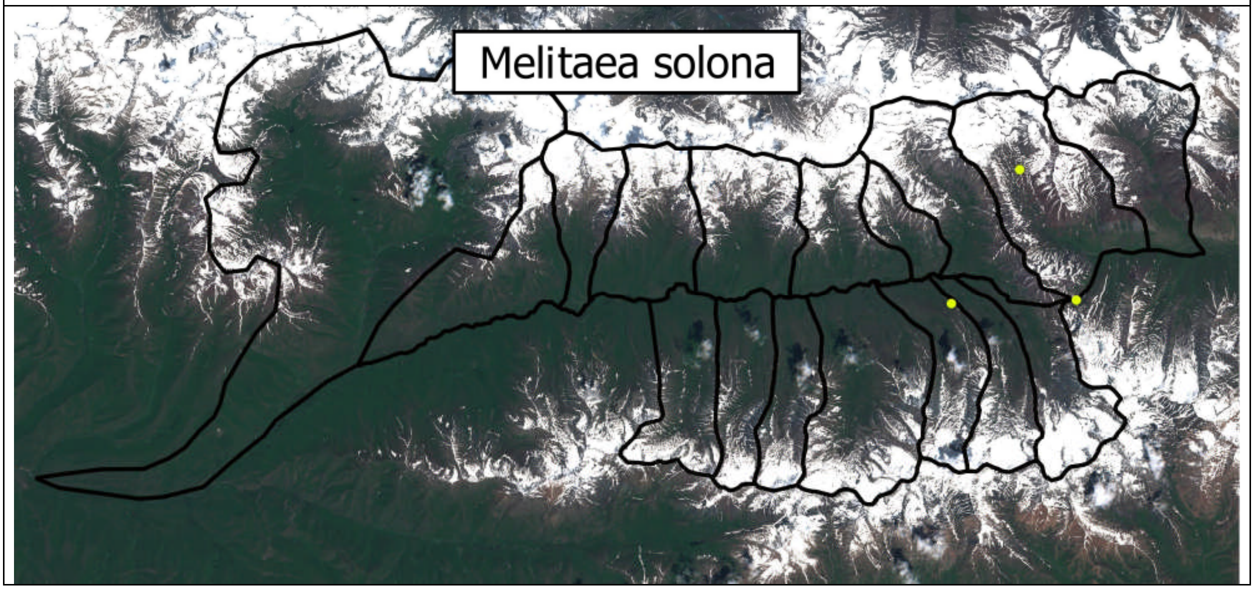
Photo courtesy of Koenraad Bracke - 2016



Boloria generator — NCN			
Flight time	July to September	Elevation (m)	2500-4500
Habitat	Moist mountain meadows and stream banks		
Food plants	*Polygonum alpinum* (Alpine Knotweed)		
Life cycle	Nothing mentioned in the literature		

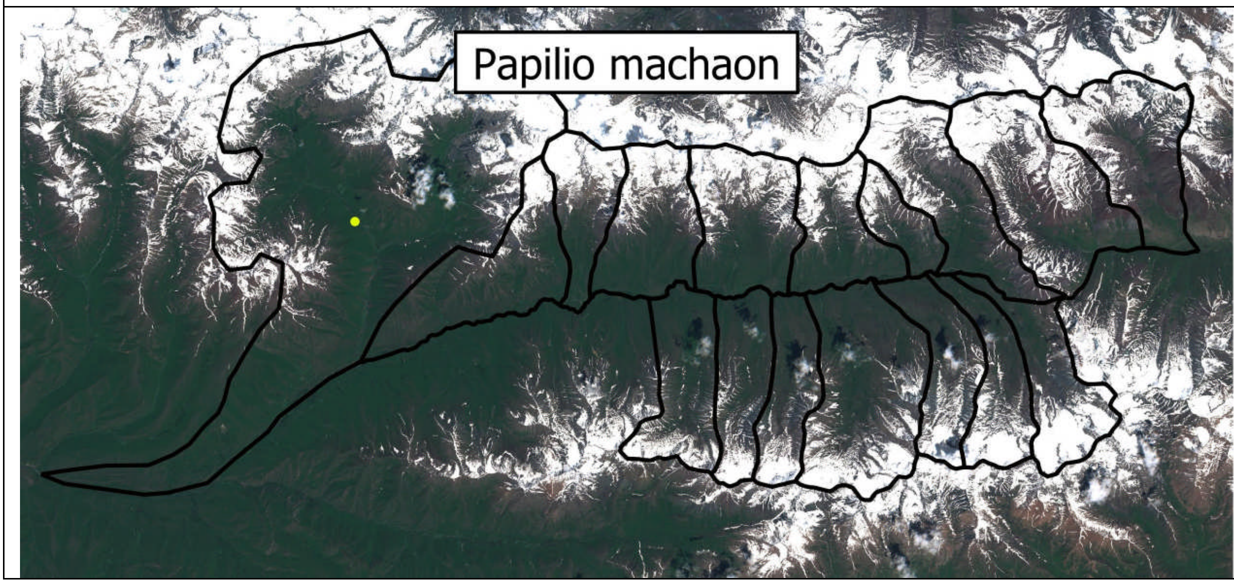


Melitaea solona — NCN			
Flight time	June to July	Elevation (m)	2700-4000
Habitat	Humid alpine meadows		
Food plants	*Pedicularis spp.* (Lousewort)		
Life cycle	Nothing mentioned in the literature		

