60 obrazov biodiverzitete

Views of Biodiversity

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Kazalo

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Narava piše zgodbe

Leta 1992 so Združeni narodi v Rio de Janeiru organizirali svetovno srečanje, kjer se je veliko razpravljalo o okolju. V zaključnem dokumentu so voditelji in predstavniki 178 držav poudarili pomen in ogroženost žive narave oz. biodiverzitete, kakor danes ta fenomen imenujemo. Saj ne, da tega brez njih ne bi vedeli, a politična odločitev je bila dobrodošla, ker je dala novega vetra v jadra raziskavam biodiverzitete in pobudam za ohranitev narave. Danes, skoraj 30 let po dogodku, je biodiverziteta še vedno ogrožena, tudi zato, ker veliko ljudi še vedno ne ve, kaj vse to sploh je.

V oddelku za raziskave organizmov in ekosistemov (EKOS) z Nacionalnega inštituta za biologijo smo se odločili, da vam biodiverziteto predstavimo nekoliko pobliže. Naredili smo knjigo, v kateri je 60 poljudnih zgodb o naravi, oziroma, kakor smo jih naslovili, 60 obrazov biodiverzitete. Nekaj zgodb je o živalih, nekaj o rastlinah, tretje so o odnosih med vrstami, četrte o čistih užitkih, ki jih doživimo ob stiku z naravo, itd. Avtorji besedil, vsi člani skupine EKOS, so imeli pri izboru tem proste roke, besedila smo uredniško poenotili le na grobo, saj je del biodiverzitete tudi to, kaj posameznik v naravi vidi in kako to zapiše.

60 zgodb na temo biodiverzitete je kot komar na slonu. Pestrost narave je nepredstavljivo večja, v resnici večja tudi od slona. Pri številki 60 smo se ustavili, ker v letu 2020 praznujemo 60 let Nacionalnega inštituta za biologijo, kjer se z biodiverziteto ukvarjamo tudi raziskovalno.

Davorin Tome

Bukov gozd v Logarski dolini

Beech forest in Logarska dolina.

Davorin Tome

Nature Stories

In 1992 the United Nations organized an Earth Summit in Rio de Janeiro, where the environment was a central topic of discussion. In their final declaration, leaders and representatives of 178 countries pointed out the importance of and threats to life on Earth, commonly called biodiversity. This political input gave a much-needed push to biodiversity research and nature conservation initiatives. Today, almost thirty years later, biodiversity is still highly threatened, and many people remain unaware of what biodiversity is all about.

In Department of Organisms and Ecosystems Research (EKOS) at the National Institute of Biology, we decided to bring biodiversity closer to you. We have written this book of sixty stories from the natural world, titled *60 Views of Biodiversity*. Some stories deal with animals, others with plants. There are stories about relationships between species and stories about the sheer pleasure of experiencing nature. Story authors, all members of the EKOS group, were free to choose their topic, and we made only mild editorial changes to their texts, since what someone sees in nature and how he or she presents this is also part of biodiversity.

60 Views of Biodiversity is like a mosquito on the elephant. Nature's diversity is vast, much bigger even than the elephant. We decided on 60 stories since in 2020 we are celebrating the 60th anniversary of the National Institute of Biology, where we work with biodiversity on a scientific level.

Davorin Tome

Lisica (*Vulpes vulpes*)

Red Fox (*Vulpes vulpes*)

Davorin Tome

Matjaž Kuntner

Kako biodiverziteta nastane

Preprost odgovor na to vprašanje je z evolucijo, katere glavni mehanizem je naravno odbiranje. V vsaki populaciji imamo bolj in manj uspešne osebke. Bolj uspešni z dedovanjem zmagovite lastnosti prenesejo v naslednje generacije, lastnosti manj uspešnih se izgubijo. Ker so v različnih okoljih zmagovite lastnosti različne, iz ene vrste postopoma nastanejo številne nove.

Spolno odbiranje spreminja vrste tako, da deluje na lastnosti, ki osebkom ne nudijo neposredne prednosti za preživetje, omogočajo pa jim večje število potomcev. Razkošno jelenovo rogovje ponosnega samca ne varuje pred mrazom, a ga, v primerjavi z manj oborožen im tekmecem, naredi močnejšega. To mu zagotovi več samic, posledično več potomcev in dolgoročno ohranitev njegove zmagovalne lastnosti.

Tudi človek ustvarja nove vrste – z umetnim odbiranjem. Pasme, sorte in variacije, ki jih že tisočletja gojimo in žlahtnimo za svoje potrebe, lahko po nekaterih merilih že razumemo kot samostojne vrste. Mehanizem je podoben kot pri naravnem odbiranju, le da tu naravo odigra človek, ki selektivno prenaša dedni material zaželenih lastnosti na prihodnje generacije.

Marjan Artnak

How Does Biodiversity Come To Exist?

The simple answer to this question is through evolution, whose primary mechanism is natural selection. Every population consists of more and less successful individuals. The features that are responsible for better success are inherited by the next generations, while the features of less importance are gradually lost. Because different environments select for different traits, one species gradually gives rise to new ones.

Sexual selection modifies species by acting on traits that do not enhance individual survival but rather enable them to have more offspring. A buck's impressive antler does not protect the proud male from the cold but makes him stronger when compared to a less well-armed rival. This allows access to more females, and consequently leads to more offspring, and the long-term preservation of his winning qualities.

People also create new species by artificial selection. For millennia, we have cultivated breeds, varieties, and variations for our needs that can be considered distinct species by certain criteria. This mechanism resembles natural selection, except that nature is played here by Humans who selectively transmit hereditary material of desirable traits to future generations.

Spolna dvoličnost nastane z različnimi pritiski naravnega in spolnega odbiranja na oba spola. Na sliki sta košuta in jelen (*Cervus elaphus*).

Sexual dimorphism arises through pressures of natural and sexual selection that differently affects each sex. The photo shows a pair of Red Deer (*Cervus elaphus*).

Jernej Polajnar

Kompleksnost

Pogosto slišimo, da je nekaj »kompleksno«, zlasti ko govorimo o življenjskih združbah. Že po učbeniški definiciji je »življenjska združba kompleksen sistem med seboj povezanih vrst«. Toda kaj sploh kompleksnost je in kaj pomeni? Kot »kompleksnega« v znanosti označujemo sistem, ki ga ni mogoče opisati z vsoto njegovih sestavnih delov in v katerem lahko drobna sprememba povzroči nesorazmerno velik učinek. Iz ekologije pa vemo, da kompleksnost – naraščanje števila medvrstnih odnosov v nekem ekosistemu – deluje kot varovalka pred spremembami, saj blaži vpliv motenj iz okolja. Raznolikost elementov je tu ključna, še bolj pa raznolikost odnosov med njimi.

A obstajata vsaj še dva pomenska odtenka: v slovarjih najdemo razlago, da je »kompleksno« sopomenka »vsestranskemu« oz. »celovitemu« ali »celostnemu«, torej obravnavanje problemov z vseh možnih vidikov, medtem ko v vsakdanji rabi pogosto pomeni, da nečesa ne razumemo oz. ne znamo predvideti.

Lahko bi rekli kar, da je naše razumevanje biodiverzitete kompleksen preplet vseh teh pomenov.

Complexity

We often say something is »complex«, especially when talking about communities of organisms. Textbooks say that, »Community is a complex system of interconnected species.« But what is complexity and what does it mean? In science, a system is regarded as »complex« when it cannot be described as a sum of its parts and in which a small change can cause a disproportionally large effect. On the other hand, we know from ecology that complexity – growing number of species relations in an ecosystem – acts to mitigate any disturbance from the environment. Diversity of elements is key here, but also diversity of relationships between them.

However, there are at least two other meanings that dictionaries tell us: »complex« is synonymous to »composite« or »aggregate«, i.e., looking at problems holistically, while in everyday use; it usually means that something is impossible to understand or predict.

We could simply say that our understanding of biodiversity is a complex tangle of all those meanings.

V gruči stenic rjavih lipovk *(Oxycarenus lavaterae)* so izražene različne ravni kompleksnosti, od molekul do združbe.

A swarm of Lime Seed Bugs (*Oxycarenus lavaterae*) features different scales of complexity, from molecules to community.

Jernej Polajnar

Al Vrezec

Pestrost poimenovanja

Da se ljudje med seboj lahko sporazumevamo, stvari, bitja in ljudi poimenujemo. Še več, nepoimenovano za nas sploh ne obstaja. Ime je nujnost, brez katere ni ne znanosti, ne umetnosti, ne razmišljanja. Znanstveno poimenovanje organizmov z latinskimi imeni je v 18. stoletju uredil švedski naravoslovec Karl Linné. A znanstvena imena so namenjena le učenjakom, različni narodi pa so v svojih jezikih poimenovali bitja na različne načine. V slovenščini je hrošču rogaču ime že leta 1763 dal Joannes A. Scopoli. Slovenska imena je konec 18. stoletja zbiral in zapisoval Žiga Zois, Frana Erjavca pa je k novim slovenskim poimenovanjem organizmov gnala misel, da se Slovenci za živi svet sploh ne zanimajo, saj vsej biotski pestrosti ne vedo niti imen. Tako je nastala kozača, sova, ki meketa kakor koza, in želva hlastavka, ker hlasta za plenom. Nekatere vrste so različni ljudje dojemali različno, kar se je pokazalo v pestrosti poimenovanj. Denimo bela pastirica kot pliska, vertorepka, tresorepka, repotreska, pastiričica, pliskavica in pastrina.

Diversity of Naming

Humans can communicate with each other, and we name things, beings, and people. Moreover, the unnamed do not even exist for us. A name is a necessity without which there is no science, no art, no thinking. The scientific naming of organisms with Latin names was formalised in the 18th century by the Swedish naturalist Carl Linnaeus. However, scientific names are primarily used by scientists, and different nations have named creatures in their own languages. In 1763, Joannes A. Scopoli named the Stag Beetle as *rogač* in Slovene. Žiga Zois documented Slovene animal and plant names at the end of the 18th century, and Fran Erjavec was motivated to name organisms in Slovenian because many Slovene people did not show interest in their unnamed biodiversity. Today all Slovene biodiversity is mainly known after named creatures of vertebrates, plants and rarely named invertebrates and fungi. And later two are still overlooked in many biodiversity discussions, so Erjavec motivation is after 100 years still a valid fact.

Pestrost poimenovanja biotske pestrosti – kozača *(Strix uralensis)* meketa kot koza, jastrebja hlastavka *(Macrochelys temminckii)* hlasta, bela pastirica *(Motacilla alba)* se smuka ob živini kot drobna pastirica.

Naming diversity of biodiversity – Ural Owl (*Strix uralensis*) from the Ural mountains, snapping jaws of the Alligator Snapping Turtle (*Macrochelys temminckii*), and the White Wagtail (*Motacilla alba*), which wags its tail.

Davorin Tome, Al Vrezec

Andrej Blejec

Majhna, velika ... kolikšna?

Včasih slišimo, da se zaradi posegov v okolje biodiverziteta manjša. Lahko gre bolj za občutek, ki je povezan s tem, da izginjajo številne vrste v nekem okolju. Za trdnejšo primerjavo pa želimo ta občutek nekako ovrednotiti. Zanimiv se mi zdi pristop, ki meri našo negotovost pri napovedi, kakšna je vrsta rastline, če jo izberemo na slepo. Če imamo opravka z rastlino s pšenične njive, je ta negotovost majhna – najbrž gre za pšenični klas, morda mak ali plavico. Če pa je rastlina s cvetočega alpskega travnika, ki ima večjo biodiverziteto, je ugibanje o vrsti rastline bolj negotovo. Za vrednotenje biodiverzitete lahko uporabljamo enako metodo kot za merjenje nereda (entropije) ali bralcu morda bolj znano merjenje sporočilne moči besedil v informatiki, ki jo merimo v bitih. Tole besedilo je zapisano s 25 različnimi črkami (4,6 bitov), tako da je precej negotovo povedati vnaprej, kakšen je znak na nekem mestu. V dolgočasnejšem sporočilu iz le štirih črk (2 bita), pa bi bilo to najbrž precej lažje.

Small, Large ... How Much?

Sometimes we hear that human activity in the environment diminishes biodiversity. It can be just the feeling, connected to the observation of species extinction in a particular environment. For a sound comparison, one needs to quantify that feeling. An interesting approach is to measure one's uncertainty in naming a blindly picked plant. When a plant is picked from a wheat field, the uncertainty is low; it is most probably a wheat stalk, or maybe a Poppy or Cornflower. But if the plant is picked from a blooming alpine meadow, with higher biodiversity, the ability to guess is less certain. To assess biodiversity, one can use these methods used to measure entropy or, for the more familiar reader, measure information capacity, which is measured in bits. This note is written with 26 different letters (4.7 bits), and it is hard to guess which letter is in a specific place. In a message written in an alphabet with four letters (2 bits), the guess is much easier.

Pšenica (*Triticum aestivum*) ali poljski mak (*Papaver rhoeas*)? Skoraj gotovo pšenica, a mak dela pestrost.

Wheat (*Triticum aestivum*) or Common Poppy (*Papaver rhoeas*)? Almost certainly Wheat, but the Poppy brings diversity.

Davorin Tome

Anamarija Žagar

Koliko je še plazilca v meni?

V otroštvu je zelo pogost pojav šum na srcu. Tudi pri meni so ga odkrili v začetku osnovne šole. Sledila je serija zdravniških preiskav, med njimi tudi moja prva izkušnja z rentgenskim slikanjem. Še danes se spomnim okusa grenke tekočine, ki sem jo morala spiti, ko so pritisnili gumb za slikanje prsnega koša, da se je na sliki videl moj požiralnik. Rentgenska slika ni pokazala nič. Do dna izvoru šuma na srcu smo prišli z ultrazvokom, ki je pokazal, da del pregrade (septum) med dvema prekatoma srca ni povsem zarasel. Ali sem imela nekakšen ostanek plazilskega srca? Plazilci namreč nimajo popolnega septuma, njihov tretji prekat srca je le napol pregrajen. Moja otroška diagnoza dejansko ni bila ostanek plazilskega srca, nepopolno zrasel septum je bil le posledica zakasnjenega razvoja. Z leti se takšne odprtine navadno zarastejo in šum na srcu izgine, kakor je bilo tudi pri meni. Res pa so plazilci naši predniki in so zato naše telesne lastnosti do določene mere podobne njihovim, le da so se med evolucijo še dodatno razvile.

Komodoški varan *(Varanus komodoensis)* je največji živeči kuščar na svetu, uvrščamo ga med plazilce.

Comodo Dragon (*Varanus komodoensis*) is the biggest extant species of lizard and belongs to the group of reptiles.

Miha Krofel

How Much of the Reptile is Left Inside Me?

During childhood, a heart murmur - an unusual sound heard between heartbeats - is very common. Doctors detected a heart murmur in me during one of my regular medical check-ups at the beginning of elementary school. A series of medical examinations followed, including my first X-ray. I still remember the taste of the bitter liquid I had to drink that contained color, which allowed them to see my esophagus in the picture. The X-ray showed nothing. We reached the source of my heart murmur by ultrasound, which showed that part of the septum between the two ventricles of my heart was not completely grown over. Did I have some kind of residual reptile heart? Reptiles do not have a complete septum; their third ventricle is only halfway obstructed. My childhood diagnosis was not actually the remnant of the reptilian heart; my incompletely grown septum was merely a result of delayed development. Over the years, such openings usually heal, and the heart murmur disappears, as was the case with me. Indeed, reptiles are our ancestors and our physical characteristics are to some extent similar to theirs, though we have evolved further from one another during the course of evolution.

Davorin Tome

Če bi bili vsi ljudje nogometaši

Ljudem se zdijo vse lisice med sabo enake, prav tako vse marjetice. Kaj to, celo ljudje se nam pogosto zdijo enaki – Evropejci na primer ne ločimo obrazov Kitajcev. Podobno se zdimo Kitajcem enaki vsi Evropejci. Pa vendar so razlike med nami velike in ključne za preživetje in blagor. Tudi če imamo vsi po dve očesi, dva uhlja in en nos, se razlikujemo po načinih komunikacije, imamo različne potrebe, navade, sposobnosti, nadarjeni smo za različna področja ipd. Zakaj je ta pestrost osebkov tako pomembna?

Lionel Messi je znan po tem, da izvrstno brca žogo. Steven Jobs je izumitelj iPhonea in iPada. Gianni Versace in Frank Sinatra – svetovno znani modni oblikovalec in odlični pevec. Če bi bili vsi ljudje kot na primer Messi, bi vsi ves čas samo brcali žogo, a po svetu bi še vedno hodili v medvedji koži in peš, ker nihče ne bi znal sešiti lepe obleke in izumiti kolesa. Dolgčas bi nam bilo za umret, saj nihče ne bi znal lepo peti. Ljudje smo uspešna, prilagodljiva vrsta prav zaradi razlik med nami in enako velja tudi za druge vrste.

If All People Were Football Players

To most people, all Foxes seem the same, all Daisies too. Even other people look the same to us – Europeans, for example, have a hard time distinguishing faces of Chinese people and vice versa. Still, there are differences between us that are important to our survival and well-being. Even if we all have two eyes, two ears, and one nose, we differ in how we communicate, our needs, habits, abilities, and talents. Why is this diversity of individuals so important?

Lionel Messi is renown as an excellent football player, Steven Jobs as the genius inventor of the iPhone and iPad. Gianni Versace and Frank Sinatra – world-famous fashion designer and iconic singer, respectively. If we were all like Messi, we would play ball all the time, but walk around the world barefoot and naked, since there would be no one to invent the wheel or to sew a nice dress. We would be bored to death since no one would know how to sing harmoniously. Differences among us are the reason we are such a successful and adaptable species, and the same applies to other species as well.

Davorin Tome

Osebki sekulj (*Rana temporaria*; spodaj) so si med sabo zelo podobni, kot tudi osebki pinož (*Fringilla montifringilla*; zgoraj). V resnici med njimi niti dva nista enaka.

Individuals of European Common Frog (*Rana temporaria*; below) seems much alike, also individuals of Brambling (*Fringilla montifirngilla*; above). In fact, not two are the same.

Al Vrezec

Uspešnost v pestrosti preoblek

V Evropi se je leta 2002 začel neustavljivi pohod harlekinske polonice iz Azije. Kmetovalci so jo v Evropo zanesli kot način boja proti škodljivcem, a postala je ena najbolj invazivnih tujerodnih vrst. A zakaj? Odgovor se skriva v pestrosti njenih oblik. Te so tako raznolike, da bi jih pripisali celo različnim vrstam. Različni aleli na spolnih kromosomih določajo količino temnih pigmentov na pokrovkah. Genska pestrost pa ni edina, ki določa to pestrost. Odločujoče so tudi okoljske temperature, ki lahko med razvojem polonice precej vplivajo na to, kakšna žival se bo iz bube izlegla. V hladnejših okoljih je večina polonic temnejša, medtem ko v toplejših prevladujejo svetlejše. Temnejše polonice bolje preživijo v mrzlih okoljih in ob pičlih zalogah hrane, medtem ko so svetlejše bolj plodne in ješče. Ta pestrost oblik zagotavlja uspešno preživetje vrste v zelo različnih okoljih. Ob grozečih podnebnih spremembah smo tako dobili klimatsko prilagodljivo invazivko, ki ji tudi globalne spremembe temperatur ne bodo prišle do živega.

Appearance Diversity

The Harlequin Ladybird's invasion of Europe started in 2002 and has proved unstoppable. The Ladybird was brought to Europe from Asia by farmers as a way to fight pests, but it has become one of the most invasive species in Europe. But why? The answer lies in the variety of its forms. The Harlequin Ladybird's appearances are so diverse they could be attributed to different species. Different alleles on the sex chromosomes determine the amount of dark pigments on the elytra. However, genetic diversity is not the only thing that determines this diversity. Environmental temperatures are also decisive, which can have a significant impact on the nature of the animal that will hatch from the pupa. In cooler environments, most Ladybirds are darker, while in warmer temperatures, they are lighter. Darker Ladybirds survive better in cold environments and with scarce food supplies, while brighter ones are more fertile with greater appetites. This diversity ensures the successful survival of the species in very different environments. In the face of climate change, Europe has received a climate-adaptive invasive species, which will not be affected by global changes in temperatures at all.

Risbe: Žarko Vrezec

Številne raznobarvne polonice skrivajo le eno samo vrsto – invazivno tujerodno harlekinsko poloni-co *(Harmonia axyridis)*.

Numerous multicoloured Ladybirds are in fact only one species – the invasive Harlequine Ladybird (*Harmonia axyridis*).