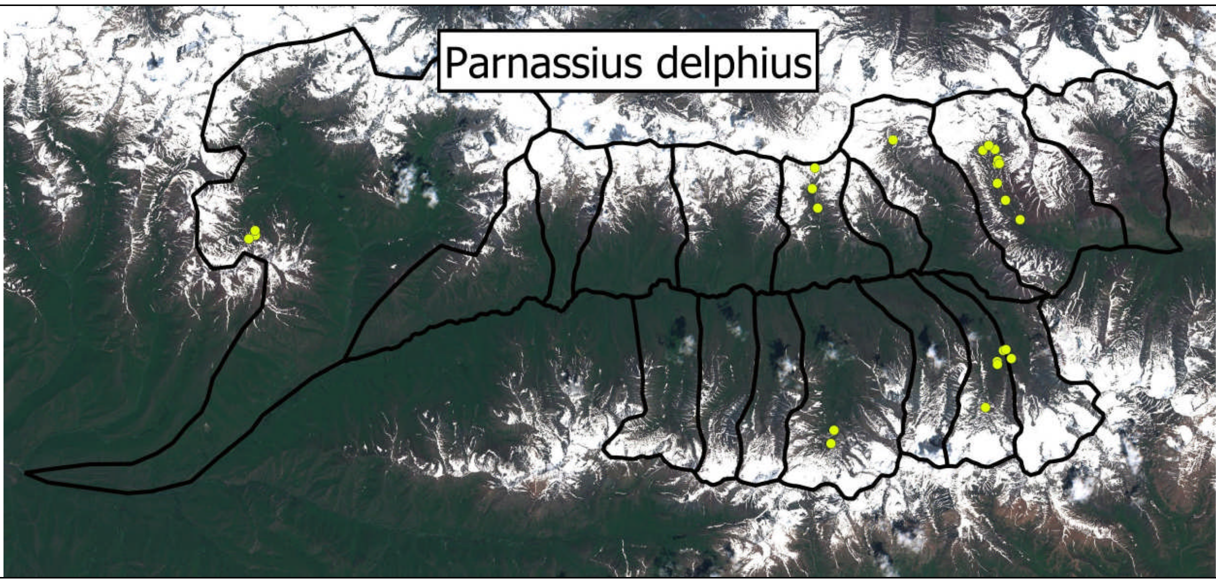


Papilionidae

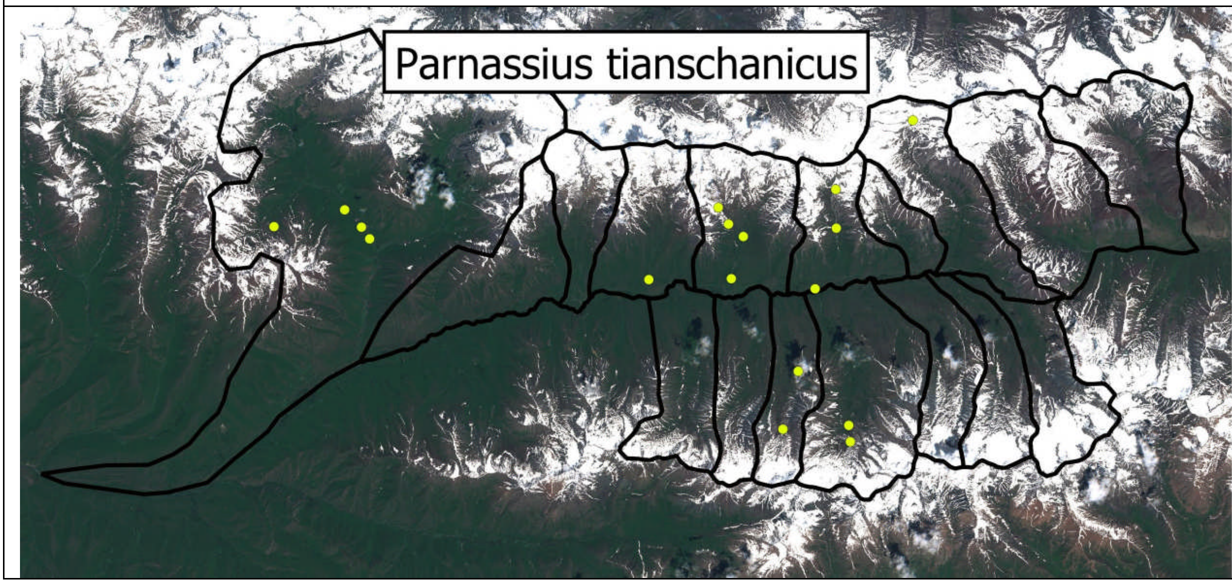
Papilio machaon — Old World Swallowtail			
Flight time	April to November	Elevation (m)	Up to 4000
Habitat	Found in virtually any ecosystem from lowlands to high mountains		
Food plants	*Artemisia spp.* (Wormwood), *Ferula spp., Haplophyllum spp., Prangos spp.*		
Life cycle	Eggs laid singly on host plant. Overwinters as a pupa. Pupal diapause is possible for up to 3 years before adult emergence. Univoltine or bivoltine depending on location.		



Parnassius delphius — Banded Apollo			
Flight time	June to July	Elevation (m)	3000-4000
Habitat	Western facing rocky slopes, scree fields and mountain meadows		
Food plants	*Cysticorydalis fedtschenkoana*, *Corydalis tenella* (Discreet Corydalis), *Corydalis gortschakovi*		
Life cycle	Follows a 2 year life cycle. Initially overwinters as an egg hatching in spring. Larvae feed for 1 year then overwinter as pupae the second winter		



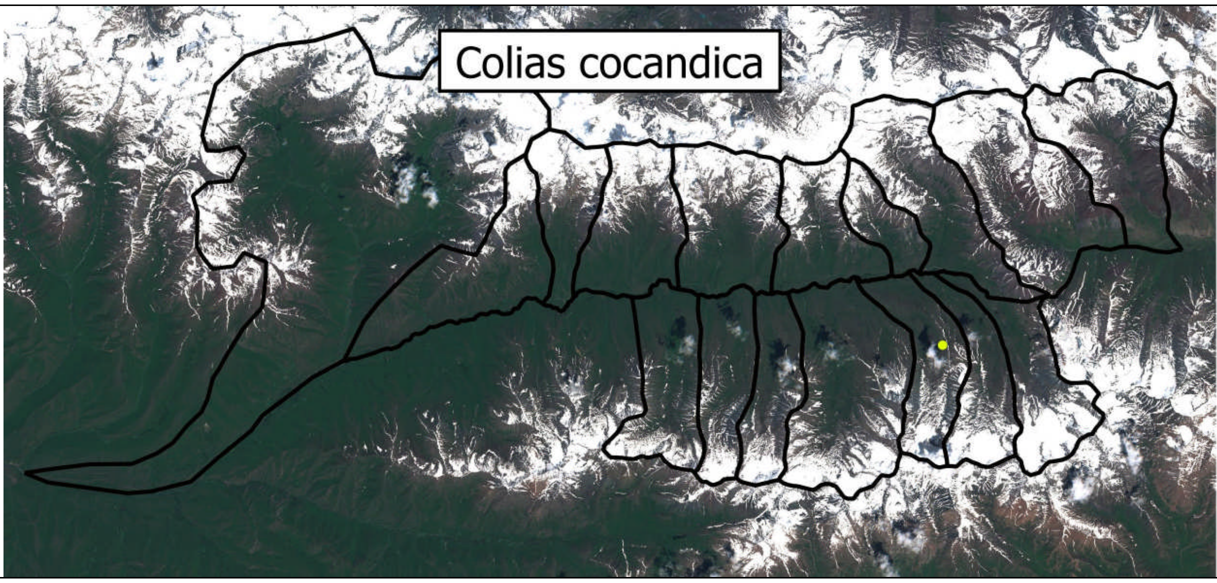
Parnassius tianschanicus — Large Keeled Apollo			
Flight time	May to September	Elevation (m)	1700-3500
Habitat	East and south facing rocky slopes in subalpine and alpine areas		
Food plants	*Rhodiola spp.*, *Sedum ewersii* (Stonecrop), *Sedum hybridum*		
Life cycle	Overwinters as a larva		



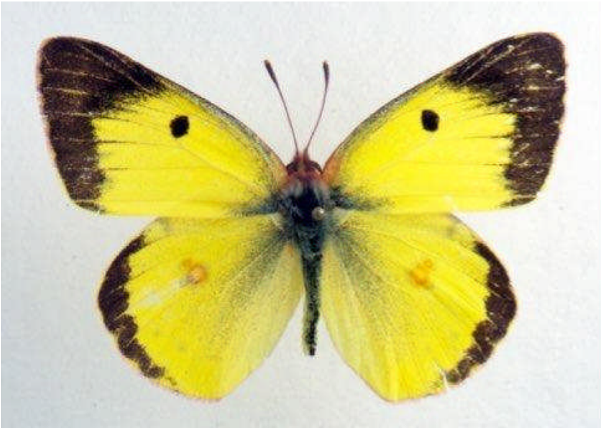
Pieridae

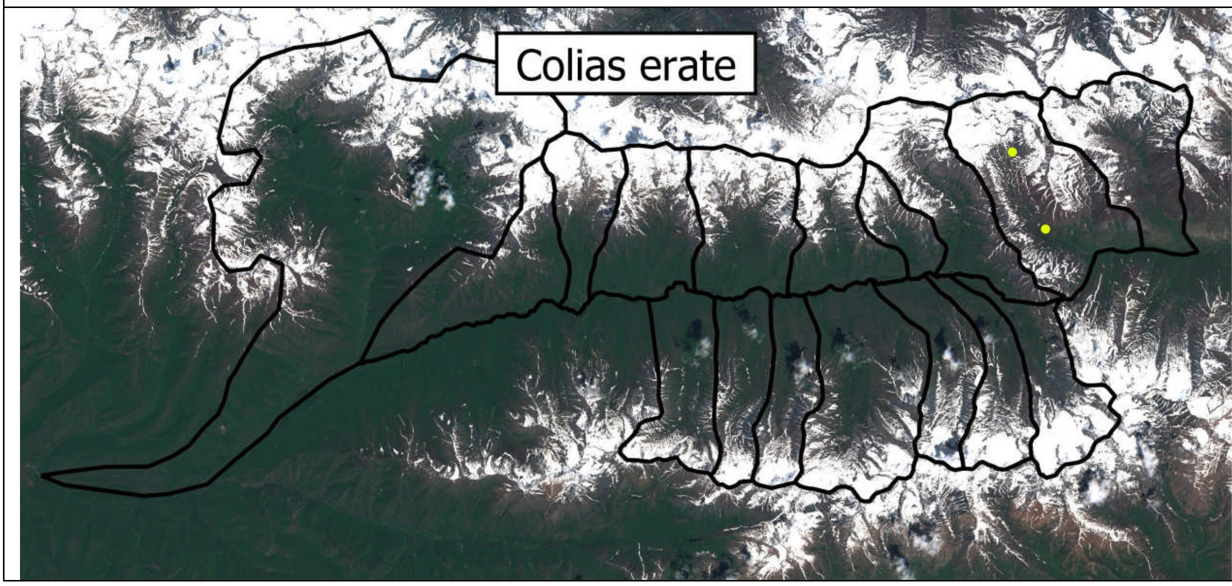
Colias cocandica			
Flight time	June to July	Elevation (m)	3000 - 4500
Habitat	Stoney slopes and mountain meadows		
Food plants	*Astragalus spp.* (milkvetch)		
Life cycle	Overwinters as a second instar larva		