Klemen Čandek

Množica okusov

»Natakar, eno ale pivo, prosim,« zaslišim v svoji neposredni bližini. Prav gotovo pivo vsi poznamo, ni pa tako samoumevno, da se ljudje zavedamo pomembnosti biološke pestrosti pri varjenju tega produkta. Pivo sestavljajo slajena žita, hmelj in voda ter glavni akterji – kvasovke. Ljudje so že davno spoznali, da te enocelične glive proizvajajo opojne substance in prva pivu podobna pijača je tako nastala pred več kot 6000 leti. Danes poznamo preko 1500 vrst kvasovk, vendar se prava pestrost za okuse piva tu šele začne. Ljudje smo z umetnim odbiranjem ustvarili na stotine različnih sevov ene same vrste *Saccharomyces cerevisiae*, ki je v pivovarstvu najpomembnejša, vsak sev pa pivo obogati z drugo noto okusa. Podobno kot s kvasovkami, pivovarstvo doživlja razcvet tudi zaradi visoke pestrosti hmeljev in žit. Sedaj pa si predstavljajte neposrečeno situacijo, kjer bi brez biodiverzitete obstajal en sam tip kvasovke, hmelja in žita – celo življenje bi bili primorani piti eno vrsto piva in kakšno smolo bi imeli, če bi bilo to pivo slabega okusa!

An Array of Flavors

"Waiter, one ale, please," I hear in my immediate vicinity. We are all familiar with beer, yet it is not self-evident that people are aware of the importance of biological diversity in brewing. Beer is made from malted barley, hops, water and the main actors - yeasts. People realized long ago that these single-celled fungi produce intoxicants, and the first beer-like beverage was created over 6000 years ago. Today we know over 1500 yeast species, but the array of beer flavors only starts with this diversity. People have created hundreds of different strains of the most commercially important yeast species for brewing *Saccharomyces cerevisiae* through artificial selection, and each strain enriches beer with a unique flavor. Also, the brewing industry is booming thanks to the high diversity of hops and cereals. Now imagine the unfortunate situation without biodiversity, where only a single sort of yeast, hop and cereal would exist. You would be forced to drink one type of beer your entire life, and what a shame it would be if that beer tasted bad!

Biotska pestrost le treh osnovnih sestavin piva – kvasa, ječmena in hmelja – nam zagotavlja neskončno množico različnih okusov piva.

The biological diversity of three basic ingredients of beer – yeast, barley and hops – provides us with an infinite array of beer flavors.

Matjaž Kuntner

Mojca Pibernik

Ste že videli kako štajerko?

Kaj pa ciko? Skoraj gotovo pa ste že videli lipicanca. To so le tri slovenske avtohtone pasme domačih živali. Poleg štajerske kokoši ali štajerke in cikastega goveda ali cike so to še lipicanski, posavski in slovenski hladnokrvni konj, krškopoljski prašič, jezersko-solčavska ovca, istrska in belokranjska pramenka, bovška ovca, drežniška koza, kraški ovčar in kranjska čebela. Tudi domače živali in kmetijske rastline, ki zagotavljajo večino današnje hrane, so del biotske raznovrstnosti. Skupaj z njihovimi divjimi predniki so pomembna zakladnica genov in s tem lastnosti, ki so pomembne za prilagajanje vrst na podnebne in druge spremembe v okolju. Mnoge so ogrožene, ker jih izpodrivajo sodobne visoko produktivne pasme in sorte. Vendar imajo stare sorte in pasme še vedno tudi določene prednosti. Prilagojene so lokalnemu okolju in so pogosto odpornejše. Njihova vzreja oziroma gojenje zahteva manj vloženega dela in drugih sredstev (zdravil, močne krme, pesticidov, gnojil) ter manj poseganja v prostor, kar je prijaznejše okolju. Omogočajo tudi pridelavo visokokakovostne in zdrave hrane.

Have You Ever Seen a *Styrian*?

What about a *Cika*? I am pretty sure you have seen a Lipizzaner. These are all indigenous Slovenian breeds of domestic animals. Besides the Styrian Hen and *Cika* Cattle, we have Lipizzan, *Posavski*, the Slovene Cold-Blooded Horse, *Krškopoljski* Pig, *Istrska pramenka*, *Belokranjska pramenka*, *Jezersko-Solčava* Sheep, *Bovec* Sheep, Karst Shepherd and the Carniolan Honeybee. Domestic animals and the crops that feed us are a part of biodiversity. Together with their wild ancestors, they form an important genetic treasure trove that involves traits that are important for species adaptation to climate and other environmental changes. Many are at risk because they are being replaced with modern, highly productive breeds and varieties. However, older breeds and varieties still have certain advantages. They are adapted to the local environment and often more resilient. They are easier to breed and cultivate because they require less invested labor, medicines, pesticides, and fertilizers. They also enable the production of high quality and healthy food.

Cikasto govedo je edina slovenska avtohtona pasma govedi, slovenska rastlinska genska banka pa v svoji zbirki hrani prek 1100 avtohtonih genskih virov fižola.

Cika Catle (*Bos taurus*) is the only Slovenian indigenous breed of cattle, but the Slovenian plant gene bank stores over 1100 indigenous genetic sources of Beans (*Phaseolus* sp.) in its collection.

Danilo Bevk

Tako različni, a vsi pripadajo isti vrsti. Od zgoraj levo: cavalier king Charles španjel *Aša*, mešanka *Žuža*, kratkodlaki škotski ovčar *Sid*, mešanec *Stark* in srnin pinč *Ruby*, tibetanski terier *Tari2*, kelpie *Loki1*, nemški kratkodlaki ptičar *Višnja*, zlati prinašalec *Pal*.

They are so different from one another, but all belong to the same species. Starting above left: Cavalier King Charles Spaniel *Aša*, mixed-breed *Žuža*, Smooth Collie *Sid*, mixed breed *Stark* and Miniature Pinscher *Ruby*, Tibetan Terrier *Tari2*, Australian Kelpie *Loki1*, German Shorthaired Pointer *Višnja*, Golden Retriever *Pal*.

Špela Ambrožič Ergaver

Pasje življenje

Mednarodna kinološka zveza (The Fédération Cynologique Internationale FCI) trenutno beleži 339 pasem psov. Razlikujejo se po videzu in nekaterih značilnostih, medtem ko so si njihovi genomi zelo podobni. Mala čivava in velika nemška doga imata tako skoraj enake gene. Velike fizične razlike med njima so posledica izražanja različnih genov v sicer podobnem genomu. Križanje med pasmama pa je omejeno z različnimi partitvenimi vzorci oziroma fizičnimi omejitvami. Ljudje smo proces razlikovanja pospešili tako, da smo umetno izbirali osebke z želenimi lastnostmi, kar imenujemo umetna selekcija. Čeprav je parjenje med nekaterimi pasmami fizično nemogoče, pa možnost genske izmenjave, zaradi podobnosti v genomu, še vedno obstaja. Zato različne pasme psov ne uvrščamo med samostojne vrste. Nazoren primer tega so potepuški psi, ki kažejo, kako se različne genske baze pasem psov hitro pomešajo, ko se odstranijo omejitve umetne vzreje. Znan je primer moskovskih potepuških psov, ki so ločeni od čistokrvnih pasem psov že vsaj 150 let. Opazujejo, da so v tem času v veliki meri izgubili lastnosti, ki razlikujejo eno pasmo od druge, in prijazno vedenje do ljudi, ki ločuje udomačene od divjih psov.

Matej Slabe, Davorin Tome, Katarina Drašler, Žan Kuralt, Jernej Polajnar, Miloš Borovšak, Anja Ivančič

Dog's Life

The Fédération Cynologique Internationale (FCI) - the World Canine Organisation currently records 339 dog breeds. These breeds differ in appearance and some characteristics, while their genomes are very similar. Small Chihuahuas and Great Danes have almost identical genes. Their great physical differences are a consequence of different gene expression in otherwise similar genom. Crossbreeding between breeds is limited by different mating patterns and physical limitations. People have accelerated the process of differentiation by artificially selecting specimens with the desired characteristics; this is called artificial selection. Although mating between some breeds is physically impossible, the possibility of gene exchange, due to similarity in the genome, still exists. Therefore, different breeds of dogs are not classified as separate species. A good example of this is seen in stray dogs, which show how the various genetic bases of a dog breed mix quickly when artificial breeding restrictions are removed. There is a known example of stray dogs on Moscow streets that have been separated from purebred breeds for at least 150 years. During this time, the stray dogs have largely lost features that distinguish one breed from another, and friendly behaviour towards people that separate domesticated dogs from wild dogs.

Rok Janža

Barvna paleta življenja

Od cvetočih travnikov do ptičjih peres. Kamorkoli se zazremo, vidimo, da je naš svet pestro obarvan. Živahni odtenki rastlinskega in živalskega kraljestva so posledica strukturne obarvanosti in obarvanosti na račun pigmentov. Strukturne barve so posledica interference svetlobe ob stiku s finimi, pogosto slojevitimi mikroskopskimi strukturami na površini telesa živali. Pomislimo na kovinske odtenke, ki jih najdemo pri hroščih, metuljih, pajkih in pticah. Njihova obarvanost se lahko ob spremembi kota opazovanja spreminja in prehaja od zelenih pa vse do modrih in vijoličnih odtenkov. Pravimo, da je površina njihovih teles iridescenčna. Drugače obarvajo pigmenti. To so v glavnem organske molekule, ki nastajajo v celicah ter selektivno vpijajo oz. odbijajo svetlobo specifičnih valovnih dolžin. V nasprotju s strukturnimi so pigmentne barve neodvisne od kota opazovanja. Strukturne barve in pigmenti lahko delujejo v interakciji in tako ustvarijo nove barvne kombinacije.

The Colour Pallet of Life

From flowering meadows to bird feathers, wherever we look, we see that our world is colourful. The vibrant hues of the plant and animal kingdom are due to the structural coloration and coloration at the expense of pigments. Structural colours result from the interference of light upon contact with fine, often layered microscopic structures on the surface of an animal's body. Think of the metallic shades found in beetles, butterflies, spiders and birds. Their coloration can change as the angle of observation changes, from green to blue to purple. We say that the surface of their bodies is iridescent. Pigments paint differently. They are mainly organic molecules that are formed in cells, and they selectively absorb or reflect the light of specific wavelengths. Unlike structural colours, pigments are independent of the viewing angle. Structural colours and pigments can interact to create new colour combinations.

V pisanem svetu biodiverzitete so bitja obarvana s pigmentnimi barvili, kakršna je pisana vzhodna rozela (*Platycercus eximius*; zgoraj), ali pa je njihova obarvanost posledica igre svetlobe na iridiscenčnih strukturah njihovih teles, kot je to pri zlati minici (*Cetonia aurata*; spodaj).

How creatures are coloured creates scenic diveristy. Colours come from pigments as in Eastern Rosella (*Platycercus eximius*; above) or from the play of light on the iridiscent structures of their bodies as in the Green Rose Chafer (*Cetonia aurata*; below).

Davorin Tome

Samec hrošča kozlička ogrličarja (*Arhopalus rusticus*) z vonjem privabi samico, samica tasmanskega vraga (*Sarcophilus harrisii*) po vonju prepozna svoje mladiče.

A male Longhorn Beetle (*Arhopalus rusticus*) uses volatile compounds to attract a female, while a female Tasmanian Devil (*Sarcophilus harrisii*) recognizes its young by the smell.

Alenka Žunič Kosi

Neslišni jezik vonjav

Besede, kot sta na primer geraniol ali 2-furfuriltiol, večini ne povedo veliko. Ko pa te snovi pristanejo na naši nosni sluznici, prepoznamo vonj po vrtnici in jutranji kavi, kar v nas prebudi prijetne občutke. Okolje je vse polno najrazličnejših vonjav, ki so za večino živih bitij izjemnega pomena. Če ne bi bili sposobni vonjati, ne bi mogli najti in okušati hrane. Po vonju se prepoznajo matere in otroci ter drugi člani družine, tropa ali gnezda. Živali vonjave uporabijo kot orožje v boju s tekmeci in napadalci. Vonj je nepogrešljiv pri označevanju teritorija ter izbiri spolnega partnerja. Rastline se z vonjavami branijo pred škodljivci. Vonj zaznamo, prepoznamo in se nanj odzovemo na različne načine. Vonj po dimu za večino pomeni nevarnost, za žuželke, ki odlagajo jajčeca v odmrl les, pa priložnost. Ljudje prepoznamo bilijon različnih vonjav, ker pa sta vid in sluh za nas pomembnejša, se vseh vonjav niti ne zavedamo. Prvak med vohljači je severni medved, ki svojo družico zazna na razdalji več kilometrov.

Silent Language of Scent

Words like geraniol, 2-furfurylthiol do not mean a lot to most people. However, when these aromas hit our scent receptors, the smell of roses and morning coffee triggers pleasant feelings. A large number of chemicals are present in the environment, and they are essential to many living things. Animals use smell to find food. Many mothers and their young, members of a family group, trope, or nest recognize each other by smell. Animals use chemicals to fight against their rivals and enemies. Smell is indispensable in marking territory and choosing a mate. Plants use volatiles as a defence against pests. Living things detect, perceive and respond to odours in many ways. In general, the smell of smoke implies danger, but for insects that lay eggs in deadwood, that smell means opportunity. Humans can detect one trillion different odours, but we rely more on vision and hearing, and are not even aware of all the volatiles. Polar Bears have the keenest of smell in the animal kingdom; they can detect the presence of a mate over distances of several kilometres.

Alenka Žunič Kosi, Davorin Tome

Anamarija Žagar

Gibalne sposobnosti

Biodiverziteta je raznolikost živih organizmov. Vendar vrste niso le različnih barv, oblik, velikosti, marveč se razlikujejo tudi po tem, kako se gibljejo. Po tleh hodijo in tečejo, v zraku letijo, v vodi plavajo, lahko so tudi negibne in pritrjene na podlago. In to še ni vse. Po tleh se kače plazijo, polž si pomaga z eno samo nogo, po dveh nogah hodijo ptice, število nog pa lahko narašča in narašča. Lisica ima štiri noge, kobilica šest, pajek osem, stonoge izredno veliko. Ne gibajo se samo živali, gibajo se tudi rastline. Upogljivost vej se spreminja glede na letne čase. Semena imajo lahko posebne, padalom podobne izrastke, ki jim pomagajo, da se z vetrom premikajo na dolge razdalje, ali pa imajo kavlju podobne strukture, da se zataknejo za dlako živali, da jih raznesejo. Zakaj v naravi obstaja tako velika pestrost v gibanju? Tudi na tak način je vrstam uspelo zapolniti vse kotičke našega sveta, obenem pa jim pestrost gibanja omogoča sobivanje v prostoru in času. Biodiverziteta je vse okoli nas in tudi v različnih oblikah.

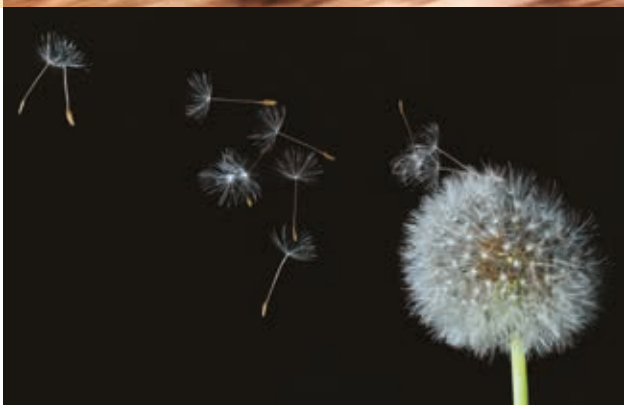
Movement Skills

Species do not only differ in color, shape, or size, but have also adapted to move in a myriad of ways. The ones living on land usually walk and run, in the air they fly, in the water they swim, while some can also be motionless or even attached to the surface. And that is not all. Snakes slithers, snails moves using a single leg, and birds walk on two legs. The number of legs organisms need varies widely. Fox has four legs, grasshopper six, spider eight, and centipede an extremely large number of legs. Animals are not the only creatures that move – plants move too. The flexibility of their branches varies depending on the season. Plant seeds can have special, parachute-like shapes that help them move long distances with the wind or hook-like structures that latch onto an animal's hair and use them as vehicles for dispersal. Why is there such a great diversity in the ways species move in nature? Through movement, species have succeeded in filling all corners of our world, and at the same time, their variability of movement skills allows them to coexist in space and time. Remember that biodiversity is all around us and is present in the many different ways, also how organisms move.

Pestrost v načinih gibanja je v naravi ogromna; ptice letijo, volkovi tečejo, semena jadrajo, ...

Diversity of movement skills in nature is enormous; birds fly, Wolves run, seeds glide, ...

Miha Krofel, Davorin Tome



Cvrček *(Acheta domesticus)* ima uho na sprednjih nogah (povečana slika).

The House Cricket (*Acheta domesticus*) has its ears on the front legs (enlarged picture).

Nataša Stritih Peljhan

Kako slišijo žuželke

Ali ste vedeli, da tako kot vretenčarji tudi številne žuželke zelo dobro slišijo? V nasprotju z nami, ki imamo ušesa na glavi, imajo žuželke slušne organe lahko tudi na oprsju, zadku, nogah, krilih ali celo obustnih okončinah. Pri murnih in kobilicah cvrčalkah je slušni organ na primer razvit na sprednjih nogah, medtem ko imajo kratkotipalčne kobilice, kot je kobilica selka, slušni organ ob straneh zadka. Podobno kot pri človeku tudi uho žuželk sestavlja bobnična membrana iz stanjšanega dela telesne povrhnjice. Ta je povezana z resonančnim prostorom v telesu, ki vibracije zraka ojačuje in prenaša na čutilni slušni organ. Mnoge žuželke se s pomočjo sluha in oddajanja zvokov sporazumevajo, vsem slišečim vrstam pa sluh omogoča izogibanje plenilcem. Murni, na primer, oddajajo zvočne signale nizkih frekvenc za privabljanje partnerjev, medtem ko slišijo daleč v visokofrekvenčno območje. Ta sposobnost jim med letom omogoča izogibanje netopirjem, ki za orientacijo v prostoru oddajajo ultrazvočne signale.

Hearing in Insects

Did you know that, like vertebrates, many insects can also hear well? Unlike us, however, with ears on our heads, insects may have auditory organs located on almost any body part, from the head, legs, and thorax, to wings and the abdomen. Crickets and bush crickets, for example, have ears located on their front legs, while in grasshoppers, such as the Migratory Locust, they are at the sides of the abdomen. Like humans, insect ears typically contain an eardrum or tympanic membrane developed from a thinned integument. This membrane is typically associated with a resonant cavity in the body that amplifies and transmits air oscillations to the sensory part of the organ. Many insects use hearing, together with sound emission, for communicating with animals that belong to the same species, while most of them make use of this sense to avoid predators. Field crickets, for example, emit low-frequency sound signals to attract mating partners, but they can hear far into the high-frequency range. Such hearing ability allows flying crickets to avoid bats, which emit ultrasound signals for orientation.

Nataša Stritih Peljhan

Anamarija Žagar

Ustaljeni vzorci

Kolikokrat se prisilimo v početje, ki je zunaj naših ustaljenih vzorcev življenja? Večina bi rekla, da vsak dan, saj je vsak dan nov dan in vsak trenutek nov trenutek, zato se neprestano dogaja nekaj novega. No, pa ni ravno čisto tako. Pomislite, kaj zjutraj najpogosteje zaužijete za zajtrk. Recimo, skodelica črne kave brez mleka in sladkorja, kos kruha z maslom in marmelado. Sledi jutro, vstanete in ... če bi naredili nekaj neustaljenega, bi morali namesto tega skuhati zeleni čaj, mu dodati mleko in 3 žličke sladkorja, zraven pa pojesti še hrenovko z gorčico. In kolikokrat naredite kaj takega? Morate priznati, da po ustaljenem vzorcu počnemo tudi številne druge stvari, od poti v službo do umivanja, pogovorov, kratkočasenj ... Vsak si je našel najljubši način vsega, kar opravlja in se tega bolj ali manj drži. Po biološko bi temu rekli, da se vsak po svoje prilagaja danim razmeram. In to je značilno za vse vrste, ne le za ljudi, saj z ustaljenimi vzorci obnašanja porabimo za preživetje kar najmanj energije.

Established Patterns

How many times do we force ourselves to do things outside of our established patterns of life? Most people would say we do it every day, because every day is new and every moment a new one, so something new is constantly happening. Well, that is not quite the case. Think about what you most often eat for breakfast in the morning. Say, a cup of black coffee without milk and sugar, a piece of bread with butter and jam. If the next morning, you did something unusual, you might change your regular pattern and drink green tea with milk and three teaspoons of sugar, and eat ham and eggs instead. How many times do you actually change your routine? For most of us, almost never. There are many set patterns and routines that we have built into our behaviors during the day. For example, how we commute to work, how we sit, and how we spend free time. Most people have found a routine way of doing things and more or less adhere to it. As we use the established patterns of behavior, we optimize the energy expenditure. Biologically, we would say that each person adapts to their own circumstances. This is characteristic of all species, not just Humans.