Photo courtesy of Josef Greishuber - 2005

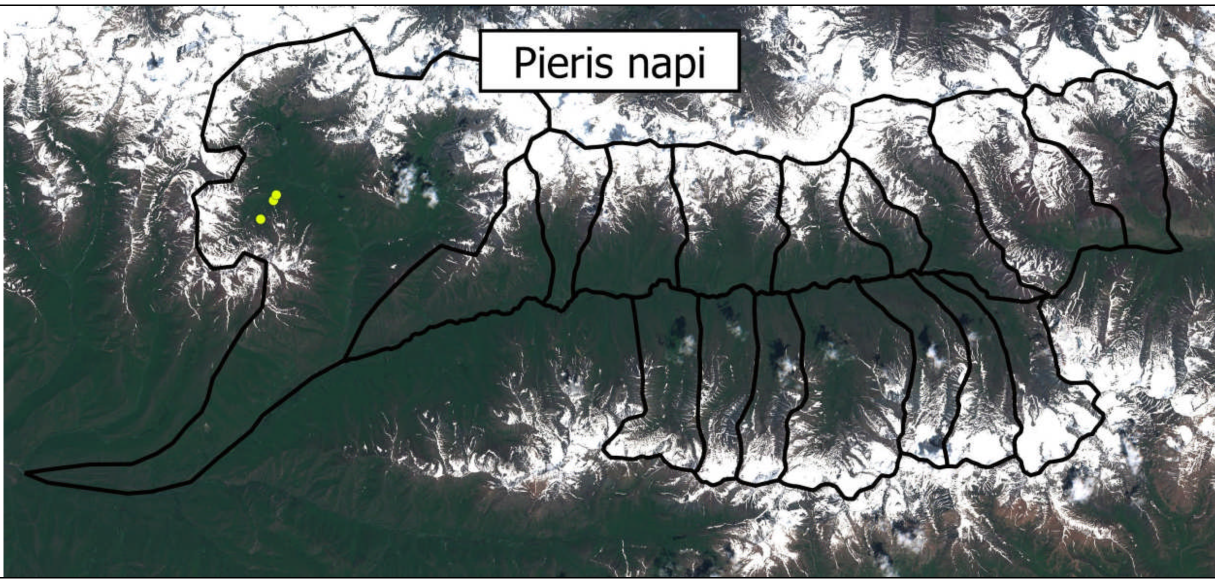


Colias erate — Pale Clouded Yellow			
Flight time	April to October	Elevation (m)	up to 3300
Habitat	Steppes, fields, and mountain meadows		
Food plants	*Onobrychis spp.* (Sainfoin), *Medicago spp.* (Burclover), *Trifolium spp* (Clover), *Trigonella spp* (Fenugreek), *Alhagi spp.* (Camelthorn)		
Life cycle	Bivoltine. Overwinters as either a pupa or larva		

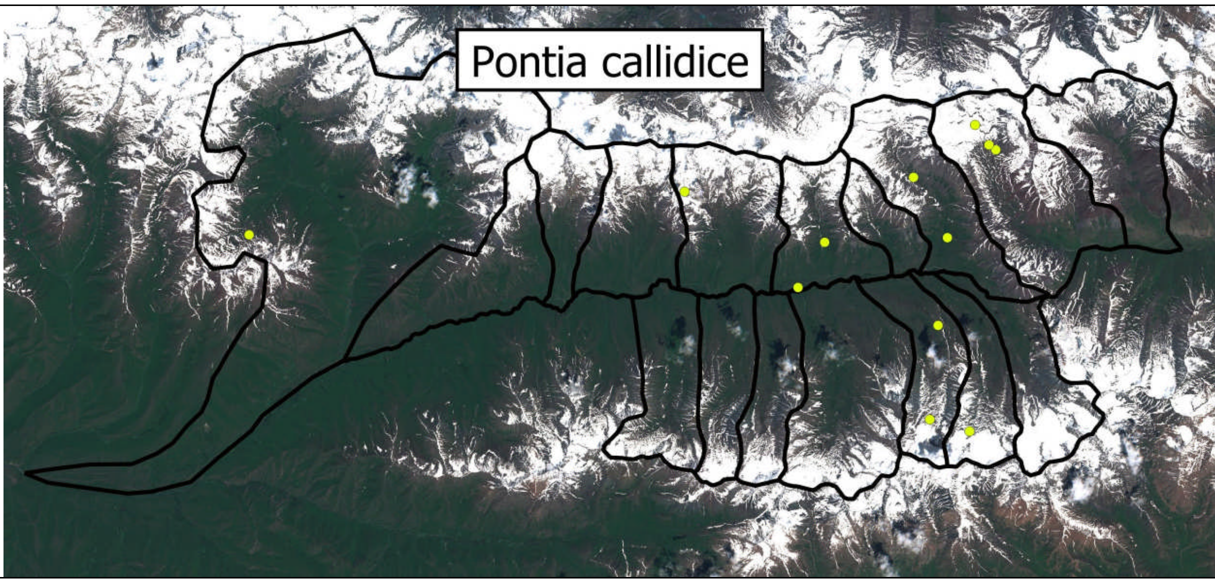




Pieris napi — Green Veined White			
Flight time	April to September	Elevation (m)	up to 3000
Habitat	Meadows and river valleys		
Food plants	*Alyssum spp.*, *Arabis spp.* (Rockcress), *Barbarea spp.* (Winter Cress), *Brassica spp.* (Cabbage), *Cardamine spp.* (Bittercress), *Descuriania spp.* (Tansymustard), *Draba spp.* (Whitlow-grass), *Erysimum spp.* (Wallflower), *Lepidium spp.* (Peppercress), *Reseda lutea* (Wild Mignonette), *Sisymbrium spp.* (Rocket), *Thlaspi spp.* (Pennycress)		
Life cycle	Bivoltine or monovoltine depending on the altitude. Eggs are laid singly. Overwinters as a pupa.		

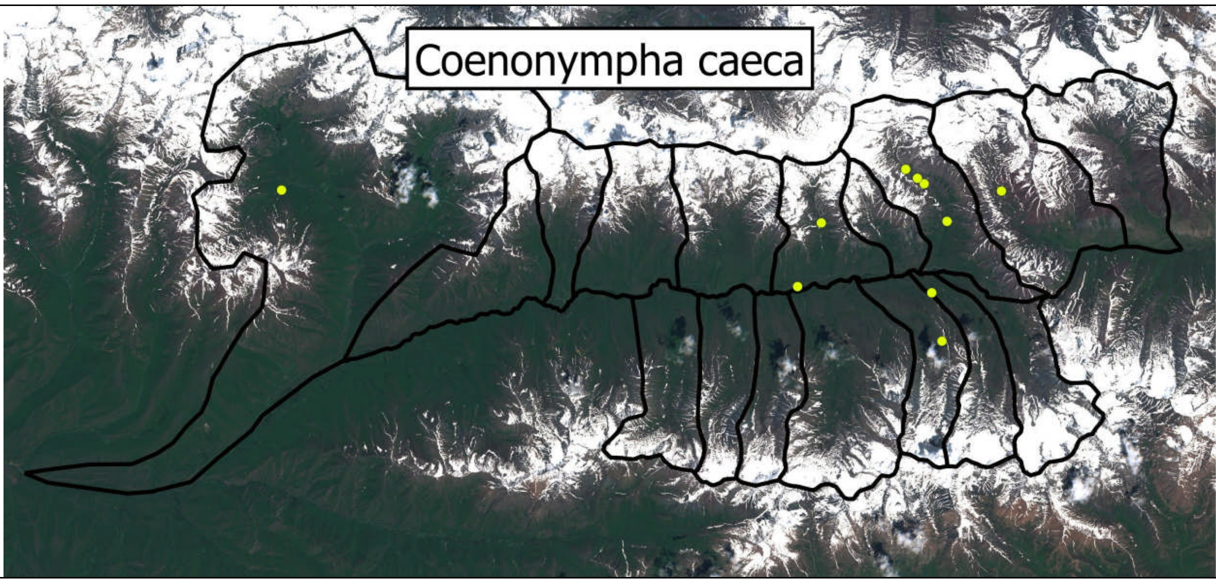


Pontia callidice — Lofty Bath White			
Flight time	May to September	Elevation (m)	2000-4500
Habitat	South facing river valleys and steppe slopes		
Food plants	*Brassica spp.* (Cabbage), *Alyssum spp., Arabis spp.* (Rockcress), *Barbarea spp.* (Winter Cress), *Descurainia spp.* (Tansymustard), *Erysimum spp.* (Wallflower), *Sisymbrium spp.* (Rocket), *Thlaspi spp.* (Pennycress), *Draba spp.* (Whitlow-grass), *Lepidium spp.* (Peppercress), *Reseda lutea* (Wild Mignonette), *Orostachys spp.* (Chinese Hat)		
Life cycle	Bivoltine. Second generation hibernates as a pupa		

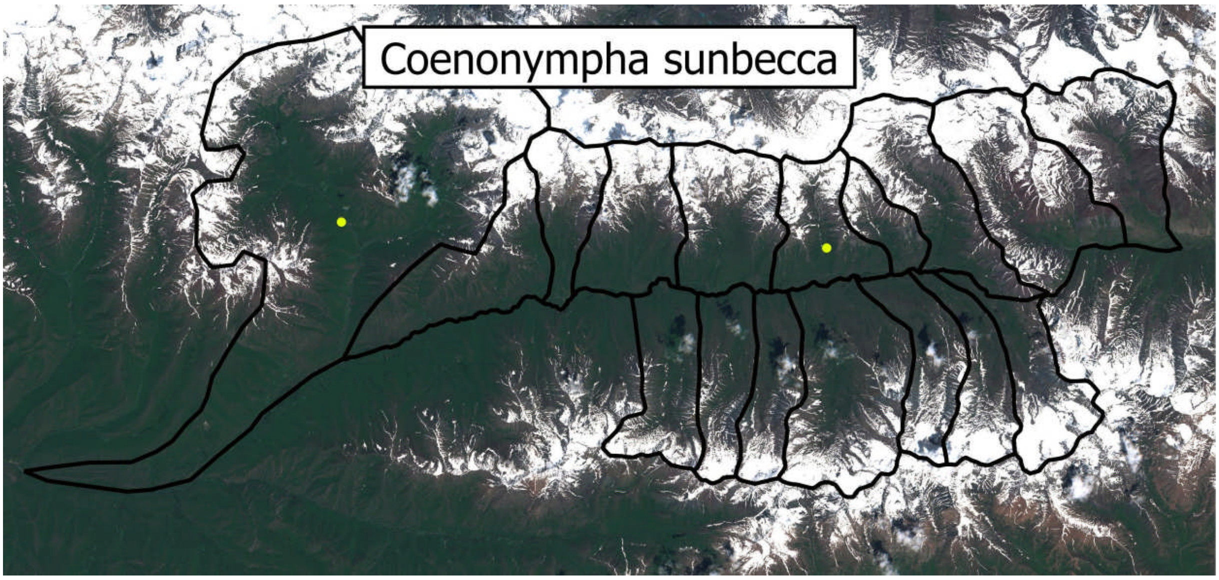


Satyridae

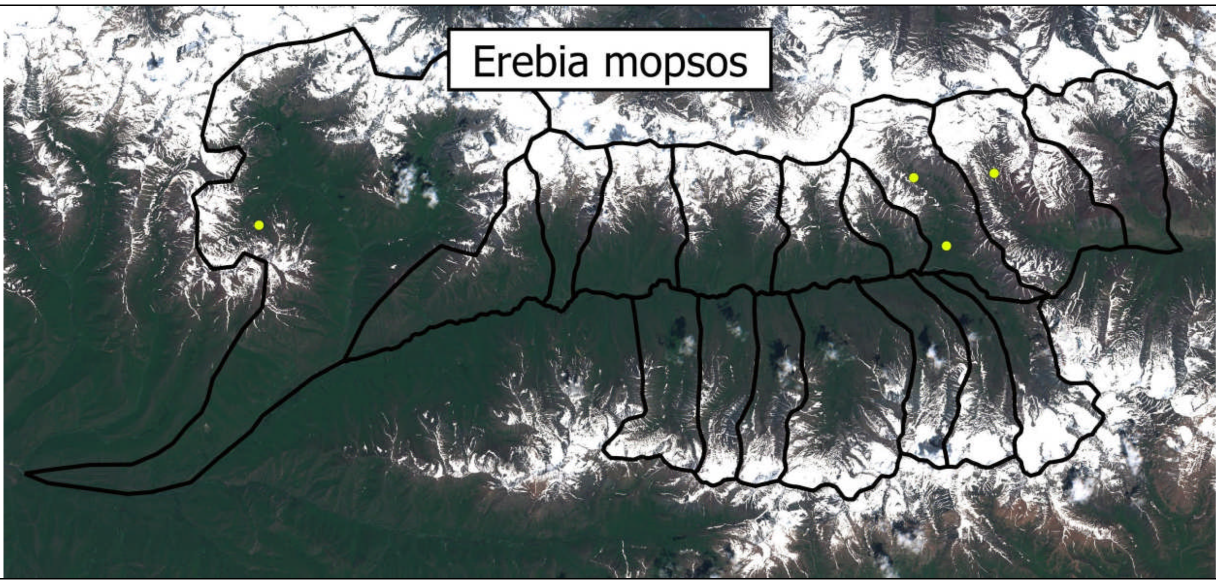
Coenonympha caeca			
Flight time	June to July	Elevation (m)	2000-3500
Habitat	Alpine meadows, stream banks, and stony slopes that face eastward		
Food plants	*Carex spp.* (sedge)		
Life cycle	Nothing mentioned in the literature		



Coenonympha sunbecca			
Flight time	June to August	Elevation (m)	1500-3400
Habitat	Sloped meadows and stream banks		
Food plants	*Poaceae spp.* (grasses)		
Life cycle	Nothing mentioned in the literature		