Ptice pogosto ustvarjajo vzorce v skupinah, ki so zanimive za fotografovo oko.

Birds in groups often make patterns that catch the attention of wildlife photographers.

Miha Krofel, Davorin Tome

Nataša Stritih Peljhan

Prilagoditve jamskih živali

Podzemno okolje se razlikuje od površinskega po tem, da v njem ni svetlobe, in po pomanjkanju hrane, kar vpliva na številne značilnosti jamskih živali. Njihova presnova se upočasni, razvojni krog se podaljša in spremeni se vedenje, povezano z iskanjem hrane in partnerjev. Od zunanjih znakov telesna obarvanost in vid praviloma zakrnita, ob tem pa se drugi čuti izpopolnijo in dolžina okončin se poveča. Pri jamskih žuželkah se tako podaljšajo tipalnice, noge in obustne okončine, s čimer se izboljša zaznava okusa in tipa. Hkrati se pri njih močno zmanjšata sposobnost zaznave vibracij podlage in uporaba vibracijskih signalov za sporazumevanje, ki je sicer razširjena pri površinskih vrstah. Razlog je zelo slabo prevajanje vibracij prek kamnite podlage, ki prevladuje v jamah. Posledično vibracijski čutilni organi v nogah žuželk lahko zakrnijo, kar smo ugotovili pri mediteranskih jamskih kobilicah iz rodu *Dolichopoda*.

Adapting to Cave Life

Cave environments differ from the surface ones by the absence of light and scarcity of food, thus influencing animal characteristics at many levels. In cave-dwelling organisms, metabolism slows down, the life cycle is prolonged, and behaviours related to finding food and partners are modified. In the animals' outer appearance, body coloration and eyes are typically reduced, while the appendages increase in length, by which senses other than vision become more elaborate. In cave insects, in particular, the elongation of antennae, legs, and mouthparts results in improved perception of taste and touch. At the same time, detection of substrate-borne vibration and the use of such stimuli in communication, prevalent in the surface-living species, is highly constrained for cave insects. This is due to an inefficient transmission of vibration over the rocky substrates that are prevalent in caves. Consequently, insect vibrosensory organs in the legs may be reduced, which we have recently found out in the Mediterranean Cave Crickets of the genus *Dolichopoda*.

Par sredozemskih jamskih kobilic *(Dolichopoda araneiformis)* med sporazumevanjem

A pair of Mediterranean Cave Crickets (*Dolichopoda araneiformis*) communicating.

Nataša Stritih Peljhan

Rok Janža

Več pogledov na isto stvar

Ko pri različnih organizmih med seboj primerjamo dele telesa ali organe s podobno ali enako funkcijo, ne moremo govoriti, da je eden boljši od drugega. Vedno se je treba vprašati, kako služi specifičnim ekološkim potrebam vrste in kakšen je bil evolucijski kontekst nastanka. Tako je tudi pri vidu. V živalskem kraljestvu najdemo širok nabor tipov očes, ki ne glede na raven kompleksnosti odlično služijo svojim lastnikom. Do glavnih razlik med različnimi tipi pride zaradi energetskih omejitev, ki pripeljejo do tega, da se določeni vidiki vida optimizirajo bolj kot drugi, ki so za dotično vrsto manj pomembni. Primerjajmo npr. kamričasto oko človeka in sestavljeno oko muhe. Ali je mušje oko kaj slabše od našega? Ne – razlikuje se samo način zaznave okolice obeh vrst. Medtem ko se mi lahko postavljamo z visoko prostorsko ločljivostjo in z odličnim zaznavanjem barv, je vid muhe veliko hitrejši, vidno polje njenega očesa je širše, zaznava pa lahko celo polarizirano svetlobo in svetlobo iz ultravijoličnega dela spektra. Ni tako slabo, mar ne?

Multiple Ways of Looking at the Same Thing

When we compare body parts or organs of different animals that have similar functions, we cannot say that one is better than the other. One must always ask how the structure serves the specific ecological needs of the species, and what the evolutionary context of its occurrence was. This is also the case with vision. In the animal kingdom, we find a wide variety of eye types that, regardless of complexity, serve their owners perfectly. The main differences between eye types are due to energy constraints, which lead to certain aspects of vision being optimized more than others that are less relevant to the species in question. Let us compare the camera-type eye of Human to the compound eye of the fly. Is the fly's eye any worse than ours? No – but how it perceives the environment is different. While Humans have high spatial resolution and excellent colour perception, the fly's vision is much faster, the field of view is wider, and it can even detect polarized and ultraviolet light. Not so bad, is it?

Rok Janža

Pestrost oči – sestavljeno oko navadnega obada *(Tabanus bromius)* in kamričasto oko človeka *(Homo sapiens)*

Eye diversity – the compound eye of the Band-eyed Brown Horsefly (*Tabanus bromius*) and the camera-type eye of Human (*Homo sapiens*).

Anamarija Žagar

Kako si prilagojen?

How Well-Adapted Are You?

Razmere na našem planetu se nenehno spreminjajo in živi organizmi se, da preživijo, neprestano prilagajajo. V znanstvenem žargonu imenujemo prilagajanje trenutnim razmeram »plastičnost« ali »aklimatizacija«, in ko se uspešne prilagoditve dedujejo iz generacije v generacijo, to imenujemo »naravna selekcija«. Vrste iz stabilnih okolij se težje prilagajajo spremembam kot tiste, ki živijo v nestalnem okolju, kjer se morajo nenehno odzivati na spremembe. Kot primer stabilnega okolja najprej pomislim na podzemlje. Tu se temperatura, vlaga in svetloba spreminjajo zelo počasi, če sploh. Tu živijo vrste, ki so se na to okolje izjemno dobro prilagodile – specializirale. Kaj pa človek v razvitem svetu? V udobnem okolju imamo na voljo vse dobrine in postajamo vedno bolj neprilagodljivi. Niti predstavljamo si ne, kako bi bilo, če ne bi imeli stalnega dostopa do hrane, vode, primernega bivalnega okolja in še ogromno drugega. Zato postajamo zelo specializirani na moderni način življenja. Ali s tem izgubljamo sposobnost prilagajanja na nepredvidljive spremembe v prihodnosti?

The conditions on our planet are constantly changing, and living organisms are always adapting to survive. In scientific jargon, we call instant adaptation to current conditions "plasticity" or "acclimatization", and when successful adaptations are inherited from generation to generation, we call it "natural selection". Species from stable environments adapt less easily to new conditions than those living in a changing environment where they have to constantly respond to varying conditions. Subterranean environments exemplify a stable environment. In caves, temperature, humidity, and light are constant. Species that live in caves are extremely well adapted to this environment – they are specialized. What about us, Humans, living in the modern world? Most of us live in a comfortable environment, and we have all the amenities we need. We cannot imagine what it would be like if we did not have easy access to food, water, a suitable living environment and much more. In this way, we are becoming very specialized in the modern way of life. Are we losing the ability to adapt to unpredictable changes in the future?

Varovalne barve in oblike so prilagoditev, ki organizmom omogoča, da se skrijejo v okolju. Ali na sliki najdete rakovico z imenom gladko morsko šestilo *(Parthenopoides massena)*?

Crypsis is an evolved resemblance between an organism and environment, mostly used for hidding. Can you find the Parthenopoid Crab (*Parthenopoides massena*) in the picture?

Al Vrezec

Tatjana Simčič

Kdo bo preživel okoljske spremembe?

Who Will Survive the Environmental Changes?

Ali ste se že kdaj spraševali, zakaj neka vrsta živali ali rastline po nenadni spremembi v okolju, v katerem je živela vrsto let, izgine, druge vrste pa so po tej spremembi enako ali celo bolj uspešne? Eden izmed razlogov se med drugim skriva v biokemijskih in fizioloških značilnostih vrst. Po teh značilnostih se razlikujejo zmožnosti različnih vrst organizmov, da bodo tudi v spremenjenih razmerah proizvedli zadostno količino energije za vzdrževanje osnovnih presnovnih procesov, rasti in razmnoževanja. Medvrstne razlike v strpnosti na okoljske razmere običajno ocenjujemo s spremembami v intenziteti presnove, ki so odsev biokemijske in fiziološke pestrosti vrst. Temperatura je dejavnik, ki močno vpliva na presnovne procese organizmov in s tem na njihovo razširjenost. Le-ta se zaradi globalnega segrevanja spreminja, ob tem pa se vrste umikajo z območij z zanje neugodnimi temperaturami v temperaturno ustreznejša okolja. Če pri umiku naletijo na prepreke, ne preživijo in izumrejo.

Have you ever wondered why an animal or plant species disappears after a sudden change in the environment in which it has lived for many years, while other species are equally or even more successful after that change? One of the reasons is the species-specific biochemical and physiological characteristics. These characteristics differentiate the ability of different types of organisms to produce sufficient energy under changed conditions, to sustain basic metabolic processes, growth, and reproduction. Interspecific differences in tolerance to environmental conditions are usually assessed by changes in metabolic intensity, which reflect the biochemical and physiological diversity of a species. Temperature is an important factor that affects the metabolic processes of organisms and, thus, their distribution. Distribution is changing due to global warming, and some species are moving away from areas with unfavourable temperatures to more suitable environments. If they encounter obstacles when they relocate, they do not survive and become extinct.

Triglavska neboglasnica (*Eritrichum nanum*) in polarna lisica (*Vulpes lagopus*) zaradi specifičnih prilagoditev uspešno poseljujeta zelo hladna okolja, ki pa se pod vplivom globalnega segrevanja močno spreminjajo.

Due to their specific adaptations, the Alpine Forget-me-not (*Eritrichum nanum*) and the Arctic Fox (*Vulpes lagopus*) successfully inhabit very cold environments, which are changing significantly under the influence of global warming.

Tanja Menegalija, Davorin Tome

Urška Ratajc, Rok Šturm

Žuželčji jedilni pribor

V primerjavi z nami imajo žuželke jedilni pribor vedno pri ustih. Imenujemo ga obustni aparat. Različne skupine žuželk imajo različne obustne aparate - takšne, ki jim pridejo najbolj prav na poti do hrane, ki jim najbolj tekne. Kolikšna je pestrost jedače, tolikšna je pestrost pribora zanjo. Vsi smo se že srečali z obustnim aparatom samice komarja, ki je spremenjen v bodalo, s katerim prebode povrhnjico kože in pije kri. Tudi metulji imajo praktičen obustni aparat za sesanje medičine iz cvetov. Velerilec, vrsta metulja vešča, je dobil ime po zelo dolgem sesalu, s katerim doseže medičino tudi v najglobljih cvetovih. Muha s spužvastim lizalom srka in liže razliti sok na kuhinjskem pultu. Najbolj razširjena in izvirna oblika obustnega aparat pa je grizalo, ki ga imajo hrošči, kobilice, kačji pastirji in mnoge druge žuželke. Pri samcih rogača je grizalo še dodatno preoblikovano in s svojo kleščasto obliko ni več namenjeno prehranjevanju, temveč je v pomoč pri boju z drugimi samci in pri osvajanju samic.

Insect Cutlery

Unlike Humans, insects carry their cutlery with them at all times. Different groups of insects have different types of mouthparts, which come in handy with their favourite food. The diversity of their food reflects the diversity of their mouthparts. We have all had an unpleasant encounter with the mouthpart of female mosquitos, which is a long, tube-like structure called a beak and is used to pierce the skin and suck the blood. Butterflies suck nectar from flowers and have adapted their mouthparts accordingly. The Hummingbird Hawk Moth has a very long siphoning mouthpart, called the proboscis, which enables it to reach nectar even in the deepest flowers. A fly uses its sponge-like mouthpart to soak up the spilled juice on kitchen counter. However, the most common and the most primitive is the chewing mouthpart, which is found in beetles, grasshoppers, dragonflies, and many other insects. The males of the Stag Beetle do not use their reshaped mandibles for feeding but for wrestling with other males to fight over females.

Rogač (*Lucanus cervus*) je dobil ime po preoblikovani čeljusti, ki spominja na jelenje rogovje.

The Stag Beetle (*Lucanus cervus*) got its name by its reshaped mandibles, which resemble the antlers of stags.

Urška Ratajc

Matjaž Bedjanič

Lažna pobožnost

False Piety

Pri poletnem sprehodu po travniku, ob mejici ali robu gozda še pomislimo ne na kakršno koli nevarnost. Toda pod našimi nogami, v vzporednem svetu manjših bitij, prav takrat lahko potekajo neusmiljeni boji in krvoločne drame, ki jim pravimo tudi plenilstvo, tekmovanje ali, bolj splošno, »interakcije« med živimi bitji.

Če imamo srečo in med travnimi bilkami zagledamo bogomolko, ki s pobožno zloženimi prednjimi nogami na videz mirno opazuje okolico, ne bi pomislili, da gre za pravcatega žuželčjega farizeja in nevarnega plenilca. Z barvo telesa, ki se povsem zlije z okolico, nepremično držo in velikimi očmi je odlično opremljena na lov iz zasede. Seznam vrhunske plenilske opreme dopolnjujejo še preoblikovani prvi par nog, z nazobčanim in na koncu zašiljenim golencem, ki se kot rezilo pipca zapira proti s trni oboroženemu stegencu, ter močne čeljusti.

Manjša bitja smrtonosnemu objemu požrešne bogomolke kratko malo ne morejo ubežati. Skozi prizmo človeške velikosti pa je drobna bogomolka vendarle prav prikupna žuželka in njeno življenje je polno zanimivosti.

When taking a summer stroll through the meadow or forest edge, one does not often think of danger. However, at our feet, in the parallel world of smaller creatures, at that same moment, relentless fights and bloodthirsty dramas are taking place. They are called predation, competition, or, more generally, "interactions" among living beings.

With a bit of luck, we can see a Praying Mantis among the grass blades. With her devoutly folded forelegs and calmly observing her surroundings, one would not think of it is a true insect pharisee and a dangerous predator. With a camouflaged body that blends in with the surroundings, immovable posture, and big eyes, the Praying Mantis is perfectly equipped for ambush hunting. The list of topmost predatory equipment is supplemented by the transformed first pair of legs, with a serrated and terminally pointed tibia which can fold like a clasp knife towards a thorn-armed femur, and strong jaws. Smaller creatures simply cannot escape the deadly grasp of the voracious mantis. Through the prism of human size, however, the tiny Mantis is simply an adorable insect, and its life is full of charms.

Neusmiljen boj za preživetje je lahko v naravi poln presenečenj - bogomoljka (*Mantis religiosa*).

The relentless struggle for survival in nature can be full of surprises - the Praying Mantis (*Mantis religiosa*).

Matjaž Bedjanič

Al Vrezec

Ksenodiverziteta

Xenodiversity

Tujerodna vrsta se pojavlja zunaj svojega naravnega območja razširjenosti. Njeno širjenje je posledica namernega ali nenamernega vnosa na novo območje s strani človeka. Nove vrste sicer prispevajo k povečanju biotske pestrosti, kar pa je le navidezen dobrobit. Tujerodne vrste so danes eden glavnih dejavnikov, ki prispevajo k upadanju biodiverzitete. Obsežne invazije, kakor imenujemo proces njihovega vključevanja v naravne ekosisteme, so povzročile spremembe nekaterih ključnih ekosistemskih storitev. Med drugim so povzročile tudi velike škode v kmetijstvu, turizmu, na infrastrukturi in zdravju ljudi. Da bi jasno ločili naravno oziroma ekosistemsko biodiverziteto od tiste, ki jo prispevajo tujerodne vrste, ta del pestrosti opisujemo kot ksenodiverziteta. Čeprav so se vnosi tujerodnih vrst v naravne ekosisteme pričeli že pred 10.000 leti s širjenjem človeške vrste po planetu, število vnosov novih vrst v zadnjih 100 letih strmo narašča zaradi medcelinskih transportov.

We call a species an alien species when it is found outside of its natural range. Alien species are spread through deliberate or unintentional introduction into a new area by Humans. While new species contribute to an increase in biodiversity, this is only an apparent benefit. Alien species are one of the main threats to biodiversity. Invasions, as we call the process of integrating alien species into natural ecosystems, have led to adverse changes in some key ecosystem services. They have caused major damage to agriculture, tourism, infrastructure, and human health. To clearly distinguish between natural or ecosystem biodiversity from that of alien species, we describe this part of diversity as xenodiversity. Although the introduction of alien species into natural ecosystems began 10,000 years ago with Human species expansion, there has been a steep increase in the number of new species introductions over the past 100 years due to intercontinental transports.

Prelomnica za svetovno biodiverziteto je bilo leto 1492, ko so se s pomočjo človeka po Evropi pričele širiti ameriške tujerodne vrste, zato vrste, prenesene po tem letu, kakršna sta koloradski hrošč *(Leptinotarsa decemlineata)* iz Severne Amerike in nutrija *(Myocastor coypus)* iz Južne Amerike, označujemo kot neobiota.

The turning point for world biodiversity was the year 1492, when alien species from America began to spread through Europe, so species introduced thereafter, such as the Colorado Potatoe Beetle (*Leptinotarsa decemlineata*) from North America and the Coypu (*Myocastor coypus*) from South America, we designate as neobiota.

Al Vrezec, Davorin Tome

Andrej Kapla

Le kaj bi to bilo?

Na naši Zemlji živi zelo velika skupina organizmov. Živijo na travnikih, v gozdovih, v vodi, v podzemlju, veliko jih s pticami deli nebo. Le morja (še) niso osvojili. Po številu vrst prekašajo vse znane skupine organizmov, tako živali in rastline, kot tudi glive ter gniloživke. Celo več kot znanih virusov in bakterij jih je. Vidimo in srečamo jih povsod, z nami si delijo celo bivališča. Včasih se jezimo nanje, ker se hranijo z našimi najljubšimi ovsenimi kosmiči ali pa vrtajo v leseno ogrodje pradedove stenske ure. Večinoma pa smo jih veseli, ker pobirajo polže s solate na maminem vrtu. Nekateri so temni, nekateri svetli, nekateri izjemnih bleščečih barv, noben pa ni dolgočasen. Ne smemo pozabiti na njihovo velikostno pestrost. Najmanjši so veliki kot peščeno zrno na plaži, največji pa veliki kot copat in težki kot veverica. Nekateri živijo le nekaj dni, spet drugi desetletje ali več. Tu so že približno 380 milijonov let in sape jim še ne zmanjkuje. Skratka, so vseh možnih oblik, barv in načinov življenja. Na kratko jim pravimo hrošči.

What Are They?

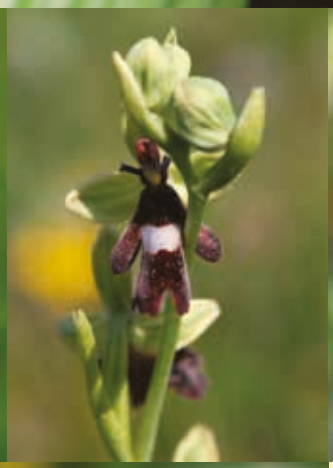
A very large group of organisms lives on our Earth. They live in meadows, forests, water, and underground; many of them share the sky with birds. Only the sea has not been conquered by this organism. The number of species in this one group exceeds all known groups of animals, plants, fungi and slime moulds. There are even more of these than known viruses and bacteria. We see and meet them everywhere; they even share homes with us. Sometimes we get mad at them for feeding on our favourite oat flakes or drilling into the wood frame of a great-grandfather's wall clock. For the most part, we are glad that they are picking snails from lettuces in mother's garden. Some are dark, some are bright, some are dazzling colours, and none are boring. We must not forget about diversity of their sizes. The smallest are as tiny as grains of sand and the largest are as big as slippers and heavy like Squirrels. Some live only a few days, others a decade or more. They have been on Earth for about 380 million years, and they have not run out of breath. In short, they are of all possible shapes, colours and ways of life. We call them beetles.

Hrošči – največja in najbolj pestra skupina organizmov na Zemlji

Beetles – the largest and the most diverse group of organisms on the Earth.

Andrej Kapla



Pestri obrazi naših kukavičevk. Lepi čeveljc (*Cypripedium calceolus*), bleda naglavka (*Cephalanthera damasonium*), pikastocvetna kukavica (*Orchis ustulata*), muholiko mačje uho (*Ophrys insectifera*), čebeljeliko mačje uho (*Ophrys apifera*), opičja kukavica (*Orchis simia*).

Diverse faces of our orchids: Lady's Slipper (*Cypripedium calceolus*), White Helleborine (*Cephalanthera damasonium*), Dark-Winged Orchis (*Orchis ustulata*), Fly Orchid (*Ophrys insectifera*), Bee Orchid (*Ophrys apifera*), Monkey Orchid (*Orchis simia*).