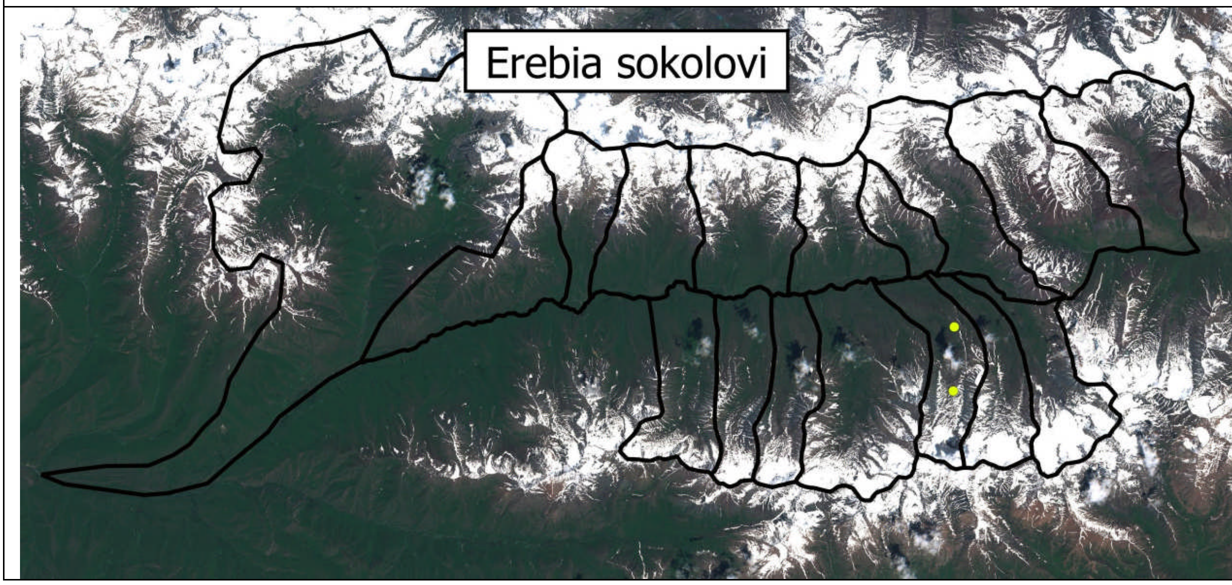


Erebia mopsos			
Flight time	June to July	Elevation (m)	2800-3500
Habitat	Meadow slopes in subalpine and alpine areas		
Food plants	*Festuca spp.* (Fescue)		
Life cycle	Nothing mentioned in the literature		



Erebia sokolovi			
Flight time	July to August	Elevation (m)	3000-3600
Habitat	Meadow slopes in subalpine and alpine areas		
Food plants	*Poaceae spp.* (grasses)		
Life cycle	Nothing mentioned in the literature		

Photo courtesy of Peter Sporrer - 2015



3.4. Discussion and conclusions

The region studied is already alpine in elevation, but there are limits to the elevation that many butterflies can live at. Much of this is due to physiological limitations, but may also be due in part to a variety of environmental factors such as temperature or host plant availability. A simple analysis was done using GIS software to determine the species composition of butterflies living above 3,600 m. This elevation was chosen as it represents the average elevation where the majority of vegetation ceases to survive.

Generally, above this elevation, only lichen, cushion plants, and small forbs are able to persist, greatly reducing the availability of host plants to butterflies dependant on certain low-alpine plant species. Thirty-two records of butterflies found above 3,600 meters between the years of 2015 - 2018 are shown in Table 3.4a.

Table 3.4a. Butterflies recorded above 3,600 meters during the 2015 - 2018 seasons with number of records in brackets.

2015	2016	2017	2018
A. urticae (1)	*A. urticae (1)*	*A. urticae* (3)	*A. urticae* (2)
C. erate (1)	*P. callidice (1)*	*B. generator (1)*	*C. buddhista (1)*
C. erubescens (1)	*P. tianschanicus (1)*	*C. erate (1)**	*C. erate (1)*
P. callidice (1)		*P. callidice* (5)	*P. callidice* (4)
P. tianschanicus (1)		*P. delphius* (4)	*P. delphius* (6)
		P. tianschanicus (1)	*P. tianschanicus (2)*

* This record is of a dead specimen found on glacial ice above 4000 meters. It may have been blown up to the glacier and died as a result.

Using data from Tschikolovets (2005) and Toropov and Zhdanko (2006, 2009), elevation profiles for each species (detailed in the above species descriptions) were used to determine if a species was "alpine" or not. An elevation of 3,600 m was used again for consistency. Any species that had an elevation range above 3,600 m was considered alpine. Any species with a range below 3,600 m was not considered alpine (Table 3.4b).

Table 3.4b. A list of "alpine" butterflies based on their elevation profiles.

Species	Elevation (in meters)	Species	Elevation (in meters)
Aglais urticae	up to 4000	*Lycaena phlaeas*	up to 4500
Argynnis aglaja	up to 4200	*Melitaea solona*	2700-4000
Aricia agestis	1700-3800	*Papilio machaon*	up to 4000
Boloria generator	2500-4500	*Parnassius delphius*	3000-4000
Clossiana erubescens	2000-3600	*Pontia callidice*	2000-4500
Colias cocandica	3000-4500	*Pontia daplidice*	500-4000
Erebia sokolovi	3000-3600		

Although the sample size is rather small (only 9% of the total number of sightings), we should expect that a significant majority of individuals found above 3,600 m would belong to one of the alpine species. The data show that over the course of four years' research, 77% of all butterfly individuals collected above 3,600 m are in fact alpine species (Fig. 3.4a). This means that 23% of individuals found above 3,600 m are outside their established elevation ranges, suggesting that high alpine habitat is becoming favourable to these species. It is hypothesised that further study will show that the percentage of non-alpine butterflies found above 3,600 m will continue to grow over time as a consequence of climate change in the alpine environment, most specifically, the establishment of host plant populations at higher elevations due to receding glaciers and more favourable growing conditions. Using this model, these two butterfly groups (alpine vs. non-alpine) can be used as indicators of broad changes in the alpine environment due to climate change.