Anka Kuhelj

Bahave in skrivnostne prebivalke Slovenije

Kdo ne pozna orhidej? Ste vedeli, da uspevajo tudi v Sloveniji? In da imajo celo slovensko ime – kukavičevke? Rastejo na tleh in so precej manjše od tropskih sorodnic, vendar zato nič manj bahave in skrivnostne. Lahko se pohvalimo s kar 83 vrstami in podvrstami, kar je skoraj 3 % slovenskega rastlinstva. Mnoge so redke, nekatere ogrožene, večina je uvrščena v nacionalni rdeči seznam ogroženih rastlin. Nekatere so tudi prave prebrisanke. Z obliko cvetov in vonjavami posnemajo samice žuželk in tako zavedejo in izkoristijo »zaljubljene« samce npr. os ali muh. Medtem ko se poskušajo pariti s takšno »samico«, se nanje prilepi posebna opraševalna enota s cvetnim prahom. Znane so tudi po sožitju z glivami. Ker njihova izjemno majhna semena nimajo rezervnih hranil, so vsaj na začetku razvoja prehransko popolnoma odvisna od gliv. Tudi ko se rastline popolnoma razvijejo, ohranijo tesno povezavo.

Kukavičevke bogatijo in krasijo naše travnike, gozdove ter brežine cest. Naj tako tudi ostane!

Showy and Mysterious Inhabitants of Slovenia

Who does not know about orchids? Did you know that they are native to Slovenia? We even have a Slovenian name for them. They are terrestrial and are much smaller than their tropical relatives but no less showy and mysterious. Slovenia boasts as many as 83 species and subspecies of orchids, which represent almost 3 % of Slovenian flora. Many are rare, some are endangered, and most are listed on the Slovenian Red List of Threatened Species. Some orchids display remarkable cunning. Their flower is adapted to have a colour, shape, and odour which attracts male insects, for example, flies or wasps by means of mimicry of a receptive female. As the male insect attempts to mate with such a "female", a special pollinating unit with pollen adheres to it. Orchids are also known for their symbiosis with fungi. Because orchids' tiny seeds have no nutrient reserve, their germination is entirely nutritionally dependent on fungi; even fully developed plants maintain a close bond with them.

With their presence, orchids enrich and adorn our meadows, forests and the banks of roads. Let's keep it this way.

Anka Kuhelj

Anton Brancelj

Kaj nam kaplja na vrat?

Kje? – v kraških jamah. Od kod? – s stropa. Ob obisku jame nam lahko v kapljici vode pade za ovratnik tudi jamski rakec, velik okoli 0,5 mm.

Po svetu je dobro poznana trideset cm dolga človeška ribica. V Sloveniji ji dela družbo še okoli 200 vrst podzemnih vodnih živali, a je večina manjša od enega centimetra.

Že v preteklosti so jamski biologi v lužicah jamske kapnice odkrivali nove živali, vendar niso posvečali pozornosti temu, od kod so prišle. Leta 2000 pa smo ugotovili, od kod. V jami Velika Pasica na Gornjem Igu smo začeli z intenzivnimi raziskavami drobnih vodnih curkov, curljajočih iz jamskega stropa. Voda od tam izpira živali, ki živijo v le nekaj metrov debeli plasti kamnine. Izkazalo se je, da tam živi veliko število novih vrst. V približno dveh desetletjih je bilo tako na podlagi naših raziskav odkritih blizu 50 novih vrst ne samo v Sloveniji, pač pa tudi v Evropi in širše.

Torej, če po padcu kapljice za vrat začutite rahlo ščegetanje, je to rakec iz jamskega stropa. Ne padajo za vrat samo pajki!

What Trickles On Our Neck?

Where? In the karst caves. From where? From a ceiling. When you visit a cave in Slovenia, a cave crustacean, about 0.5 mm long, might be in a drop of water dripping down from above.

A thirty centimeter long Human Fish lives in subterranean rivers in Slovene caves and is well-known worldwide. In addition, there are about 200 groundwater species, most of them smaller than one cetimeter.

In the past, cave biologists have found several new animals in the pools made from dripping water, but they did not pay attention to how these animals got there. In 2000, we discovered where these organisms originated. In the Velika Pasica Cave near village Gornji Ig, we started intensively researching the tiny water jets dripping from the ceiling. This water washed out animals that live above in layers of rock just a few meters thick. We found a large number of new species living there. In the next two decades, about fifty new cave-dwelling species were discovered not only in Slovenia, but also in Europe and beyond.

So, if after the fall of a water drop on your neck you feel a slight tingling, it is a crab from the cave ceiling. Not only spiders fall on your neck!

"Makaronči" oz. "špageti" so eno izmed vstopnih mest za deževne kapljice in rakce v jamo.

"Macaroni" or "spaghetti" are among the spots for rain drops and crustaceans entering into a cave.

Anton Brancelj





Jernej Polajnar

Pisani spreletavci

Poleti lahko ob skoraj vsakem ribniku ujamemo odmev pradavnine. Kačji pastirji so se razvili pred skoraj 300 milijoni let in njihov način življenja se je izkazal za tako uspešnega, da se od takrat niso bistveno spreminjali. Njihova eleganca navdihuje pesnike, slikarje in druge umetnike, pa tudi inženirje, saj so sposobni izjemnih akrobacij v letu, s katerimi lovijo svoj plen in se postavljajo pred tekmeci za življenjski prostor ter družicami, s katerimi bodo ustvarili nov rod. Že zaradi tega je vredno varovati njihovo okolje – stoječe ali počasi tekoče vode, kar blagodejno vpliva tudi na njihove manj opazne sosede. Zaradi opaznosti so uporabni kot indikatorski organizmi, ki s svojo prisotnostjo sporočajo, da je okolje še dovolj neokrnjeno zanje. Vendar kačji pastir ni enak kačjemu pastirju: sinji presličar uspeva celo v betonskih koritih, s kakršnimi »reguliramo« potoke v naseljih, nekatere druge vrste pa najdemo le v zelo ranljivih ostankih visokih barij. Zato jih moramo znati ločevati, da jih lahko ohranimo. Le tako bodo ti krasni spreletavci navdihovali tudi bodoče rodove.

Colourful Fliers

In the summertime, almost every pond contains echoes of an ancient age. Dragonflies and damselflies evolved nearly 300 million years ago and proved so successful that they remain almost unchanged. Their elegance serves as an inspiration to poets, painters and other artists. Engineers try to emulate their amazing acrobatics with which they capture prey, fend off competitors and court mates to produce the next generation. This alone merits preserving their habitat, standing or slowly moving waters, which also benefits their less notable neighbours. Most dragonflies and damselflies are easily observable and thus useful as indicators of a well-preserved environment. But not all. For example, the White-legged Damselfly thrives even in concrete channels used for »regulating« waterways in human settlements, while some species only inhabit vulnerable remnants of raised bogs. Therefore, we must learn how to distinguish them from one another in order to preserve them, so that these fantastic fliers may continue to inspire us for generations to come.

Kačji pastirji (*Odonata*) so najrazličnejših velikosti, oblik in barv.

Dragonflies and damselfies (*Odonata*) come in a wide variety of sizes, shapes and colours.

Matjaž Bedjanič, Jernej Polajnar

Meta Virant Doberlet

Oglasi se in povem ti, kdo si

Večino vrst lahko hitro razločimo, ker se med seboj razlikujejo po zunanjih znakih, ki jih zlahka opazimo, kot so na primer velikost, barva in oblika izrastkov na površini telesa. Nekatere vrste pa so si med seboj tako zelo podobne, da jih tudi z natančnimi anatomskimi primerjavami, včasih celo z genetskimi analizami, ne moremo razlikovati. Pri žuželkah, ki se sporazumevajo z zvokom, si pri razločevanju takih prikritih vrst lahko pomagamo z njihovim jezikom. Pogosto sta nam do tedaj nepoznan jezik in hkrati tudi razumevanje tega jezika s strani poslušalcev, ki jih sporočevalci nagovarjajo, prvi znak, da imamo mogoče opravka z do sedaj še neopisano vrsto, ki govori svoj jezik. Pomen vrstno-značilnega jezika ni le v tem, da lahko zaznamo vrste, ki so po podobi neločljive, temveč tudi v tem, da nam omogoča vpogled v procese, ki potekajo v naravnem evolucijskem laboratoriju. Prav ta jezik je namreč vrsti omogočil, da se je med evolucijo ločila od drugih.

Speak and I Will Tell You Who You Are

We can identify the majority of species by body characteristics that are easily observed, like size, colour pattern, and shape of appendages. However, some sister species cannot be distinguished even by detailed anatomical investigations, and sometimes even by standard genetic analyses. Nevertheless, when dealing with morphologically cryptic insect species communicating by sound, we can rely on their unique language. Often, the first indication that we may be dealing with a new species is undescribed insect language and an understanding of this language by intended receivers. Species-specific insect language not only allows us to identify morphologically cryptic species, but also offers an insight into processes running in nature's evolutionary laboratory, since unique language enables individuals to isolate reproductively from other species.

Na travniku lahko hkrati slišimo več kot 50 različnih žuželčjih jezikov.

In a meadow, more than 50 different insect languages can be heard at the same time.

Davorin Tome

Stiven Kocijančič

Svet letečih plenilcev

Ti preživeli dinozavri letijo povsod, nad mesti, polji, travniki, gozdovi, tudi nad gorami. Naselili so vse celine, razen Antarktike. Zaradi njihove hitrosti, poguma in predrznosti jih ljudje že stoletja opazujemo in občudujemo. Nekateri so našli mesto v državnih simbolih moči in slave. Drugi jih prezirajo in uničujejo, saj ne razumejo njihovega evolucijskega in ekološkega poslanstva biti na vrhu prehranjevalne verige. Najmanjši so le nekoliko večji od človeške dlani, pri največjih razpon peruti doseže kar tri metre. Tisti manjši plenijo večinoma žuželke in male sesalce, medtem ko se njihovi večji sorodniki prehranjujejo s srednje velikimi sesalci. Kljub temu se lahko na njihovem jedilniku znajdejo tudi plazilci, dvoživke in ptice. Ker so na vrhu prehranjevalne verige, so med prvimi, ki jih prizadenejo okoljske spremembe in so zato pomemben kazalec kakovosti okolja. Tisti najmočnejši jadrajo med oblaki tudi par desetletij. Ti neustrašni bojevniki so ujede.

The World of Flying Predators

These surviving dinosaurus fly everywhere, over cities, fields, meadows, forests, even over mountains. They inhabit all continents except Antarctica. Because of their speed, bravery, and boldness, people have observed and admired them for centuries. Some have their images printed on flags or blazons. Others are despised and destroyed because their evolutionary and ecological mission to live at the top of the food chain is not understood. The smallest are only a bit larger than the human palm, and the largest has a wingspan of as much as three meters. Smaller predators hunt mostly insects and small mammals, while their larger relatives feed on medium-sized mammals. However, reptiles, amphibians and birds may also be found on their menu. As they are at the top of the food chain, they are among the first species affected by environmental changes and are, therefore, an important indicator of environmental quality. The most powerful ones sail over the clouds for a couple of decades. These fearless warriors are birds of prey.

Rjavi škarnik *(Milvus milvus)* – preživeli leteči dinozaver z vrha prehranjevalne verige

The Red Kite (*Milvus milvus*) – surviving flying dinosaurus from the top of the food chain.

Davorin Tome

Al Vrezec

Koevolucijska zajedavska zagata

Leta 1859 so v italijanski Lombardiji pričeli poginjati potočni raki, v naslednjih 30 letih je Evropo zajela smrtonosna epidemija račje kuge. Povzročiteljica je bila oomiceta *Aphanomyces astaci*, ki okuženega raka pokonča v nekaj dneh. Vendar so za bolezen občutljivi le evropski raki, ameriški pa ne. Z njimi so sklenili naseliti po kugi izpraznjene evropske vode. In res uspešno, a le za nekaj časa, potem so začeli poginjati tudi ti. Spet zaradi račje kuge. Zagata je bila v spremenljivosti genoma oomicete, ki se pri različnih vrstah rakov pojavlja z različnimi sevi. Neka vrsta potočnega raka je odporna na svoj sev, saj sta se zajedavec in gostitelj v koevolucijskem razvoju prilagodila. A zaradi mešanja različnih vrst rakov in s tem sevov račje kuge, je prišlo ponovno do smrtonosne kombinacije. Z naselitvami ameriških rakov smo ljudje mislili naravo prelisičiti, a je narava prelisičila nas. Evolucija se ne ustavi! Tudi ko tujerodna vrsta prispe v novo okolje, se spreminja in postaja nekaj drugega, novega. Kaj bo postala, pa je kratko malo nemogoče predvideti.

Coevolutionary Parasitic Trouble

In 1859, crayfish began to die in masses in the Lombardy region of Italy. Over the next thirty years, this deadly crayfish plague expanded all over Europe. The causative agent was a parasite, oomycetes *Aphanomyces astaci*, which kills infected crayfish within a few days. However, only European crayfish are susceptible to the disease; the American crayfish are not. Experts decided to introduce the American plague-resistant crayfish to emptied European waters. The introduction was successful, but only for a while. Then even American crayfish started to die, again due to crayfish plague. The problem was in the variability of the oomycete genome, which occurs in different crayfish with different strains. Certain crayfish species are resistant to their own strain as the parasite and the host adapt to each other. So when different crayfish species were mixed with the crayfish plague strains, a new outbreak of the deadly crayfish plague occurred. With the introduction of the American crayfish, people thought they were outwitting nature, but nature outwitted us. Evolution does not stop! Even when an alien species arrives in a new environment, it starts to change and becomes something else, something new. It is impossible to predict what it will become at the end.

Davorin Tome, Al Vrezec

Potočni rak koščak *(Austropotamobius torrentium)* simbolizira čiste vode, a ga pesti nevidni zajedavec, povzročitelj smrtonosne račje kuge, ki na okuženih osebkih povzroči črne madeže.

The Stone Crayfish (*Austropotamobius torrentium*) is a symbol of pure water, but it is infested by an invisible parasite, agent of deadly crayfish plague, which causes black spots on infected specimens.

Tjaša Matjašič

Ravnovesje

Raznovrstnost razpoznamo tudi v odnosih med vrstami v ekosistemu. Ptice se hranijo s plodovi rastlin, hkrati pa kot zelo mobilen organizem raznesejo semena rastlinam, ki so stalno pritrjene. Tudi plenilec je pomemben za ohranitev svojega plena, čeprav se to sprva zdi protislovno. Najprej uplenijo osebke, ki so šibkejši, in tako zagotavljajo, da se razmnožujejo le osebki, ki so najbolj »fit«. Povezave postanejo kompleksnejše, ko so v enačbi vsaj trije: plenilec in dve vrsti plena. Če sta v eksperimentalnem terariju dve različni vrsti žuželk in rastlina, s katero se hranita, sistem v določenem času propade. Vrsti imata na začetku na voljo obilje hrane in se namnožita, rastlina pa se ne zmore obnavljati dovolj hitro in propade, z njo pa tudi obe vrsti žuželk. Plenilec obeh vrst žuželk uravnava število osebkov in prispeva k stabilnosti sistema; rastlinojedi vrsti se ne namnožita prekomerno, ker plenilec uravnava njuno število. S tako poenostavljenimi modeli opazimo, kako pomemben je prispevek posamezne vrste k vzpostavljanju in ohranitvi ravnovesja v ekosistemih.

Balance

Relationships between species in the ecosystems are diverse. Birds feed on fruits and, as highly mobile organisms, spread the seeds of the stationary plants. It may seem contradictory at first, but predators are important in maintaining the prey abundances. Weaker individuals are caught first, ensuring only the most "fit" specimens reproduce. The relationships become more complex if there are three in the equation - a predator and two prey species. If there are two species of insects feeding on plants in an experimental terrarium, the system will collapse. At first, the insects have an abundance of food at their disposal, so they reproduce, but the plants are unable to regenerate fast enough and then decline along with both insect species. The insect predator regulates the number of herbivores and contributes to the stability of the system; herbivorous insects do not multiply excessively because the predator regulates their numbers. With such simplified models, we notice the importance of each species in establishing and maintaining equilibrium in ecosystems.

Panterjev kameleon (*Furcifer pardalis*) v naravi lovi raznolike žuželke, v ujetništvu pa je velikokrat nadomestek za naravni plen gojeni cvrček (*Acheta domesticus*).

The Panther Chameleon (*Furcifer pardalis*) hunts a variety of insects in the wild, but in captivity, House Crickets (*Acheta domesticus*) are the main substitute for the natural prey.

Tjaša Matjašič

Tatjana Simčič

Veriga je močna toliko kakor njen najšibkejši člen

A Chain Is as Strong as Its Weakest Link

Večina ljudi ob besedi biodiverziteta pomisli na raznolikost vrst, ki poseljujejo neko okolje, le malokdo pa pomisli na pestrost znotraj posamezne vrste, ko ima osebek med razvojem povsem različno zunanjo in notranjo zgradbo. Tak primer so žuželke, ki imajo popolno preobrazbo – njihov razvoj poteka vse od oplojenega jajčeca prek ličinke in bube do odrasle živali. Poleg različnega videza pa imajo na posameznih stopnjah tudi različne ekološke zahteve. Ličinke komarjev potrebujejo denimo za svoj razvoj vodno okolje, medtem ko odrasle živali letajo po zraku. Različne ekološke zahteve med razvojem se kažejo tudi pri vretenčarjih, kot so na primer ribe. Razvojni stadiji postrvi od oploditve pa vse do ličinke, ki preživijo obdobje do plavanja v rečnem dnu, so bolj občutljivi za povišanje temperature kot prosto plavajoče mladice iste vrste. Za uspešen obstoj vrste v danem okolju morajo biti potemtakem zagotovljene ugodne razmere za vse razvojne stadije, saj je veriga močna toliko kakor njen najšibkejši člen.

Most people think of biodiversity as the diversity of species that inhabit an environment. However, few of them think of the diversity within each species when the organism has an entirely different outer and inner structure during development. Consider insects that undergo a complete metamorphosis from a fertilized egg to a larva and a pupa to an adult animal. In addition to their changing appearance, they also have different ecological requirements at each stage. For example, mosquito larvae need an aquatic environment for their development, while adult animals fly through the air. Different ecological requirements during development are also seen in vertebrates such as fish. The developmental stages of trout that survive from fertilization until swimming in the riverbed are more sensitive to increased temperature than free-floating juveniles of the same species. Therefore, the successful existence of a species in a given environment must be ensured by favourable conditions in all stages of development, since the chain is as strong as its weakest link.

Ikre z očmi so razvojni stadij soške postrvi (*Salmo marmoratus*), ki je bolj občutljiv za povišanje temperature kot prosto plavajoče mladice iste vrste.

The developmental stages of Marble Trout (*Salmo marmoratus*), such as eyed eggs, are more sensitive to increased temperature than free-floating juveniles of the same species.

Luka Dakskobler

Al Vrezec

Selitvena pestrost

Nabor vrst spomladi gostolečih ptic, ki se pripravljajo na gnezdenje, kaže vsako leto enako združbo ptic, značilno za gozd, travnik ali naselje. Vendar pa se te ptice le manjši del leta držijo skupaj in večji del leta preživijo drugje. Naša »začasna« združba namreč odraža pestrost ptičjih selitev izjemnih razsežnosti. Vsako leto se z enega dela Zemlje na drugega in nazaj premakne kar 10 milijard ptic. Vsaka vrsta izbere svojo pot in svoj cilj. V naši gozdni združbi se denimo gozdni jereb premakne za največ 5 km, grivarji se odselijo 500 km daleč v Italijo, cikovti 1000 km v Španijo, kobilar pa kar 6000 km daleč v afriški Kongo. Vendar, ne le vsaka vrsta, tudi vsak osebek si izbere svojo pot, kar še povečuje pestrost in prepletenost selitev, ki so pravzaprav mostovi med ekosistemi na Zemlji. Naše bele štorklje na primer večinoma odletijo vse tja do juga Afrike, več kot 8000 km daleč, medtem ko imamo med štorkljami tudi takšne, ki na dolgo pot sploh ne krenejo in ostanejo pri nas celo leto.

Migration Diversity

In our forests, meadows, and urban areas each spring more or less the same bird species are gathered each year together to breed and are forming characteristc breeding bird assemblages. However, these birds only stay together for a short time. They spend the rest of the year elsewhere. These "temporary" species assemblages reflect the vast diversity of bird migrations and migratory routes. Every year, as many as 10 billion birds move from one part of the Earth to another and back. Each species chooses its own route and destination. In our forest community, for example, the Hazel Grouse moves no more than 5 km, the Wood Pigeon 500 km away to Italy, the Song Thrush 1000 km to Spain, and the Oriole 6000 km to the African Congo. Furthermore, within every species, each individual chooses its own route, which further enhances the diversity of migrations, vital bridges between Earth's ecosystems. For example, White Storks from Slovenia mostly fly all the way to South Africa, more than 8000 km away, but some Storks do not migrate and stay with us year-round.

Bela štorklja *(Ciconia ciconia)* s svojo vsakoletno selitvijo povezuje naše kraje (levo) z Afriko (desno).

With its annual migration, the White Stork (*Ciconia ciconia*) is linking European (left) with African continent (right).

Davorin Tome

Alenka Žunič Kosi

Govorica telesa, besed, barv in vonjav

Ste se že kdaj vprašali, kakšno bi bilo naše življenje, če ne bi mogli povedati ali pokazati, kaj potrebujemo, kaj si želimo, mislimo in čutimo? Ljudje se sporazumevamo s približno 7000 jeziki in še več narečji. Informacije sporočamo in sprejemamo tudi z nebesedno komunikacijo, z višino in barvo glasu, s pogledi in kretnjami. Na zelo različne načine komunicirajo tudi drugi organizmi, od bakterij, rastlin in živali, in to vse samo zato, da bi pri osebkih iste ali druge vrste sprožili natančno določen odziv. Živali se lahko sporazumevajo z oglašanjem; pojejo, renčijo, topotajo, bobnajo, piskajo in brenčijo; se dotikajo in si pošiljajo vidna sporočila; premikajo uhlje ali rep, spreminjajo obrazno mimiko, držo in obarvanost telesa. Rastline in živali se zelo pogosto pogovarjajo tudi z neslišno in nevidno govorico - govorico vonjav. Prav ta velika raznolikost izmenjave informacij omogoča uspešno komuniciranje, ki je ena najbolj osnovnih lastnosti živih bitij in je nujna za njihovo sobivanje in obstoj.

Speaking with Words, Colours, Smell and Body Language

Have you ever wondered what would be like to live without the ability to express our needs, thoughts and feelings? Humans speak about 7000 languages and many more dialects. We also convey and perceive information through non-verbal communication, pitch and tone of voice, or body language. Other living organisms – bacteria, plants, and animals – also interact in a variety of ways, in order to trigger a specific response in another individual of the same or other species. Animals talk to each other with sound; they sing, roar, drum, squeal and buzz. They touch and send visual signals. They move their ears or tail, change facial expression, body posture, and coloration. Very often plants and animals communicate using silent and invisible language – language of smell. This diversity of information exchange enables successful communication, which is one of the basic attributes of living things and is fundamental to their co-existence and survival.

Številne živali svoj teritorij označujejo in branijo z oglašanjem in značilno telesno držo: Kapski morski medved (*Arctocephalus pusillus*) in veliki strnad (*Emberiza calandra*).

Many animals mark and defend their territory with vocalization and characteristic body posture: Cape Fur Seal (*Arctocephalus pusillus*) and Corn Bunting, (*Emberiza calandra*).

Davorin Tome, Marko Kosi

Anton Brancelj

Pod mirno gladino gorskih jezer

Under the Peaceful Surface of Mountain Lakes

Sedeti ob gorskem jezeru in uživati v miru in ob sončnem zahodu, je cilj številnih obiskovalcev gora. Vendar se pod na videz mirno jezersko gladino dogaja marsikaj.

Le redki vedo, da so za kristalno čisto vodo gorskih jezer pomembne tudi ličinke žuželk in drobni rakci (zooplankton), ki se hranijo z algami. Ko je alg malo, je voda kristalno čista, ko pa se namnožijo, postane voda motna in celo smrdeča.

Visokogorska jezera v Sloveniji so bila v preteklosti brez rib. Človek jih je šele leta 1991 naselil tudi v Dvojno jezero. Ko so ribe tam pojedle rakce in ličinke, ki so se hranili z algami, sta se kakovost vode in videz jezera močno poslabšala. Vnos rib je v prvem trenutku sicer res povečal biodiverziteto, ki pa so jo ribe v naslednjih nekaj letih dobesedno "pojedle". Ribe so s prehranjevanjem z rakci in ličinkami sprožile proces, ki je močno poslabšal kakovost vode. Primer slovenskih visokogorskih jezer je lep dokaz, da povečana (umetna) biodiverziteta ne prispeva k izboljšanju stanja. Ravno nasprotno!

Many mountain visitors enjoy sitting along a mountain lake, appreciating the serenity and sunset. However, many things are going on under the seemingly peaceful surface of the lake.

Few people know that the crystal-clear water found in mountain lakes results from insect larvae and small crustaceans (zooplankton) feeding on algae. When there are fewer algae, the water is crystal-clear, but when algae blooms, the water becomes murky and smelly.

In the past, the high mountain lakes in Slovenia were fishless. People introduced fish to the Lake Dvojno Jezero in 1991. When these fish ate zooplankton and larvae that had been fed with algae, the water quality and appearance of the lake severely deteriorated. The introduction of fish initially increased biodiversity, but since then, the fish have literally eaten it. Fish have triggered a process that greatly exacerbated the water quality by eating zooplankton and larvae. The example of Slovenian high-mountain lakes is good evidence that increased (artificial and introduced) biodiversity does not contribute to improving the situation. Just the opposite!

Dvojno jezero v Dolini Triglavskih jezer – lep zračni posnetek zakriva nepopravljivo škodo pod njegovo gladino, narejeno v preteklosti.

Lake Dvojno jezero in the Valley of the Triglav lakes – pretty aerial photo obscures irreversible damage done below its surface in the past.

Domen Grauf & Matevž Lenarčič

Danilo Bevk

Tisoč in en opraševalec

Vsi vemo, da je opraševanje pomembno in da je "vsaka tretja žlica hrane odvisna od čebel". Pa je medonosna čebela edina opraševalka? Še zdaleč ne. Oprašujejo tudi divji opraševalci. V prvi vrsti so to divje čebele. V Sloveniji je bilo doslej najdenih 35 vrst čmrljev in prek 500 vrst drugih divjih čebel. Oprašujejo pa tudi druge žuželke, kot so muhe, metulji, nekateri hrošči in celo ose. Vseh opraševalcev pri nas je tako nekaj tisoč vrst.

Pa tako pestrost opraševalcev potrebujemo ali zadostuje že, če imamo in varujemo medonosno čebelo? Čebela je nedvomno pomembna opraševalka, vendar ne more oprašiti vseh tipov cvetov. Divji opraševalci so pogosto bolj učinkoviti, čmrlji pa so med drugim nepogrešljivi opraševalci v slabem vremenu. Divji opraševalci tako v kmetijstvu oprašijo vsaj polovico, v naravi pa še več. Zaradi vse večje nepredvidljivosti vremena bo pestrost divjih opraševalcev vse bolj pomembna. Pestrost opraševalcev je tako ključna za zanesljivo pridelavo hrane in ohranjanje biodiverzitete.

One Thousand and One Pollinators

We all know that pollination is essential and that "every third spoonful of food depends on the bees." But is a honeybee the only pollinator? Actually, no. There are many wild pollinators. First of all, there are wild bees. So far, thirty-five species of bumblebees and over five-hundred species of other wild bees have been found in Slovenia. Other insects also pollinate, such as flies, butterflies, some beetles, and even wasps. There are several thousand pollinators in Slovenia.

Do we need such a high diversity of pollinators, or is it enough if we only have and protect the honeybee? While the honeybee is undoubtedly an important pollinator, it cannot pollinate all types of flowers. Wild pollinators are often more efficient than honeybees, and bumblebees are indispensable pollinators in bad weather. Wild pollinators contribute to at least half of pollination in agriculture, and even more in wild plants. With climate change, the diversity of wild pollinators will become increasingly important. The diversity of pollinators is crucial for reliable food production and biodiversity conservation.

Vsak opraševalec je pomemben člen mozaika.

Each pollinator is an important element of the mosaic.

Danilo Bevk

Jernej Polajnar

Uglašenost v raznolikosti

Tuned in Diversity

Okolje ima bistven vpliv na vse vidike bivanja organizma. Pri sporazumevanju mora denimo žival proizvesti signal, ki se na daljavo prek okolja prenese do sprejemnika, pri tem pa mora biti sporočilo čim bolj energetsko učinkovito. Z evolucijo je narava našla pot, kako to storiti na način, ki kar najbolje izkorišča lastnosti okolja; pravimo, da so signali uglašeni z medijem. Seveda pa je na svetu ogromno različnih življenjskih okolij, ki jih sooblikujejo neživi dejavniki in organizmi sami, zato obstaja prav toliko različic sporazumevanja, kot je vrst živih bitij.

Pri žuželkah, ki se sporazumevajo z vibracijami, je uglašenost z medijem – trdno podlago – posebej očitna, saj ni enostavno zanihati rastlinske vejice, če si manjši od pol centimetra. Obstaja skupina vrst grbastih škržatkov, ki jih na videz ni mogoče razločiti, uporabljajo pa zelo različne vibracijske signale. Pri njih je namreč prišlo do več preskokov na nove gostiteljske rastline, čemur so sledile lastnosti signalov. Prek tega pojava lahko spremljamo nastanek novih vrst skoraj »v živo«.

The environment influences all aspects of an organism's life. For example, in order to communicate, an animal must produce a signal which transmits across some distance to the receiver. However, the message must be as energy-efficient as possible. With evolution, nature has discovered how to exploit environmental properties to the maximum extent; we say that signals are tuned to the medium. Nevertheless, there are numerous different environments co-shaped by non-living forces and organisms themselves, so there are as many variants of communication as species of organisms.

In insects that communicate with vibration, tuning to the medium – solid surface – is crucial, because it is not easy to shake a branch if you are less than half a centimeter long. There is a group of treehopper species that are indistinguishable by anatomy, but their vibrational signals are quite diverse. Several species switched hosts in recent evolutionary history, and signal properties followed. With this, we can monitor the emergence of new species almost in real time.

Škržatki, na sliki dvopikčasti škržatek (*Cicadella viridis*), se sporazumevajo izključno z vibracijami podlage, zato je uglašenost še posebej pomembna zanje.

Leafhoppers, Green Leafhopper (*Cicadella viridis*) on the photo, communicate using exclusively substrate vibrations, thus being in tune is especially important to them.

Jernej Polajnar

Klemen Čandek

Svilene pasti

Mreže pajkov so prave arhitekturne mojstrovine, ki so se milijone let spreminjale, izboljševale in postale pasti, iz katerih plen le stežka pobegne. Pestrost oblik in velikosti pasti lahko opazujemo že v naši neposredni bližini. Kolesasto mrežo na sosedovem grmovju vsak dan splete navadni križevec, pri vhodu v klet se razteza velika ploščata mreža lijakarja, na travniku pa se lesketa na desetine malih baldahinastih mrež, ki jih zgradijo le kakšen milimeter veliki pajki. Tudi v stanovanju pogosto naletimo na lepljive pasti. Kletni pajek postavi svojo na videz neurejeno, a zelo učinkovito mrežo v kotu sobe ali za zaveso, za radiatorjem pa male žuželke lovijo krogličarji. Če smo pozorni, v stanovanju včasih najdemo tudi pajka, ki mešanico lepila in svile celo pljune na plen! Na svetu poznamo že več kot 48.000 vrst pajkov in vsi proizvajajo svilo, zato upam, da teh nekaj primerov iz našega domačega okolja predrami zavedanje o neverjetni pestrosti ne samo organizmov, marveč tudi struktur, ki jih ustvarjajo.

Silken Traps

Spider webs are architectural masterpieces that have been changing and improving for millions of years to become traps, from which prey can hardly escape. We can observe the diversity of silken traps' shapes and sizes in our immediate vicinity. The European Garden Spider weaves its orb web daily on the neighbor's shrubs. A funnel weaver makes a large flat web at the entrance to the cellar, and dozens of small sheet webs, built by just a few millimeter-sized spiders, sparkle on a meadow. Even in apartments, we often come across sticky traps. The cellar spider places its seemingly messy but very efficient net in the corner of the room or behind the curtain, and the cobweb spider hunts small insects behind the radiator. If we pay attention, we might even spot a spider that spits a mixture of glue and silk to catch prey in the apartment! We currently know of over 48,000 species of spiders worldwide, and all of them produce silk. I hope that these few examples from our home environment raise awareness of the incredible diversity, not only of organisms but also of the structures they create.

Navadni križevec (*Araneus diadematus*) vsak dan splete kolesasto mrežo, ki je le ena od množice različnih svilenih pasti, ki jih postavljajo pajki.

The European Garden Spider (*Araneus diadematus*) weaves an orb web, which is just one of many different types of silken traps made by spiders every day.

Matjaž Gregorič

Meta Virant Doberlet

Žuželčji jezik

Tako kot se ljudje sporazumevamo v različnih jezikih, tudi vsaka žuželčja vrsta, ki se sporazumeva z zvokom, govori svoj jezik. Žuželčji jezik sicer ni tako bogat kot človeški, je pa ravno tako raznovrsten. Približno 200.000 vrst žuželk se sporazumeva z zvokom, ki se prenaša prek zraka ali podlage, in pripadniki vsake od teh vrst se morajo prepoznati med sabo. Tako kot mi, imajo tudi žuželke svoje besede, ki jih imenujemo napeve, sestavljene iz zlogov, ki jih imenujemo pulzi, kliki ali čiriki, medtem ko njihovim stavkom pravimo fraze. Nekatere vrste imajo tudi svojo slovnico, saj poslušalci stavka ne razumejo, če se napevi napačno zlagajo v fraze. Pri mnogih vrstah samci in samice, včasih tudi ličinke, uporabljajo različne besede, vendar se med seboj vseeno dobro razumejo. Žuželkam se njihovega jezika ni treba učiti, imajo ga zapisanega v genih. Pripadniki iste vrste, ki pa živijo na različnih koncih sveta, govorijo svoja značilna narečja in se včasih niti ne razumejo več med sabo.

Insect language

Like Humans of different nationalities use different languages, each insect species that communicates with sound uses its own language. Although insect language is not as complex as ours, it is equally diverse. More than 200,000 insect species rely on communication by air-borne or substrate-borne sound, and members of each species have to recognize each other. As in Humans, insect language is formed by words that we name songs, which are composed of syllables known as pulses, clicks or chirps, as well as sentences termed phrases. Some species even have their own grammar, since the receivers do not understand the message if songs appear in the phrase in the wrong order. In many species, males and females, as well as larvae, use different words; however, they still understand each other. Since species-specific language is written in their genes, insects do not have to learn it. Members of the same species living in different parts of the world use distinct dialects and sometimes do not understand each other.

Kobilice lahko že na daljavo prepoznamo po njihovih napevih - prešerna lepotka (*Poecilimon ornatus*)

We can identify bushcrickets from a distance by their songs - Ornate Bush Cricket (*Poecilimon ornatus*)

Jernej Polajnar

Al Vrezec

Mrtvo za živo

V šolskem učbeniku piše, da je razgradnja proces razkroja organske snovi in je ključna za kroženje snovi v naravi. Proces ne more potekati brez specializiranih razgrajevalcev. S sodobnimi higienskimi standardi pa ne gre skupaj dejstvo, da so tudi odmrli organizmi del narave, na katerih živi cela kopica drugih organizmov. Odmrlo drevo naselijo glive, žuželke in ptice, ki jim pravimo saproksili in veljajo za eno najbolj ogroženih skupin organizmov v Evropi, saj je odmrle lesne mase v izkoriščanih gozdovih premalo. Mrhovinarje pesti še več tegob. Ne samo, da so dandanes trupla večjih poginulih živali v naravi že prava redkost, še tisto, kar mrhovinarju uspe najti, je lahko zastrupljeno. Še najbolje gre razgrajevalcem iztrebkov. A tudi pri govnojedcih se je izkazalo, da je njihova pestrost odvisna od količine iztrebkov. In ne boste verjeli, tudi navadnega dreka je v okolju zaradi zdesetkanih populacij velikih rastlinojedov in drugačnih živinorejskih praks vse manj, zato nekatere specializirane govnače le še stežka najdemo.

Living off the Dead

In school textbooks, students learn that decomposition is the process of degradation of organic material and is crucial for natural cycles. The process cannot proceed without specialized decomposers. Dead organisms are a central part of natural systems, on which many other organisms live. Fungi, insects, and birds, called saproxyls, inhabit dead trees; these groups of organisms are considered some of the most endangered in Europe, since sufficient quantities of deadwood are missing in managed forests. Scavengers face even more problems. Large animal carcasses are difficult to find in the wild, and even those found can be poisoned due to drug treatments or illegal poisoned by people to exterminate carnivores. Even decomposers of faeces – coprophags – are facing many challenges. Coprophags' diversity depends on the amount of excrement found in the environment. Believe it or not, even common excrement is harder to find due to the decimated populations of large herbivores and changes in modern cattle rearing practices, so some specialized coprophagous beetles have become extremely rare.

Mrtva biodiverziteta poraja živo – bukova kreslika (*Fomes fomentarius*) na odmrlem lesu, mrhovinarski južni veleviharniki (*Macronectes giganteus*) ob poginulem morskem slonu, dva govnojedca sizifa (*Sisyphus schaefferi*) se prepirata za kroglico dreka.

Dead biodiversity for life – Tinder Fungus (*Fomes fomentarius*) lives on dead wood, Southern Giant Petrels (*Macronectes giganteus*) scavenge a dead Elephant Seal, two coprophagous Dung Beetles (*Sisyphus schaefferi*) fight for a piece of excrement.

Al Vrezec, Davorin Tome, Andrej Kapla

Rok Šturm

Usodna izbirčnost

Škržatki so skupina žuželk, ki se prehranjujejo z rastlinskimi sokovi. Iz rastlin jih sesajo s kljunci, ki jih zabodejo v rastlinska tkiva. Med njimi najdemo take, ki se lahko prehranjujejo s širokim naborom rastlin. Pravimo jim generalisti. Tistim pa, ki so prehransko vezani le na eno samo vrsto, pravimo specialisti. Razširjenost takšnih vrst je tesno povezana z razširjenostjo rastline, na kateri se hranijo. Izginjanje take rastline pomeni tudi izginjanje njenega škržatka, saj je z njo prehransko povezan. Prehranski specialist je tudi kranjski škržatek, v letu 2017 novo opisana vrsta škržatka. Gre za vrsto, ki do sedaj ni bila najdena še nikjer drugje kot na prehodu med Alpami in Dinarskim gorstvom. Vrsta je prehransko vezana na malocvetno sito, ki uspeva na vlažnih rastiščih. Zaradi uničevanja vlažnih okolij je malocvetna sita danes ogrožena. Z izginotjem rastline pa bo izginil tudi škržatek, ki smo ga šele začeli spoznavati.

Fateful Pickiness

Leafhoppers are a group of insects that feed on plant sap. They suck sap from plants with their proboscis by cutting into plant tissue. Among leafhoppers are generalists, that can feed on a wide variety of plants, and specialists, that are nutritionally linked to only one species. The prevalence of specialist species is closely related to the prevalence of their host plant. The disappearance of host plants means the disappearance of the leafhoppers that feed on the plant. One of the specialists is the Carniola Leafhopper, which was discovered as a new species in 2017. So far, this Leafhopper has only been found in Slovenia on the border between the Alpine and Dinaric regions. This leafhopper species is nutritionally linked to Fewflower Spikerush, which grows in wetlands. Due to the destruction of wetland environments, the Fewflower Spikerush is now endangered. With the disappearance of this plant, we will also lose the Leafhopper which we only recently had the opportunity to meet.

Kranjski škržatek (*Limotettix carniolicus*) je prehranski specialist, ki se hrani le na rastlini malocvetni siti (*Eleocharis quinqueflora*).

The Carniola Leafhopper (*Limotettix carniolicus*) is nutritionally linked only to Fewflower Spikerush (*Eleocharis quinqueflora*).

Gabriel Seljak

Tatjana Simčič

Biodiverziteta na zimskih počitnicah

Ko se spomladi in poleti sprehajamo po pisanih, cvetočih travnikih in ob tem poslušamo petje murnov, brenčanje čmrljev ter žvrgolenje ptic, zagotovo pomislimo na vso pestrost življenja, ki nas obdaja. S prihodom jeseni in zime pa nastopi čas krajših dni in nižjih temperatur in s tem prej živahni, pisani travniki spremenijo svojo podobo. Raznolikost življenja je na videz izginila in zdi se, da so na travniku ostale le najbolj prilagojene vrste rastlin in živali. Dejansko pa nas v tem času zapustijo le nekatere ptice, da si poiščejo ugodnejše okolje za prezimitev. Druge rastline in živali pa neugodne razmere preživijo v različnih bolj ali manj trpežnih oblikah, pogosto v tleh, kar jim omogoči takojšnjo ponovno rast in razvoj ob pojavu zanje ugodnih razmer za uspevanje. Raznolikost je torej predvsem posledica spreminjanja videza in dejavnosti osebkov posameznih vrst, ne pa toliko spremenjenega števila prisotnih vrst. Podoba narave se čez leto nenehno spreminja in travnik nam v vsakem letnem času pokaže drugačen obraz.