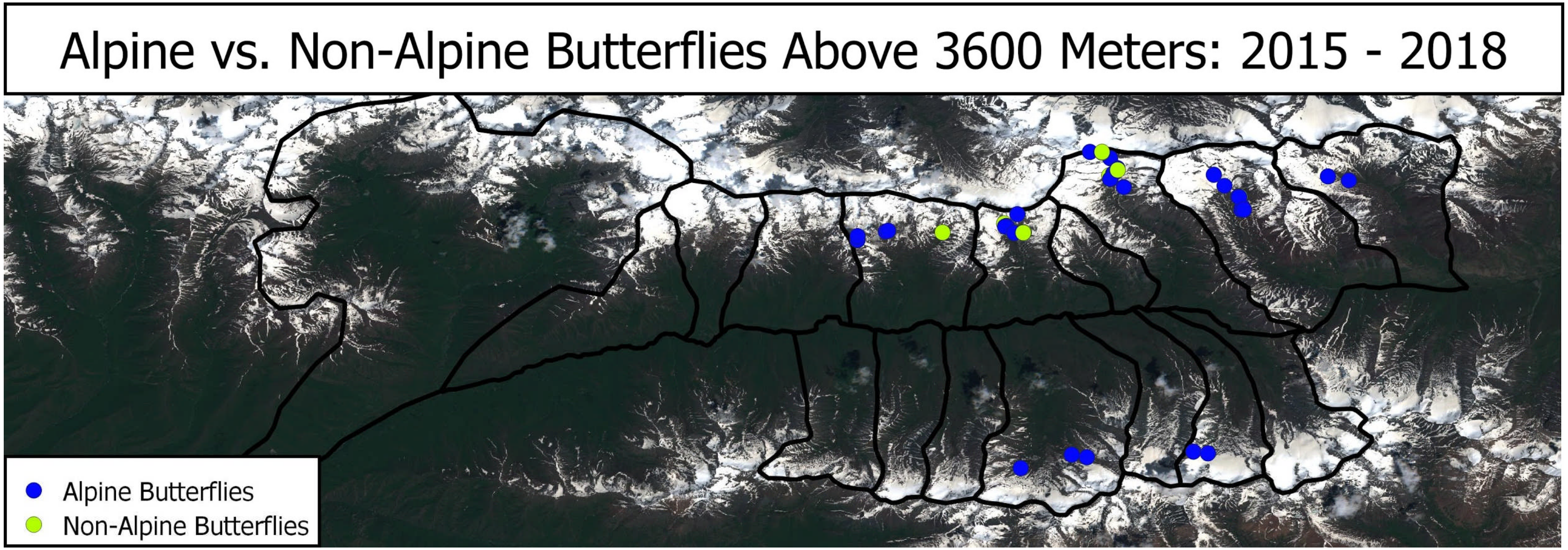


Figure 3.4a. Alpine vs. non-alpine butterflies 2015-2018.

3.5. Literature cited and *resources used

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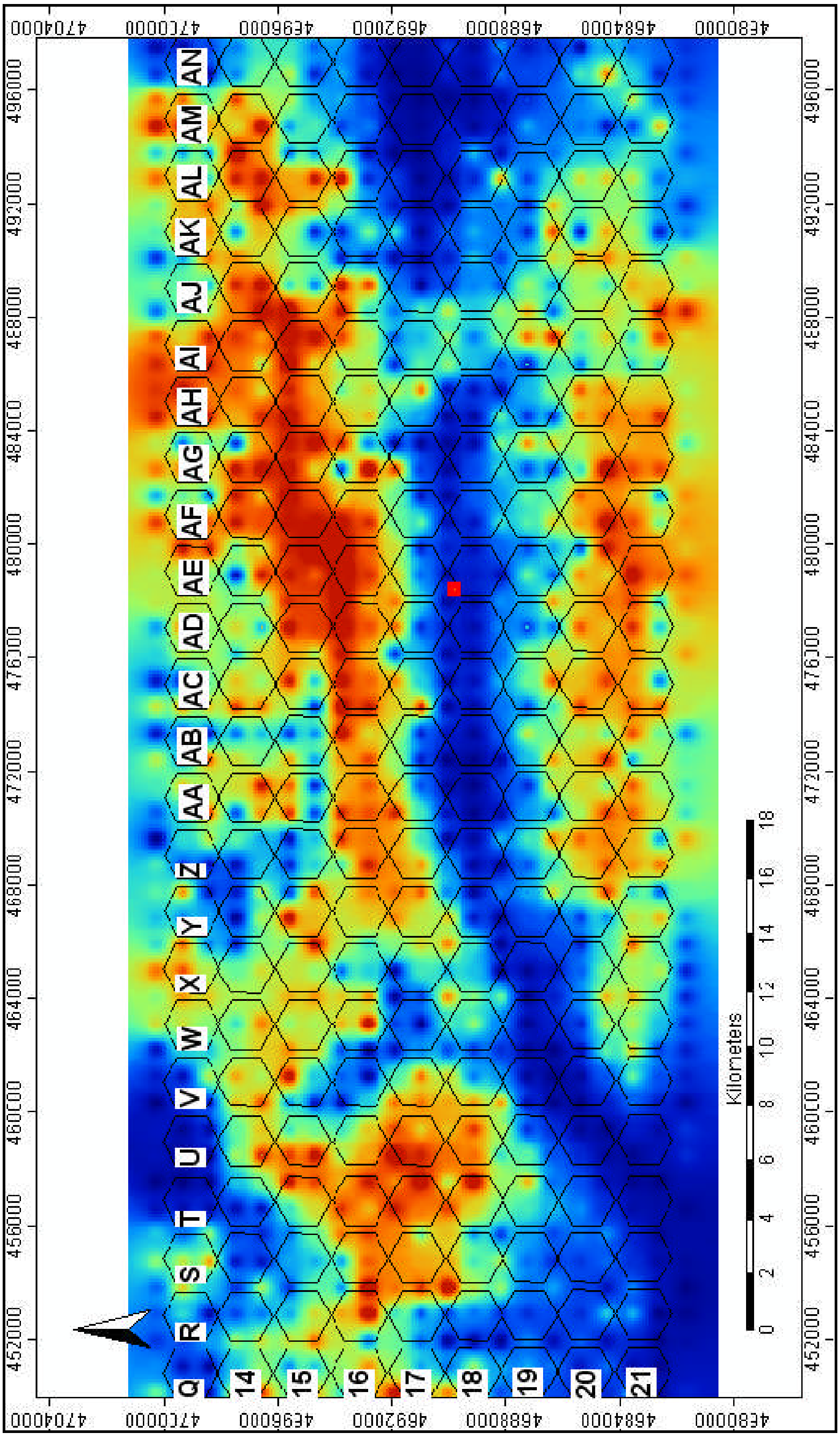
Appendix I: Snow leopard signs found by the expeditions 2014-2018.