Biodiversity on Winter Holidays

As we stroll through the colourful, flowering meadows in the spring and summer, listening to the chirping of the crickets, the buzzing of the bumblebees, and the singing of birds, we certainly think of all the diversity of life that surrounds us. In autumn and winter, with shorter days and lower temperatures, the lively, colourful meadows change their appearance. The diversity of life has seemingly disappeared, and only the most adapted species of plants and animals seem to have remained in the meadow. However, only a few birds migrate to a more favourable wintering environment. Other plants and animals endure adverse conditions in a variety of more or less resistant forms, often in the soil, which enables them to re-grow and develop when favourable conditions to thrive occur. Diversity, therefore, is mainly due to changes in the appearance and activity of individual species, rather than a change in the number of species present. The image of nature is constantly changing throughout the year, and the meadow shows us a different face each season.

Travnik na Ljubljanskem barju nam pozimi kaže drugačno podobo kakor poleti, saj rastline in živali neugodne razmere preživijo v različnih neaktivnih oblikah, ki so našim očem skrite.

The meadow at the Ljubljansko barje shows us a different image in winter than during the summer, as animals endure adverse conditions in a variety of inactive forms that are hidden to our eyes.

Davorin Tome

Al Vrezec

Medvrstna razmerja krojijo pestrost naravnih združb

Odnosi ali razmerja med vrstami so osnovno gibalo v oblikovanju združb, njihove vrstne sestave in številčnosti vrst v njej. Različne vrste se med seboj lahko plenijo, zajedajo, tekmujejo ali si pomagajo, a učinki teh odnosov se lahko razpletajo med več vrstami in več prehranskimi ravnmi v splet posrednih odnosov. Pravzaprav gre za splet različnih neposrednih razmerij, v katerih dve vrsti, ki nista v neposrednem stiku, prek tretje posredniške vrste vplivata druga na drugo. Izkazalo se je, denimo, da rastline lucerne precej bolje uspevajo ob rastlinah regrata kot drugje. Regratove sosede namreč precej manj napadajo listne uši kot one druge. Vendar regrat listnih uši ne privlači in tudi ne odganja, še manj uničuje. Razlog je v tretji posredniški vrsti, polonici, ki jo privlačijo regratovi cvetovi, polni slastnega nektarja. Polonice pa so tudi plenilci listnih uši in tako pospravijo še listne uši iz regratu sosednjih rastlin. Regrat in listna uš sta v tem primeru prikrita tekmeca ob posredovanju plenilske polonice.

Interaction Webs and Biodiversity

Interactions between species – interspecific interactions – are a basic driver in the formation of assemblages, their species composition and abundance. Different species can prey on each other, parasitize, compete, or help each other. The effects of these interactions can be intertwined between multiple species and multiple trophic levels into a web of indirect interactions. It is, in fact, a web of different direct interactions in which two species that are not in direct contact, interact through the third mediating species. For example, it turns out that Alfalfa plants thrive growing near Dandelion plants. The Dandelion's neighbours are much less affected by aphids. However, the aphids are neither attractive nor repulsive to the Dandelion. The reason lies in the third mediating species, the ladybird, which is attracted by Dandelion flowers full of sweet nectar. Ladybirds predate on aphids, removing them from the adjacent plants. The Dandelion and aphids are apparent competitors through the mediating predatory ladybird.

V pestrem prepletu medvrstnih odnosov se rastlina obrani zajedavskih listnih uši s privabljanjem plenilske sedempikčaste polonice (*Coccinella septempunctata*).

In the diverse intertwining of interspecific interactions, the plant defends itself from parasitic aphids by attracting the predatory Seven-Spot Ladybird (*Coccinella septempunctata*).

Al Vrezec

Urška Ratajc

Hrošč pirotehnik

Biodiverziteta se lahko kaže tudi v pestrosti obrambe pred plenilci ali napadalci. Krešiči so hrošči, ki se navadno branijo z močnim ugrizom, smrdečimi izbljuvki ali curkom dražečih spojin, ki ga iz žlez v zadku usmerijo plenilcu v oči. Prasketači pa so šli pri odganjanju plenilcev še korak dlje. V nevarnosti namreč ne odreagirajo nič kaj skromno in zadržano, saj z lastnimi izločki povzročijo pravo malo eksplozijo! V zadku imajo dve kamrici, v katerih kopičijo izločke posebnih žlez. V eni hranijo kinone in vodikov peroksid, v drugi pa posebne encime (katalaze in peroksidaze). Ob vznemirjenju te snovi sočasno sprostijo, kar povzroči burno kemijsko reakcijo. Pri tem se prasketačem iz zadka pokadi bel oblaček, slišen je rahel pok, napadalec pa lahko izbrizgane pekoče spojine zavoha in začuti na koži. Prasketači zmorejo reakcijo ponoviti nekajkrat zapored, če je treba, in s tem običajno uspešno odvrnejo plenilce pred napadom.

Beetle Pyrotechnician

We can see biodiversity in the variety of ways organisms defend themselves against predators or attackers. Ground beetles usually defend themselves with their strong bite, regurgitation of foul-smelling liquid, or spraying defensive chemical compounds from their abdominal glands, which they aim at their attacker's eyes. However, the bombardier beetle took defence mechanisms to a whole new level. There is no modesty or shyness when in danger - they respond with an actual mini explosion! They keep compounds from special glands in two chambers inside their abdomen. They store quinones and hydrogen peroxide in one and special enzymes (catalases and peroxidases) in the other. When threatened, they release these compounds simultaneously and cause a strong chemical reaction. The explosion can be seen as a little white cloud, heard as a slight pop, and the attacker can smell and feel the irritating chemicals sprayed on the skin. If needed, the bombardier beetles can repeat the reaction over and over again and are usually successful at turning away the attackers.

Al Vrezec, Tomi Trilar

V slovenskih gozdovih je najpogostejša vrsta prasketačev pokač *(Aptinus bombarda)*, ki ga v gozdu, polnem plenilcev, varuje poseben žgoč in eksploziven mehanizem na koncu napihnjenega zadka.

In Slovenian forests the most common bombardier beetle is *Aptinus bombarda*, which protects itself againts predators with a hot and explosive mechanism at the end of the bloated abdomen.

Sredozemski čmrlj (*Bombus haematurus*), ena redkih vrst čmrljev, ki jim podnebne spremembe koristijo.

Bumblebee *Bombus haematurus* is one of the few species of bumblebees that benefit from climate change.

Danilo Bevk

Podnebni migranti so že tu

Podnebje je eden najpomembnejših dejavnikov, ki vpliva na razširjenost vrst, podnebne spremembe pa zato pomemben dejavnik ogrožanja. Spremembe so za večino vrst neugodne, za nekatere pa tudi priložnost. Poglejmo si to na primeru čmrljev. V Evropi bodo za večino vrst spremembe neugodne. Glede na podnebne modele lahko pričakujemo, da bo do leta 2100 skoraj polovica vrst čmrljev izgubila 50 % do 80 % sedanjega območja razširjenosti. Najbolj ogrožene so gorske vrste, ki se bodo morale umikati vedno višje in višje. Peščici vrst pa spremembe koristijo in že povečujejo svoje območje razširjenosti. Tak primer je sredozemski čmrlj, nekdaj značilna vrsta v jugovzhodni Evropi, Turčiji in Iranu, danes pa se hitro širi proti srednji Evropi. V Slovenijo je prispel že pred dobrim desetletjem, pričakovati pa je, da bo naselil tudi zahodno Evropo in celo Skandinavijo.

Climate Migrants Are Already Here

Climate is one of the most critical factors affecting the distribution of species. Thus, climate change is a serious threat. For most species, changes are unfavourable, but for some, they present opportunity. Let us look at the example of bumblebees. In Europe, climate change will be unfavourable for most species. According to climate model projections, by 2100, almost half of the bumblebee species will lose 50 % to 80 % of their current areal. The most endangered are the mountain species, which will have to retreat to higher and higher altitudes. However, a few species benefit from changes and are already increasing their range. One example is bumblebee *Bombus haematurus*, a species from South-eastern Europe, Turkey, and Iran, that is rapidly and successfully expanding towards Central Europe. It arrived in Slovenia more than a decade ago, and is expected to settle in Western Europe and eventually even Scandinavia.

Danilo Bevk

Maja Opalički Slabe

Izvirska voda

Vsi smo že kdaj odšli na izlet v naravo in odkrili izvir vode, iz katerega je bila voda še posebno dobra. Sama ji pravim čista, naravna, naravnost iz podzemlja in obožujem njen okus, ki ga načeloma ni, in prav zaradi tega mi je še bolj všeč. Pa se je kdo vprašal, v čem se voda iz enega izvira razlikuje od vode iz naslednjega? In ali je voda iz enega izvira poleti drugačna kot pozimi? Se je kdo vprašal, ali je v njej tudi kaj živega?

Vsem je dobro znano, da izvirska voda vsebuje različne minerale, ki jih pridobi med popotovanjem po podzemlju. Manj pa je znano, da v njej prebivajo združbe bakterij, katerih sestava se ne spreminja samo od izvira do izvira, marveč tudi od sezone do sezone. Torej vsak izvir ni zgodba zase samo za naš okus in naše oko, ima tudi povsem samosvojo sestavo mineralov in združbo bakterij, ki je prav tako pomemben delček naše izjemne biodiverzitete.

Spring Water

When we venture into the nature, many of us have discovered springs from which the water tasted especially good. I call it pure, natural, and straight from the underground. I love its taste, which, in principle, is not there, and which is why I like it even more. Have you ever wondered what makes water from one spring different than water from another? Is the water from one spring different in summer than in winter? Moreover, have you ever asked if there was anything alive in it?

It is well known that spring water contains various minerals, which are obtained from underground. However, it is less known that spring water is also home to bacterial communities, whose structures vary not only from spring to spring but also between seasons. Therefore, each spring offers not only a story in itself for our taste and sight, it also has an entirely distinct composition of minerals and bacterial communities, which is an integral part of our remarkable biodiversity.

Izvir potoka Šumnik na Krimu

Šumnik creek spring on Krim mountain.

Davorin Tome

V alpskih kraških izvirih pogosto najdemo postranice (*Gammarus* sp.), ki so še posebej številčne na mestih, kjer je veliko listnega opada, ki ga drobijo in se z njim hranijo.

In the Alpine karst springs, we often find scuds (*Gammarus* sp.), which are particularly numerous in places where there is a great amount of leaf litter, which they break into fragments and eat.

Nataša Mori

Biodiverziteta – odsev okolja

Območja, kjer podzemna voda priteka na površino - izviri rek in potokov - so pogosto prepoznana kot naravna vrednota, torej kot nekaj izjemnega, dragocenega. Lepota teh okolij prepriča skoraj vsakega. Manj vidna izjemnost pa je v pestrosti živalskega in rastlinskega sveta, ki naseljuje ta velikokrat miniaturna prebivališča. Natančen opazovalec bo ugotovil, da so izviri zelo raznoliki. Nekateri občasno presahnejo. V takšnih okoljih preživijo samo tiste živali ali rastline, ki zmorejo nekaj časa preživeti ali ohraniti potomce v okolju brez vode. V drugih voda bruha zelo močno in odnaša tiste, ki se ne znajo dovolj dobro pritrditi ali najti primernih zavetišč. V tretjih je voda izjemno mrzla in toploljubna bitja tu ne preživijo. Vrstna pestrost je tako zrcalo raznolikosti okolja, in poznavalec, ki razume ekološke zahteve posameznih vrst, dejavnike, ki omejujejo ali spodbujajo njihovo razširjanje, razmnoževanje in obstoj, lahko napove, katere vrste bo našel v določenem okolju.

Biodiversity - An Environmental Mirror

Springs of the rivers and streams, areas where groundwater comes to the surface, are often recognized as having high natural value. The beauty of these environments convinces almost everyone. The diversity of the animal and plant life that inhabits these miniature habitats, is less noticeable. A careful observer will find that the springs are very diverse. Some occasionally dry up; in such environments, only those animals or plants that can survive or maintain offspring in a water-free environment survive. In others, the water flows very fast and washes away those who are unable to attach themselves well enough or find suitable shelters. In the third, the water is frigid, and species that prefer warmer temperatures cannot survive. Thus, species diversity mirrors the features and diversity of the environment. An expert who understands the ecological requirements of each species, the factors that limit or encourage their distribution, reproduction, and existence, can predict which species are present in a particular environment.

Nataša Mori, Jernej Polajnar

Maja Opalički Slabe

Pod morsko gladino

In the Sea

Potapljanje je ena izmed izjemno sproščujočih aktivnosti, s katero v živo spoznaš podvodni svet, ki si ga prej opazoval le na televizijskem zaslonu ali na fotografijah naravoslovnih revij. Mnogi se v poletnem času radi potapljajo na dah in raziskujejo obalni del morja, le redki pa se odločijo za potapljanje z jeklenko. Potapljanje v Jadranskem morju je sicer zanimivo, vendar pa se potapljači še posebno razveselijo potopov v tropskih morjih. Tam jih poleg toplejše vode pozdravijo jate raznobarvnih rib, pisani koralni grebeni ter večje morske živali, kot so želve, morski psi, skati in kiti.

Ob tem navdušenju nad življenjem v tropskih morjih se sprašujem, ali s tem nevede delamo našemu domačemu morju krivico? Na prvi pogled res ni tako barvito in pestro, ampak morje je mnogo več kot le-to. Če dobro pogledaš, tudi v našem morju vidiš mnogo različnih in čudovitih vrst, ki so seveda drugačne kot v tropih, vendar prav ta drugačnost daje čar biodiverziteti tudi pod morsko gladino.

Scuba diving is a relaxing activity that allows people to experience the underwater world first hand, which you previously only saw on television or in photographs in nature magazines. Many people like to snorkel in the summer and explore the coastal part of the sea, but only a few choose to scuba dive. While diving in the Adriatic Sea is interesting, divers often prefer diving in tropical seas. In addition to warmer water, they are greeted by flocks of colourful fish, vivid coral reefs, and larger animals like turtles, sharks, stingrays and whales.

With this enthusiasm for life in the tropical seas, I wonder if we do our Slovenian sea injustice. At first glance, it is not as colourful and rich, but the sea is much more than that. If you take a close look, we also have many different and wonderful species in our sea, which are of course different from those in tropics. However, this very variety gives a magic to the biodiversity that exists below the sea level.

Borut Mavrič, Matej Slabe

Ne samo v tropskih morjih (zgoraj), tudi v Jadranu (spodaj) najdemo pisane organizme.

We can find colourful organisms in the Adriatic (below), not only in tropical seas (above).

Nataša Mori

Vročica sobotne noči in biodiverziteta

Kultni romantični film »Vročica sobotne noči«, z Johnom Travolto v glavni vlogi, je konec sedemdesetih prejšnjega stoletja povzročil pravo norijo in popularizacijo disko glasbe po vsem svetu. Niso pa »vroči« samo filmi in igralci. »Vroča« je lahko tudi biodiverziteta. Biologi so začeli v osemdesetih letih ugotavljati, da na našem planetu obstajajo območja z izjemnim številom rastlinskih in živalskih vrst. Leta 1988 je biolog Norman Myers uvedel koncept »vročih točk« biodiverzitete – na Zemlji je začrtal 10 območij tropskih gozdov, za katere je značilna visoka koncentracija endemnih vrst, tj. vrst z omejeno geografsko razširjenostjo, hkrati pa število teh vrst zaradi človekovega vpliva naglo upada. Na teh »vročih točkah«, ki so takrat obsegale le 3,5 % vseh gozdov na Zemlji, je uspevalo 13 % vseh znanih rastlinskih vrst. Vroče točke biodiverzitete pa najdemo tudi v Sloveniji, ki se uvršča v sam svetovni vrh po številu kraških jam z zelo visokim številom podzemnih vrst. Prav tako pa je v primerjavi z evropskimi državami zaradi visokega števila endemnih vrst vroča točka celotna Slovenija.

Saturday Night Fever and Biodiversity

In the late 1970s, the cult romantic film *Saturday Night Fever*, starring John Travolta, sparked a disco madness and popularity of disco music around the world. Movies and actors are not the only things that are "hot"; biodiversity can also be "hot". In the 1980s, biologists began to discover areas on our planet with an outstanding number of plant and animal species. In 1988, biologist Norman Myers introduced the concept of biodiversity "hot spots" on Earth; he exposed ten areas of tropical forests that were characterized by high concentrations of endemic species that were in rapid decline due to human impact. These "hot spots", which at that time comprised only 3.5 % of all forests on Earth, contained 13 % of all known plant species. Biodiversity hot spots are also found in Slovenia, which ranks among the world's top in terms of the number of karst caves with outstanding numbers of underground species. Also, Slovenia is a hot spot in comparison with other European countries due to the high number of endemic species in general.

Slovenske kraške jame so bogate z endemiti, kot sta drobnovratnik (*Leptodirus hochenwartii*), ki naseljuje le del Dinarskega krasa (zgoraj), in miniaturni rak dvoklopnik *Fabaeformiscandona aemonae*, doslej najden le v podzemnih vodah Slovenije (spodaj).

Slovenian karst caves are rich in endemic species, such as the Narrow-necked Blind Cave Beetle (*Leptodirus hochenwartii*), which inhabits only part of Dinaric Karst (above) and the small Crustacean *Fabaeformiscandona aemonae*, found only in Slovenian groundwaters (below).

Jernej Polajnar, Nataša Mori

Tatjana Simčič

Na bojni nogi z biodiverziteto

Fighting with Biodiversity

Težko je verjeti, toda biodiverziteta ni vedno zaželena in dobrodošla. S tem imamo seveda v mislih kmetijske površine, ki so posajene z monokulturami in je ohranjanje čistosti kulture eden glavnih ciljev obdelovalcev površin. Pri tem se zatekajo k različnim sredstvom, ki naj bi preprečila pojavljanje drugih vrst. Zaradi kemičnega zatiranja t.i. »plevelov« s herbicidi so številne vrste le-teh logično že ogrožene. Tak primer je vsem dobro znani poljski mak, ki je že skoraj povsem izginil z žitnih polj. Obsežne kmetijske površine s prevladujočo eno kulturo so zaradi nizke biotske pestrosti in porušenega naravnega ravnovesja zelo nestabilen in ranljiv sistem, ki je zato močneje dovzeten za različne škodljivce in bolezni. To pa ima v želji po čim večjem pridelku za posledico še dodatni vnos različnih fitofarmacevtskih sredstev v okolje. Gre torej za nazoren in zaskrbljujoč primer, kakšne so lahko posledice osiromašene biodiverzitete.

It is hard to believe, but biodiversity is not always desirable and welcome. This is the case in cultivated lands that are planted with monocultures, and where maintaining crop uniformity is one of the cultivators' primary goals. Thus, they use various means to prevent the appearance of other species. Due to chemical suppression – killing "weeds" with herbicides – many of "weeds" are endangered. One such example is the well-known Polish Poppy, which has almost completely disappeared from cereal fields. Extensive single-crop cultivated land is a highly unstable and vulnerable system due to its low biodiversity and disrupted natural balance, which is more susceptible to pests and diseases. In order to maximize yield, monocropping results in the introduction of various additional chemicals into the environment. This is an illustrative and concerning example of the consequences of depleted biodiversity.

Obsežno polje sončnic (*Helianthus annuus*) je zaradi nizke biotske pestrosti in porušenega naravnega ravnovesja nestabilen in ranljiv sistem, ki je močneje dovzeten za različne škodljivce in bolezni.

The extensive field of Sunflowers (*Helianthus annuus*) is unstable and vulnerable due to its low biodiversity and disrupted natural balance, making it more susceptible to pests and diseases.

Davorin Tome

Mojca Pibernik

Skriti svet naše kože

Koža je naša pregrada z zunanjim svetom in prva vrsta obrambe je ravno biodiverziteta na njeni površini v obliki pravega malega ekosistema, sestavljenega iz gliv, bakterij, virusov in celo pršic. Na kvadratnem centimetru kože prebiva kar 13 milijonov bakterijskih celic! Razmerje in pestrost organizmov, ki živijo na naši koži, sta ključna za njeno zdravje. Če se poruši in kdo prevlada, lahko pride do vnetja ali poslabša druga bolezenskega stanja, kot sta luskavica in ekcem. Ravnovesje lahko porušijo tudi patogeni organizmi, ki se naselijo na koži. Seveda pa na združbo vpliva tudi uporaba higienskih izdelkov, saj je naraven pH kože kisel, uporaba bazičnih mil pa razmere in združbo lahko zelo spremeni. Tudi prepogosta uporaba močnih mil lahko oslabi našo naravno »kožno floro« in olajša naselitev neželenih organizmov. Prav tako lahko ravnovesje poruši tudi nepravilna uporaba probiotičnih pripravkov za kožo. Biotska pestrost torej ni samo v gozdu, na travniku ali v morju, marveč jo nosimo tudi s seboj na koži in v prebavilih. Čeprav je očem nevidna, je zelo pomembna za naše zdravje.

The Hidden World of Our Skin

Our skin is the first line of defense against the outside world. It represents a small ecosystem of its own, composed of fungi, viruses, bacteria, and even mites. One square centimeter of our skin contains around 13 million bacteria cells and only the right synergy and species composition can keep our skin healthy. When one of these organisms that are usually in symbiosis prevails, we can develop rashes, thrushes, or in more severe cases, even psoriasis or eczema. Pathogens can also compromise this balance. Natural pH of skin is acidic, and the use of aggressive alkaline soaps can disrupt the microbial community and enable pathogens to grow. Improper use of probiotics on our skin can also lead to balance disruption. Biodiversity is not only found in forests, grasslands, and the sea, but also on our skin and in our intestines. Despite being invisible to us, our skin's biodiversity is crucial to our health.

Ženske imajo zaradi razlike v pH-ju kože na dlaneh bistveno večjo biodiverziteto mikroorganizmov v primerjavi z moškimi.

Because of the difference in pH of the palm of the hand, women have a significantly higher biodiversity of microorganisms on the skin compared to men.

Davorin Tome

Špela Ambrožič Ergaver

Za vsako bolezen raste rož'ca

A Plant for Each Disease

Rastline so svetovno dragocen vir novih zdravil. V Evropi je v rabi več kot 1300 zdravilnih rastlin, od katerih je 90 % nabranih v divjini. Do 80 % ljudi v državah v razvoju je popolnoma odvisnih od zeliščnih zdravil za svoje primarno zdravstveno varstvo. Več kot 25 % zdravil, ki jih predpisujejo v razvitih državah, izvira iz prostoživečih rastlinskih vrst. Z naraščajočim povpraševanjem pa uporaba zdravilnih rastlin po vsem svetu še narašča. Po poročilih Svetovne zdravstvene organizacije (WHO) se približno 80 % svetovnega prebivalstva še vedno zanaša na zdravljenje z rastlinami. Vsi statistični podatki kažejo, da so zdravilne rastline za ljudi zelo pomemben del biodiverzitete, ki pa, kakor vsi opažamo, izginja z veliko hitrostjo. Nekateri najpomembnejši vzroki za to so naraščanje prebivalstva, hitra industrializacija, krčenje gozdov, prekomerno izkoriščanje naravnih virov, onesnaževanje in globalne podnebne spremembe. Ocenjeno je, da je trenutna izguba rastlinskih vrst med 100- in 1000-krat višja od pričakovane stopnje naravnega izumiranja in da s tem Zemlja izgubi vsaj eno potencialno pomembno zdravilo vsake 2 leti.

Plants are a globally valuable source of new medicines. More than 1300 medicinal plants are used in Europe, 90 % of which are harvested in the wild. Up to 80 % of people in developing countries are completely dependent on herbal medicines for their primary healthcare. More than 25 % of the medicines prescribed in developed countries come from wild plant species. With increasing demand, the use of medicinal plants worldwide is increasing. According to World Health Organization (WHO) reports, about 80 % of the world's population relies on plant treatments. All the statistics show that medicinal plants are an essential part of biodiversity for Humans. Plant biodiversity is disappearing at high speed. Some of the main reasons are population growth, rapid industrialization, deforestation, overexploitation of natural resources, pollution, and global climate change. The current loss of plant species is estimated to be between 100 and 1000 times higher than the expected rate of natural extinction. Thus the Earth loses at least one potentially important cure every two years.

Žajbelj (*Salvia officinalis*) je sredozemska rastlina, ki se uporablja tudi kot naravno zdravilo.

Common Sage (*Salvia officinalis*) is Mediterranean plant that we use as a natural medicine.

Davorin Tome

S pomočjo oddajnikov nameščenih na hrbet spoznavamo skrivnosti iz življenja ptic: zgoraj repaljščica (*Saxicola rubetra*), spodaj vranjek (*Phalacrocorax aristotelis*).

With a help of a transmitters (mounted on the back) we are exploring the secrets of bird life: above the Whinchat (*Saxicola rubetra*), below the European Shag (*Phalacrocorax aristotelis*).

Davorin Tome

Tehnologija odkriva skrivnosti iz življenja ptic

Raziskovalci s pomočjo tehnologije odkrivamo skrivnosti narave, o katerih se nam v preteklosti ni niti sanjalo. V času Aristotela ljudje niso vedeli, kam se ptice selijo. Še v srednjem veku so znanstveniki le ugibali, kam izginejo ptice čez zimo, dokazov niso imeli. Prve verodostojne podatke smo dobili na prehodu v 20. stoletje, ko so raziskovalci začeli na ptičje noge natikati obročke, na katerih je pisalo, kje so jih ujeli. Kdorkoli je označeno ptico ujel ponovno, je lahko ugotovil, od kod je prišla. A za eno ponovno ujeto ptico jih je bilo treba obročkati več deset tisoč.

Danes ujete ptice opremimo z elektronskimi napravami, ki dnevno beležijo podatke o njihovem položaju in jih prek satelitov pošiljajo na računalnike raziskovalcev. S pritiskom na gumb izvemo, od kod gredo, kam so prišle, po katerih dolinah jih je vodila pot, koliko časa so počivale, so letele ponoči ali podnevi, kako visoko so letale, kako naporna je bila pot, kolikokrat so zamahnile s perutmi. Kot da bi odprl Wikipedijo, ki jo o sebi pišejo ptice same.

Davorin Tome, Mirko Kastelic

Technology Reveals Mysteries of Bird Life

With the help of technology, researchers are discovering mysteries of the natural world that we could only dream of in the past. At the time of Aristotle, people didn't know where birds migrate. Even in mediaeval times, scientists could only guess where birds went during the winter, but they had no proof. The first relevant data came at the beginning of the 20th century, with the start of bird ringing activities. Every ring fixed on the leg of the bird had information about the place where it was captured, so anyone re-capturing the same bird knew exactly where it originated. However, to find a ringed bird, you had to catch and ring tens of thousands.

Today we put small electronic devices on birds, which, on a daily basis, record data about their location and, via satellites, sends information back to researchers on their computers in their offices and labs. Information like where the bird is from, where it is going, which valleys were selected, the length of the resting period, whether the birds fly during the day or during the night, the altitude of their migration route, how exhausting the trip was, and how many wing beats it took them to reach their final destination is now available in real-time with the push of a button. It is almost like if you opened a Wikipedia where articles on birds were written by the birds themselves.

Rok Šturm

Nezaznavna raznolikost

Kadar stojimo sredi nepokošenega cvetočega julijskega travnika, lahko okoli sebe opazimo mnoge pojavne oblike raznolikosti. Z očmi zaznamo različne oblike in barve cvetov ali različne vzorce na krilih metuljev. Ušesa nam omogočajo razlikovati med napevi ptic in kobilic. S prsti se lahko sprehodimo med zelmi in razlikujemo dlakave liste medene trave od ostre konice ločkovih listov. Prepoznavanje raznolikosti nam omogočajo naša čutila, ki so se razvila prav za ta namen. Vendar imajo naša čutila omejitve, zaradi katerih nam je del sveta nezaznaven in prav tako njegova raznolikost. Tako nezaznaven in nepoznan je tudi svet vibracijskega sporazumevanja, ki poteka s prenosom valovanj prek trde podlage, kot so rastline ali prst. Če želimo takšno raznolikost zaznati sredi julijskega travnika, moramo s posebno tehnološko opremo prisluhniti dogajanju na rastlinah. Ko tresenje podlage pretvorimo v nam zaznavno obliko, zvok, odkrijemo novo raven travniške raznolikosti. Mnoge vrste žuželk uporabljajo vibracijske signale za iskanje ali branjenje partnerja ali za branjenje območja pred drugimi tekmeci. Ker vsaka vrsta uporablja svojstvene napeve za različne namene, je raznolikost vibracijskega sveta, čeprav za ljudi nezaznavna, neizmerna.

Imperceptible Diversity

When we stand in the middle of an unmown meadow in mid-July, we can see many manifestations of diversity around us. The eye can catch different shapes and colours of flowers or different patterns on butterflies wings. Our hearing allows us to distinguish between birds' and grasshoppers songs. Our fingers can slide among plants and feel the difference between soft leaves of tufted grass and spiky ends of rush leaves. Recognising this diversity is possible because of our sensory organs that have developed just for this reason– to notice diversity. However, our senses have limitations that make part of the world around us undetectable, and so too, its diversity. One aspect that is undetectable and unknown to human senses is vibrational communication, which is transmitted by waves through a solid surface such as plants or soil. If we want to detect this aspect of diversity, we need to use specialised technological equipment to hear what is going on in plants. When we transform substrate vibrations to detectable sound, we discover whole new aspects of meadow diversity. Many insect species use vibrational signals in interspecific communication for attracting mates or defending territory. Since every species use its own signal, the diversity of the vibrational world is immense, even though it is undetectable for Humans.

V senci travniškega velemesta poteka nam neslišna, a živahna razprava med žuželkami.

In the shade of the meadow metropolis, a silent but otherwise lively insect debate ensues.

Davorin Tome

Anka Kuhelj

Visoko barje

Eden izmed bolj nenavadnih ekosistemov v Sloveniji so visoka barja. Visoka barja nastanejo na plasteh odmrlih delno razpadlih rastlinskih delov šote. Podlaga iz šote je tako debela, da rastline, ki tam rastejo, nimajo stika s podtalnico, tako so edini vir vode zanje padavine. Poleg tega je podlaga zelo kisla in revna s hranili. Visoka barja so zelo dinamičen, redek in ranljiv življenjski prostor, ki zaradi šotnih mahov neprestano raste.

Večina živali se na visokem barju zadržuje le prehodno, razen nekaterih žuželk. Zato pa tu najdemo rastline, ki ne uspevajo nikjer drugje. Da lahko preživijo, so oborožene s posebnimi prilagoditvami. Nekatere so sposobne vodo zadrževati, druge preprečujejo njeno izhlapevanje. Nekatere pridejo do hranil tako, da so postale mesojede, druge živijo v sožitju z glivami. Najbolj posebna med njimi je rosika z listi s sijočimi lepljivimi kapljicami. Ko se žuželka nanje prilepi, se list upogne okoli nje in izloči encime, ki žuželko razgradijo, da lahko rastlina vsrka hranila.

Visoka barja pri nas najdemo v Julijskih Alpah, Karavankah, Kamniško-Savinjskih Alpah, na Pohorju, zelo majhne ostanke tudi na Ljubljanskem barju.

Raised Bog

One of the most unusual ecosystems in Slovenia is a raised bog. Raised bogs are formed on layers of dead matter, partially decayed plant parts, called peat. The layers are so thick that the plants that grow there have no contact with groundwater, hence precipitation is their only source of water. Also, the substrate is very acidic and poor in nutrients. Raised bogs are a dynamic, rare, and vulnerable habitat that is constantly growing due to peat mosses.

Raised bogs are only transiently visited by animals, except for some insects. However, we can find plants in raised bogs that do not grow anywhere else. In order to survive, those plants have particular adaptations. Some can hold water, others prevent its evaporation. Some obtain nutrients by becoming carnivorous, while others live in symbiosis with fungi. The most unique are sundews, with leaves that have glistening sticky droplets. When insects stick to them, the leaf bends around and the plant digest it.

In Slovenia, we have raised bogs in the Alps, Pohorje, and small areas on the Ljubljana Marshes.

Okroglolistna rosika (*Drosera rotundifolia*), mesojeda prebivalka visokega barja

Round-leaved Sundew (*Drosera rotundifolia*), a carnivorous inhabitant of the raised bogs.

Anka Kuhelj

Davorin Tome

Naravo moramo varovati z ambicioznimi cilji

Nature Conservation Goals Must Be Ambitious

Svetovna biodiverziteta se krči, za kar imamo veliko masla na glavi prav mi, ljudje. Zato skušamo stvari tudi popravljati. V kmetijski krajini, kjer so zaradi narave dogodkov naši vplivi med največjimi, se kot eden izmed naravovarstvenih ukrepov uveljavlja puščanje pasov neobdelane ali ekstenzivno obdelane zemlje. Raziskovalci ugotavljajo, da so učinki ukrepa pozitivni. Pa smo lahko z njimi tudi zadovoljni? Odvisno, koga vprašamo. Pozitiven učinek je, da je biodiverziteta dobila zatočišče, ki ga prej ni imela. Po drugi strani pa ti pasovi pokrivajo le nekaj odstotkov kmetijske površine. V najboljšem primeru lahko z njimi rešimo le nekaj odstotkov ogroženega življenja. Zame je to čisto premalo, komu drugemu pa verjetno povsem dovolj.

Znano je, da si ljudje običajno želijo naravo povrniti v stanje, kot se ga spomnijo iz mladosti. Ker pa se razmere slabšajo iz leta v leto že več kot 100 let, postajajo naravovarstveni cilji iz generacije v generacijo manj ambiciozni, kar je slabo.

World biodiversity is shrinking, and Humans are to blame. That is why, from time to time, we try to fix what we did wrong. In farmland, where our influences are among the greatest, one important conservation measure is a set-aside. A set-aside is when part of the land is intentionally left uncultivated for the benefit of biodiversity. Researchers have found this measure successful, but can we be really satisfied with it? Well, that depends on whom we ask. It is good that on a set-aside, flora and fauna find a refuge that did not exist before. However, set-asides usually represent only a small percentage of the farmland. So, in a best-case scenario, we can save only a small percentage of the endangered populations. For me, categorically, this is not enough; to someone else, perhaps it is more than enough.

It is well known that people want to restore the types of nature they remember from their youth. But since conditions in nature have already been deteriorating for 100 years, from generation to generation, conservation goals are becoming less and less ambitious, what is bad.

Močvirska sklednica (*Emys orbicularis*) je pri nas ogrožena vrsta. Uradno želimo obnoviti velikost njene populacije iz leta 2004, čeprav vemo, da so bile že takrat precej zdesetkane. Je to dovolj ambiciozno?

In Slovenia, the European Pond Turtle (*Emys orbicularis*) is an endangered species. Officialy, our plan is to restore its population size to that of 2004, although we know that even back then the population was already seriously depleted. Ambitious enough?

Davorin Tome

Obsežna prodišča Soče ponujajo poleg ekosistemskih storitev za ljudi tudi zavetišče za malega deževnika (*Charadrius dubius*), ki gnezdi izključno na golem, neporaščenem produ.

The extensive gravel floodplains of the Soča River offer, in addition to the ecosystem services for Humans, a shelter for the Little Ringed Plover (*Charadrius dubius*), which breeds exclusively on bare gravel bars.

Nataša Mori

Kakšna je monetarna vrednost biodiverzitete?

The Monetary Value of Biodiversity

Živimo v družbi, kjer vrednost izdelkov ali storitev ocenjujemo z denarjem. Logična posledica je, da se denar uporablja tudi za vrednotenje naravnih surovin, na katerih temelji svetovno gospodarstvo. V zadnjem času se pojavljajo pristopi, ki poskušajo monetarno ovrednotiti tudi druge ugodnosti, ki nam jih ponuja narava. Tovrstnih »ekosistemskih storitev« ni možno v celoti podvreči vrednotenju na podlagi obstoječih pravil trga, saj vključujejo poleg oskrbovalnih storitev (hrana, voda, les, vlakna, minerali) tudi uravnalne storitve (uravnavanje podnebja in širjenja bolezni, čiščenje vode in zraka), kulturne storitve (rekreacija, estetska doživetja) in podporne storitve (opraševanje, nastajanje prsti, kroženje hranil). Pristop je zanimiv, postavlja pa se vprašanje, ali je primeren tudi za ocenjevanje vrednosti biodiverzitete. Ali ima človek, kot ena biološka vrsta, res tako privilegirano vlogo, da lahko določa vrednost drugih vrst, kot je na primer afriški lev ali človeška ribica? Oziroma, da odloči, katera vrsta je dovolj »vredna« za ohranitev, katero pa prepustiti izumrtju?

We live in a society where the value of products or services is set by money. The logical consequence is that money is also used to value the natural resources that underpin the global economy. Recently, some approaches try to evaluate other benefits that nature offers us monetarily. Such "ecosystem services" cannot be fully subjected to valuation based on existing market rules, as they include, in addition to supply services (food, water, wood, fibres, minerals), regulatory services (climate and disease spread control, water and air purification), cultural services (recreation, aesthetic experiences), and support services (pollination, soil formation, nutrient cycling). The approach is interesting, but the question arises whether it is suitable for assessing the value of biodiversity. Does Man, as one biological species, really play such a privileged role that he can determine the value of other species, such as the African Lion or the Human Fish? Or even decide which species is "worthy enough" to preserve and which to leave to extinction?

Nataša Mori, Davorin Tome

Rok Janža

Kriza

Ohranjanje pestrosti živega sveta je za človekov blagor ključnega pomena, čeprav se tega pogosto niti ne zavedamo. Če za trenutek pozabimo, da je ohranjanje narave vrednota sama po sebi in se osredotočimo zgolj na gospodarske vidike, hitro ugotovimo, da smo popolnoma odvisni od delovanja ekosistemov in njihove ohranjenosti. Ekosistemi imajo poglavitno vlogo pri stabilizaciji podnebja, kroženju snovi, čiščenju zraka, vzdrževanju rodovitnosti prsti in zagotavljanju pitne vode. Vsi ti procesi so intimno povezani z dinamičnim naravnim ravnovesjem, ki se s prekomernim človekovim poseganjem v naravo poruši. Ekosistem na ta račun postane osiromašen in težko opravlja zgoraj naštete funkcije, v najslabšem primeru celo propade. Znanstveniki ocenjujejo, da je stopnja izumiranja vrst trenutno do tisočkrat višja kot kadarkoli v zgodovini človeštva. Govorimo o ti. krizi biodiverzitete, katere negativne posledice v ekosistemih bodo imele za ljudi primerljive posledice kot tiste zaradi globalnih podnebnih sprememb, ali jih bodo celo presegle.

Crisis

Maintaining the diversity of the natural world is crucial to the well-being of Humans. Even if we forget for a moment that nature is valuable in itself, and focus solely on the economic aspects, we quickly realize that we are completely dependent on functioning ecosystems and their conservation. Ecosystems play a major role in climate stabilization, circulating matter, air purification, maintaining soil fertility, and providing drinking water. All these processes are intimately linked to the dynamic natural balance, which collapses when Humans interfere excessively with nature. The ecosystem becomes depleted and has trouble performing the functions listed above. At worst, it can even fail. Scientists estimate that the extinction rate of species is currently up to one-thousand times higher than at any time in human history. We are talking about a biodiversity crisis, the negative consequences of which in ecosystems will be similar to, or will even surpass, the consequences of global climate change.

Kriza biodiverzitete je v naših rokah.

The biodiversity crisis is on our hands.

Davorin Tome

Blaž Koderman

Je gozd in je pragozd

Slovenija je med najbolj gozdnatimi deželami v Evropi, gozdovi pokrivajo 58 % celotne površine, delež pa še narašča. Večino gozdov bolj ali manj intenzivno upravljamo, približno 4 % je pragozdov. Ti so prepuščeni delovanju narave. A njihov pomen je veliko večji, kot bi lahko sklepali samo po površini.

Stara, visoka drevesa nam zbujajo občutek veličine in spoštovanja. Veliko je že odmrlih, kar je ena izmed značilnosti pragozdov. Del med njimi jih še kljubuje sili gravitacije, del se jih je že vdal usodi in ležijo na tleh. Telo podrtega velikana je hrana in zatočišče glivam, mikroorganizmom, hroščem in drugim živalim, svetlo okno v krošnji, ki ga za sabo pusti, ko pade, omogoča rast novim rastlinam. Procesi odmiranja in rasti se v prastarih sestojih izmenjujejo mozaično in dinamično. To ustvarja pestre življenjske razmere za organizme, biodiverziteta pragozdov je zato zelo velika.

There Is Forest and There Is Primeval Forest

Slovenia is one of the most forested countries in Europe, with approximately 58 % of its land covered in forests, and this percentage is still rising. Humans intensely manage most of them, while around 4 % are protected primeval forests. These primeval forests are left to natural processes. However, their importance is much greater than what we can conclude from their size alone.

The sight of old, tall trees fills us with a feeling of greatness and respect. Many dead trees defy gravity and still stand above those that have already succumbed to its force, an occurrence common in primeval forests. Dead wood provided by the fallen giants serves as food and shelter for many fungi, microorganisms, beetles and other animals, while the window of light they leave behind supports the growth of new plants. Dynamic processes are a continuously interchanging mosaic throughout the elder woods, which makes their biodiversity flourish.