Date	Location (area)	Elevation (m)	Cell	Notes
		2014		
No direct sign found; only indirect evidence through interviews with local people.				
		2015		
16 June	Karakol Pass	3,405	AI18	Tracks of one animal crossing in a SE direction in snow
15 July	Kashka-Tor	3,564	AE20*	Tracks of one animal in muddy soil
16 July	Issyk-Ata	3,846	AF14	Track of one animal in snow
*Interestingly, in 2014 in the neighbouring cell of AF20 a foal had been presumably attacked by a snow leopard and mutilated, but escaped death. Up to now this is a second indication of snow leopard presence in that particular area.				
		2016		
14 July	Issyk-Ata	3,465	AG15	Unclear pugmarks in snow
15 July	Kashka Tor	3,620	AE20	Trail following ibex
21 July	Don Jalamysh	3,775	U17	Pugmarks in muddy soil
4 August	Issyk-Ata	3,829	AF14	Trail of one animal crossing snow fields on the way up to the Issyk-Ata pass
11 August	Kashka Tor	3,562	AF20	Pugmarks in soft soil, scat, one scrape
17 August	Kashka Tor	Not recorded	AF20	Same place as visited on 11 August; several pugmarks discovered
25 August	Kashka Tor	3,560	AF20	Approximately the same place; more pugmarks discovered, snow leopard kill of ibex found
		2017		
30 June	Kashka Tor	3,591	AF20	Indistinct pugmarks in snow
5 July	Don Jalamysh	3,720	T17	Old pugmark found when setting camera trap
18 July	Kashka Tor	3,596	AE21	Pugmarks in soft soil

Date	Location (area)	Elevation (m)	Cell	Notes
		2017		
7 August	Chon Chikan	3,669	AD16	Pugmarks in clay soil
23 August	Chon Chikan	3,748	AD16	Pugmarks in clay soil
23 August	Chon Chikan	3,735	AD16	Pugmarks in clay soil
23 August	Chon Chikan	3,739	AD16	Pugmarks in clay soil
		2018		
11 July	Sary Kol	?	AI19	Dead cub found by local herders, but there was no other evidence to corroborate this record.
16 July	Chon Chikan	3,743	AD16	Two sets of tracks: adult & juvenile
24 July	Chon Chikan	3,773	AD16	Camera trap record (two shots of the same animal) made at 21:10.

Appendix II: Map for planning survey routes and camera trap locations; areas with the highest probability of Siberian ibex are coloured in shades of red, lowest in shades of blue. Red square = base camp.



Appendix III: List of bird species recorded during the 2018 expedition, including which are in the Red Data Book (RDB) of the Kyrgyz Republic (Шукуров Э.Дж. (гл. ред.) Кыргыз Республикасынын Кызыл китеби / Красная книга Кыргызской Республики 2-е изд. Бишкек: 2006. – 544 стр. – Текст на кырг., рус., англ. яз).

Latin name	English name	Русское название	RDB
Actitis hypoleucos	Common sandpiper	Перевозчик	
Anthus trivialis	Tree pipit	Лесной конёк	
Apus apus	Common swift	Чёрный стриж	
Aquila chrysaetos	Golden eagle	Беркут	Yes
Buteo buteo	Common buzzard	Обыкновенный канюк	
Calliope pectoralis	Himalayan rubythroat	Черногрудая красношейка	
Carpodacus erythrinus	Common rosefinch	Обыкновенная чечевица	
Cinclus cinclus	White throated dipper	Оляпка	
Circus pygargus	Montagu's harrier	Луговой лунь	
Corvus corax	Raven	Ворон	
Corvus frugilegus	Rook	Грач	
Cuculus canorus	Eurasian cuckoo	Обыкновенная кукушка	
Delichon urbicum	Northern house martin	Городская ласточка	
Emberiza bruniceps	Red headed bunting	Жёлчная овсянка	
Eremophila alpestris	Horned lark	Рогатый жаворонок	
Falco subbuteo	Eurasian hobby	Чеглок	
Falco tinnunculus	Common kestrel	Обыкновенная пустельга	
Galerida cristata	Crested lark	Хохлатый жаворонок	
Gypaetus barbatus	Bearded vulture	Бородач	Yes
Hirundo rustica	Barn swallow	Деревенская ласточка	
Leucosticte brandti	Brandt’s mountain finch	Жемчужный вьюрок	
Leucosticte nemoricola	Plain mountain finch	Гималайский вьюрок	
Luscinia megarhynchos	Common Nightingale	Западный соловей	
Monticola saxatilis	Rock thrush	Пестрый каменный дрозд	
Montifringilla nivalis	White-winged snowfinch	Снежный вьюрок	
Motacilla alba	White wagtail	Белая трясогузка	
Motacilla cinerea	Grey wagtail	Горная трясогузка	
Motacilla citreola	Citrine wagtail	Желтоголовая трясогузка	
Neophron percnopterus	Egyptian vulture	Обыкновенный стервятник	Yes
Oenanthe isabellina	Isabelline wheatear	Ка́менка-плясунья	
Oenanthe oenanthe	Northern wheatear	Обыкновенная каменка	

Latin name	English name	Русское название	RDB
Pastor roseus	Rosy starling	Розовый скворец	
Phoenicurus erythrogaster	Guldenstadt’s redstart	Краснобрюхая горихвостка	
Phylloscopus humei	Hume's leaf warbler	Пеночка тусклая	
Prunella himalayana	Altai accentor	Гималайская завирушка	
Pyrrhocorax graculus	Yellow-billed chough	Альпийская галка	
Pyrrhocorax pyrrhocorax	Red-billed chough	Клушица	
Saxicola torquata	Stonechat	Черноголовый чекан	
Streptopelia turtur	Eurasian turtle dove	Обыкновенная горлица	
Sylvia althaea	Hume's whitethroat	Горная славка	
Tadorna ferruginea	Ruddy shelduck	Огарь	
Tetraogallus himalayensis	Himalayan snowcock	Гималайский улар	
Tringa ochropus	Green sandpiper	Черныш	
Upupa epops	Hoopoe	Удод	

Appendix IV: Expedition diary and reports

A multimedia expedition diary is available on https://blog.biosphere-expeditions.org/category/expedition-blogs/tien-shan-2018/

All expedition reports, including this and previous expedition reports, are available on www.biosphere-expeditions.org/reports.