Pragozdni rezervat Krakovskega gozda

Primeval forest reserve in Krakovski gozd.

Davorin Tome

Juan José López Diez

Škodljivec ali nova priložnost?

Danes so stvari na svetu med sabo tesno povezane. Hrana narodov iz različnih območij Zemlje je tako dostopna pred domačim pragom. Včasih je tako eksotična, da se je ne upamo niti poskusiti. Palmov rilčkar je že ena izmed takšnih eksotičnih »delikates«. Hrošč prihaja iz tropskih območij Azije, v Evropo je prišel s transportom palm, ki so v Sredozemlju precej iskane rastline. Ker v novem domovanju nima plenilcev ali tekmecev, se brez težav razmnožuje in hitro širi svoj areal. Odrasli hrošči se naselijo na različne vrste palm in v njih odlagajo jajčeca. Ko se iz njih izvalijo ličinke, se pregrizejo v notranjost stebla in ga obžirajo, dokler se palma ne posuši. Zunaj Evrope ljudje ličinke nabirajo za prehrano, saj imajo veliko beljakovin in tudi dober okus, ponekod jih tudi gojijo. V toplejših predelih Evrope imamo zdaj ogromno palmovih hroščev, in ker nam delajo škodo, se jih želimo znebiti. Morda pa je to primeren trenutek, da okusimo nov tip hrane?

A Pest or a New Opportunity?

Our world is deeply connected. Food from almost any culture can be found around the corner from your house. Sometimes food is so exotic that we do not dare to try it. The Red Palm Weevil, is one of these exotic "delicacies." Originally from tropical Asia, this beetle came to Europe hidden in a shipment of palm trees. Palms are in demand across the whole Mediterranean basin, and the beetle found a perfect opportunity to reproduce and expand since this habitat does not have any natural competitors or enemies. Adult Weevils fly to different palms and lay eggs in them. After hatching, larvae migrate to the core of the palm, and they start eating it from the inside, causing its death. However, in other parts of the world the larvae of these beetles are not a pest, rather a delicacy. They are cooked for their high protein, nutrient value and flavor. There are even farms for them! We have tons of Red Palm Weevil in Europe at the moment, and we want to get rid of them. Maybe it's time to taste something new?

Palmov rilčkar *(Rhynchophorus ferrugineus)* – v Evropi invazivni tujerodni prišlek, v Aziji delikatesa

While the Red Palm Weevil (*Rhynchophorus ferrugineus*) is an invasive alien species in Europe, it is a delicacy in Asia.

Al Vrezec

Ljubljanske zelene strehe privabljajo, poleg medonosne čebele, tudi divje opraševalce, kot so čebele samotarke, čmrlji, muhe trepetavke in metulji.

In addition to honeybees, Ljubljana's green roofs attract wild pollinators such as solitary bees, bumblebees, hoverflies and butterflies.

Danilo Bevk

Mojca Pibernik

Zelene strehe – džungla nad mestom

V mestih smo ljudje zavzeli prostor, ki je pripadal naravi. Nekatere rastline in živali pa so tudi v mestih našle svoj življenjski prostor. Tako lahko opazimo ptice, ki gnezdijo na stolpnicah, čmrlje, ki se pasejo na cvetočih vrtovih, podgane, ki švigajo čez cesto, in komarje, ki se uspešno razmnožujejo že v koritih z rožami. Slednjih seveda nismo veseli, a v splošnem si narave v mestu želimo še več, celo na strehah. Strehe so sicer zelo negostoljuben prostor, z močnim sončnim obsevanjem, velikimi temperaturnimi nihanji, voda pa hitro odteče ali izhlapi. Toda če jih pokrijemo s posebnim substratom in nasadimo z rastlinami, ki so prilagojene tako ekstremnim rastiščem, lahko postanejo zelene oaze nad mestom. Če jih pogledamo od blizu, lahko opazimo, da jih naseliljo številne živali, predvsem žuželke. Ko zacvetijo, pa zelene strehe še posebej zaživijo, saj privabijo množice opraševalcev, lahko tudi 10 na kvadratni meter in tako delujejo kot nadomesten habitat nekaterim organizmom.

Green Roofs – A Jungle Above the City

Cities are areas where Humans have occupied space that once belonged to nature. However, some organisms have found refuge in cities. We can observe birds nesting on top of buildings, bumblebees feeding on flowers, rats scurrying across streets, and even mosquitoes breeding in flowerpots. While we are not happy about the latter, we would like more nature in cities, even on rooftops. Most rooftops are inhospitable because of extreme solar radiation and a lack of water. However, when covered with a special substrate and inhabited by resilient plants, roofs can become green oases over the city. If we take a closer look at green roofs, we can notice many animals, especially insects. When in bloom, green roofs come to life because they attract many pollinators, in some cases even up to ten per square meter and can act as a substitute habitat for some organisms.

Oddelek za raziskave organizmov in ekosistemov (EKOS)

Department of Organisms and Ecosystems Research (EKOS)

Biotska raznovrstnost (biodiverziteta) je skupni imenovalec raziskav, ki jih opravljamo na Oddelku za raziskave organizmov in ekosistemov (EKOS) na Nacionalnem inštitutu za biologijo (NIB). Ekosistemi so naravni evolucijski laboratoriji v katerih biodiverziteta ni le seznam z imeni vrst, temveč tudi vsa izjemna morfološka, ekološka, fiziološka, vedenjska in genetska raznolikost, skrita v osebkih teh vrst. S pričujočo knjigo želimo na poljuden način deliti znanje, ki smo ga pridobili pri svojem vsakodnevnem raziskovalnem delu, kjer se posvečamo biološkim procesom od nivoja celice do ekosistemov. Odkrivamo ključne evolucijske in ekološke mehanizme, ki oblikujejo vzorce biodiverzitete v ekosistemih, ter zagotavljamo znanstveno osnovo, ki je potrebna za razvoj učinkovitih varstvenih ukrepov za ohranjanje biotske raznovrstnosti in zagotavlja trajnostno rabo obnovljivih naravnih virov. Pri našem delu nas vodijo radovednost, veselje za odkrivanje vsega novega, zavedanje, da so neokrnjeni ekosistemi naše bogastvo, ter želja, da bi s svojim delom prispevali k prizadevanju za ustavitev globalnega izgubljanja biotske raznovrstnosti in omogočili, da bi Slovenija postala vzor ohranjanja biodiverzitete tudi drugim.

dr. Meta Virant Doberlet
vodja skupine

The most common theme of research carried out at the Department of Organisms and Ecosystems Research (EKOS) at the National Institute of Biology (NIB) is biological diversity (biodiversity). Ecosystems are natural evolutionary laboratories, and biodiversity includes not only a list of species but also the vast amount of variation (morphological, ecological, physiological, behavioural and molecular) represented by the individuals of these species. In this book, we aim to share the knowledge we have obtained through everyday scientific work, where we study biological processes from individual cells to ecosystems, in a more informal way. In our research, we investigate the key evolutionary and ecological mechanisms that underlie biodiversity patterns in target ecosystems. This research provides solid scientific foundations for developing efficient conservation measures to help halt the loss of biodiversity and ensure sustainable use of renewable natural resources. Our work is motivated by curiosity, delight in new discoveries, and the belief that pristine ecosystems are vital to a healthy planet. We aim to help avert global biodiversity loss and provide the opportunity for Slovenia to serve as a role model for biodiversity conservation elsewhere.

Dr. Meta Virant Doberlet
Head of Department

Polž jantarica (*Succinea putris*) na kukavičji lučci (*Lychnis flos-cuculi*)

Amber Snail (*Succinea putris*) on Ragged Robin (*Lychnis Flos-cuculi*).

Davorin Tome

Člani oddelka EKOS

Department EKOS members

Špela Ambrožič Ergaver (31, 112)

Ivan Ergaver

Vključena sem v raziskave na področju ekologije hroščev. Moje zanimanje je usmerjeno predvsem v preučevanje ekologije vodnih hroščev.

I'm involved in research in the field of beetle ecology. My main interest is in the study of water beetles.

Dr. Danilo Bevk (80, 99)

Tanja Dreo

Brez pestrosti opraševalcev ni prehranske varnosti. Zato raziskujem pomen, ogroženost in varovanje opraševalcev ter uporabo divjih opraševalcev v kmetijstvu.

No diversity of pollinators, no food security. Therefore, I explore the importance, decline, and protection of pollinators and the use of wild pollinators in agriculture.

Dr. Matjaž Bedjanič (52)

Matjaž Bedjanič

Ukvarjam se s favnistiko in ekologijo kačjih pastirjev, kobilic in potočnih rakov v Sloveniji in na Balkanu, ter s taksonomijo, zoogeografijo in ohranjanjem favne kačjih pastirjev jugovzhodne Azije. Trenutno koordiniram večletni naravovarstveni projekt LIFE.

I study the faunistics and ecology of dragonflies, grasshoppers, and crayfish in Slovenia and the Balkans, as well as taxonomy, zoogeography, and conservation of dragonfly fauna in Southeast Asia. Currently, I am coordinating a multi-year nature conservation LIFE project.

Dr. Andrej Blejec (18)

Kathy Cowell

Sem matematik in statistik, predan analizi podatkov v biologiji.

I am a mathematician and statistician, committed to analysis of biological data.

Veverica (*Sciurus vulgaris*)

Red Squirrel (*Sciurus vulgaris*).

Davorin Tome

Dr. Anton Brancelj (60, 79)

Jernej Polajnar

Sem svetovno priznan specialist za skupini Copepoda in Cladocera, avtor ali soavtor opisov 50 novih vrst širom sveta, citiran 1100 krat v znanstvenih člankih.

I am internationally recognized specialist for groups Copepoda and Cladcera, author or co-author of descriptions of 50 new species world-wide, cited 1100 times in scientific papers.

Andreja Jerebic

Davorin Tome

Vodim finančno administracijo in sistem kakovosti, koordiniram poslovne aktivnosti za uspešno in učinkovito delovanje skupine. Svetujem tudi pri delu v kemijskem analiznem laboratoriju.

I manage the financial administration and quality management system and coordinate businiess activities for the successful and efficient operation of the group. I also have an advisory role in a chemical analysis lab.

Dr. Klemen Čandek (27, 85)

Eva Turk

Gojim strast do pajkov, tako domačih kot bolj eksotičnih, primarno pa z molekularnimi pristopi raziskujem njihovo biogeografijo in evolucijo.

I have an affection for spiders, native as well as exotic, and I primarily use molecular approaches to investigate spiders' biogeography and evolution.

Andrej Kapla (56)

Marko Sotlar

Ukvarjam se s taksonomijo in ekologijo hroščev ter rakov na območju Slovenije in v bližnji okolici. Posebno pozornost posvečam nadzemnim in podzemnim vrstam iz družine krešičev.

I study the taxonomy and ecology of beetles and crustaceans in Slovenia and the surrounding area. I pay particular attention to the above ground and underground species from the Carabidae family.

Rok Janža (32, 44, 124)

Andreja Ošlaj

Raziskujem senzorične sisteme žuželk, predvsem vibracijsko komunikacijo stenic in škržatkov na vedenjskem in nevrobiološkem nivoju.

I explore Insect sensory systems, with special emphasis on the behavioural and neurobiological aspects of vibrational communication of stinkbugs and leafhoppers.

Stiven Kocjančič (67)

Aljaž Kukanja

Ukvarjam se z ekologijo in razširjenostjo ptic in hroščev v Sloveniji ter bioakustiko, etologijo, populacijsko ekologijo in migracijami ujed v Evraziji in južni Afriki.

I work on the ecology and distribution of birds and beetles in Slovenia. I also study bioacoustics, ethology, population ecology, and migrations of raptors in Eurasia and southern Africa.

Blaž Koderman (127)

Mojca Pibernik

Delam v skupini, ki se ukvarja z divjimi opraševalci, pomagam pri projektih, namenjenih raziskovanju in izboljšanju stanja divjih opraševalcev, in pri popisih njihovih združb.

I am part of a group studying wild pollinators. I help with projects that research pollinator communities as well as improving environmental conditions for them.

Dr. Anka Kuhelj (59, 119)

Anka Kuhelj

Ukvarjam se z vedenjskimi, fiziološkimi in morfološkimi vprašanji v okviru raziskav vibracijske komunikacije škržatkov.

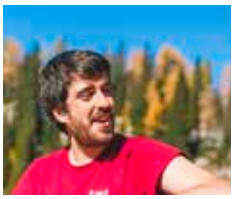
I work on behavioral, physiological and morphological aspects of vibrational communication of leafhoppers.

Dr. Matjaž Kuntner (13)

Maj Kuntner

Sem evolucijski biolog in raziskovalec biodiverzitete na Nacionalnem inštitutu za biologijo, trenutno tudi njegov direktor.

I am an evolutionary biologist and biodiversity scientist at the National Institute of Biology and currently act as its director.



Juan José López Díez (129)

Ema Demšar

Preučujem vibracijsko komunikacijo žuželk in raziskujem vibracijska okolja Slovenije, s čimer poskušam malo bolje razumeti ta starodavni, a pretežno neznani način komunikacije.

I study vibrational communication in insects and explore the different vibroscapes of Slovenia trying to understand a bit more about this ancient, but mostly unknown, way of communicating.

Tjaša Matjašič (71)

Maša Cvetko

V okviru doktorske naloge se ukvarjam s strukturo in funkcijo mikrobnih združb, ki so del biofilma v sedimentih rečnih sistemov.

Working on my doctoral thesis, I investigate the structure and function of microbial communities that are a part of biofilm in river sediments.

Dr. Nataša Mori (103, 107, 123)

Emily Quinn

Ukvarjam se z ekologijo podzemnih in površinskih celinskih voda s poudarkom na preučevanju človekovih vplivov, ter s taksonomijo, zoogeografijo in ekologijo rakov dvoklopnikov.

I am a freshwater ecologist, focusing on the study of human impacts on surface and ground waters, and I work on the taxonomy, zoogeography and ecology of ostracods.

Dr. Maja Opalički Slabe (100, 104)

Matej Slabe

Vodim projekt Life Naturaviva in raziskujem biodiverziteto bakterijskih združb ter vodnih nevretenčarjev v kraških izvirih po Sloveniji.

I am a leader of the Life Naturaviva project, and I research the biodiversity of bacterial communities and aquatic invertebrates in karst springs across Slovenia.

Urška Ratajc (51, 96)

Andrej Kapla

Zanimajo me medvrstni odnosi v gozdnem ekosistemu, zlasti povezave med hrošči, malimi sesalci in pticami.

I am interested in inter-specific interactions in forest ecosystems, particularly in interactions between beetles, small mammals, and birds.

Mojca Pibernik (28, 111, 131)

Blaž Koderman

Raziskujem dejavnost opraševalcev v sadovnjakih in na zelenih strehah, prenašam znanje v prakso in tako prispevam k varovanju življenjskega prostora opraševalcev.

I research pollinator activity in orchards and on green roofs, transferring the knowledge into practice and thus contributing to the protection of pollinators' habitat.

Dr. Tatjana Simčič (48, 72, 92, 108)

Davorin Tome

Raziskujem ekofiziološke odzive vodnih in kopenskih organizmov na spremembe v okolju, ki so posledica aktivnosti človeka, z namenom ocene pričakovanih sprememb v strukturi in delovanju ekosistemov.

I research the ecophysiological responses of aquatic and terrestrial organisms to environmental changes that result from human activities, with the aim of assessing the expected changes in the structure and functioning of ecosystems.

Dr. Jernej Polajnar (14, 63, 83)

Jelena Cvetković

Sem biolog, znanstveno se ukvarjam z biotremologijo in vedenjem žuželk.

I'm a biologist with a research focus on biotremology and insect behaviour.

Dr. Nataša Stritih Peljhan (39, 43)

Jernej Polajnar

Delujem na področjih etologije in nevrobiologije, pri čemer se osredotočam na delovanje in evolucijski razvoj čutilnih sistemov ter sporazumevanje pri žuželkah.

I work in the fields of ethology and neurobiology, with a focus on the functional and evolutionary aspects of insect sensory systems and communication.

Rok Šturm (51, 91, 116)

Rok Šturm

Raziskovalno sem razpet med opraševalci, škržatki in rastlinami, vedno znova navdušen nad naravo in njenimi pojavnimi oblikami. Če ne gre drugače, stvari pogledam ali jim prisluhnem čisto od blizu.

My research is split between pollinators, leafhoppers, and plants. I'm fascinated by nature and its manifestations. If there is no other way, I observe and listen from a very close range.

Dr. Al Vrezec (16, 24, 54, 68, 74, 88, 95)

Špela Ambrožič Ergaver

Sem neutruden raziskovalec biotske pestrosti v njenih mnogih pojavnih oblikah, od majhnih žuželk, vodnih rakov do velikih sov, znanje o biodiverziteti prenašam na splošno javnost in študentom na univerzi.

I am an enthusiastic researcher of different biodiversity aspects and forms, from small insects and crayfish to large owls, and I work to transfer the biodiversity knowledge to the general public and university students.

Dr. Davorin Tome (9, 22, 115, 120)

Davorin Tome

Sem ekolog, večinoma raziskujem ptice, znanstvena odkritja predstavljam strokovni in laični javnosti.

I am an ecologist, working mostly with birds. I present scientific discoveries to professionals and the general public.

Dr. Anamarija Žagar (21, 36, 40, 47)

Miha Krofel

Ukvarjam se predvsem s favnistiko in ekologijo plazilcev v Sloveniji, raziskujem fiziologijo in vedenje kuščaric iz Evrope in Afrike ter njihovo prilagodljivost na podnebne spremembe.

I work with faunistics and ecology of reptiles in Slovenia. My research focus is on physiology and behaviour of lizards and their response potential to climate change in Europe and Africa.

Dr. Meta Virant Doberlet (64, 87, 133)

Igor Modic

Uresničila se mi je otroška želja, da bi se pogovarjala z živalmi, saj kot žuželčji jezikoslovec preučujem sporazumevanje žuželk z vibracijskimi signali.

I have fulfilled my childhood wish of talking with animals, since as a bug linguist, I study insect vibrational communication.

Dr. Alenka Žunič Kosi (35, 76)

Joshua Rodstein

Ukvarjam se z vibracijsko komunikacijo in kemično ekologijo žuželk. Raziskujem možnosti uporabe feromonov in drugih vonjav za monitoring in ohranjanje populacij ogroženih vrst ter nadzor škodljivih vrst.

I study vibrational communication and chemical ecology in insects. I explore the possibilities of using pheromones and other chemicals in insect monitoring, in conservation of endangered insects and for controling pest species.

Viri

Sources

Virov o biodiverziteti, iz katerih smo črpali znanje za Obraze, je toliko, da je nemogoče našteti vse. Najbolj ponosni smo na tiste, ki so plod našega raziskovalnega dela. Predstavljamo nekaj večjih projektov, v katerih smo bili dejavni v zadnjem letu, in nekaj financerjev, s katerimi pogosto sodelujemo in nam omogočajo, da raziskujemo biodiverziteto in njen pomen.

We have drawn knowledge from so many sources about biodiversity for this book, that it is impossible to list them all. We are most proud of those that result from our research. We list some of the larger projects we have been active in over the last year and some of the funders who make our research on biodiversity and its importance possible.

Rahlocvetna kukavica (*Anacamptis laxiflora*)

Lax-flowered Orchid (*Anacamptis laxiflora*).

Davorin Tome

60 obrazov biodiverzitete / 60 Views of Biodiversity

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EKOS
Tudi mi smo del biodiverzitete!
We are part of biodiversity too!

Biodiverziteta je pomembna! V oddelku EKOS, ki je del Nacionalnega inštituta za biologijo, želimo med ljudmi zavedanje o tem povzdigniti na višjo raven. Zato smo se odločili, da naredimo knjigo, v kateri bomo na poljuden način predstavili 60 obrazov biodiverzitete. Seveda, pestrost narave je bistveno večja od naše knjige, a pri številki 60 smo se ustavili, ker v letu 2020 praznujemo 60 let Nacionalnega inštituta za biologijo, kjer se z biodiverziteto ukvarjamo tudi raziskovalno. Upamo, da boste s pomočjo zgodb spoznali delček tega, kaj na inštitutu delamo in ob enem nekoliko bolje spoznali pomen biodiverzitete.

Biodiversity matters! In EKOS, one of the Departments at the National Institute of Biology, we want to raise awareness about biodiversity and its importance. This book presents sixty views of biodiversity written by members of our department. We decided on sixty popular stories since we are celebrating the 60th anniversary of the National Institute of Biology in 2020, where we work with biodiversity on a scientific level. Of course, Nature's diversity is much larger than our sixty views. Still, we hope these stories provide a lens into our work and inspire people to take biodiversity seriously.

Davorin Tome

60 obrazov biodiverzitete
Views of Biodiversity