



LIFE20 NAT/AT/000049 | LIFE NBI



Annual report 2022

REINTRODUCTION OF THE NORTHERN BALD IBIS IN EUROPE

Responsible for content:

► **Dr. Johannes Fritz**, Chief Executive ► Schulgasse 28, 6162 Mutters, Austria
► +43 (0)676 550 32 44 ► jfritz@waldrapp.eu ► www.waldrappteam.at



Inhalt

1.	OVERVIEW	1
2.	HAND-RAISING, HUMAN-LED MIGRATION AN RELEASE 2022	2
3.	MIGRATION UND REPRODUCTION.....	3
4.	MORTALITY	5
5.	HABITAT AVAILABILITY UND DEMOGRAPHY.....	6
6.	THE NEW LIFE PROJECT.....	7
7.	PERSPECTIVES.....	7
8.	SCIENTIFIC PUBLICATIONS.....	7
9.	MEDIA PRODUCTIONS	8
10.	REPORT OF THE CLIMATE AND ENVIRONMENTAL MONITORING GROUP	10
2.	NATUR- UND KLIMASCHUTZMASSNAHMEN	10
11.	PARTNERS & SUPPORTERS 2022*	12

1. OVERVIEW

2022 was the first year of our second LIFE-project (LIFE20 NAT/AT/000049 | LIFE NBI) with a duration of seven years this time. The project is implemented by ten partners in four countries (GER, AUT, CH, IT), under the leadership of Zoo Vienna (see also chapter 6).

In 2023, the migrating Northern Bald Ibis population has increased from 199 to 201 animals (Tab.1). Population growth has thus almost stagnated. This has to do in particular with high losses in the two colonies Kuchl and Burghausen during a violent storm in November 2022 (see also chapter 4). As a result, the growth rate (λ) in these two colonies has fallen well below 1.0 (Tab.1). Nonetheless, reproduction in the breeding areas has developed positively with 46 fledged chicks (Tab.1). In Rosegg, breeding took place for the first time. Thus, the population already comprises four active breeding colonies.

Table 1: Demographic development 2022. Recruitment concerns birds that have independently integrated into our population from sedentary free-flight colonies; λ denotes growth, where $\lambda > 1$ means an increase in population; reproductive rate denotes the mean number of fledged chicks per nest.

	Kuchl	BGH	ÜBLG	Rosegg	Grünau	Fagagna	SUM
opening stock	59	51	36	42	4	7	199
increase	14	13	13	6			46
release	15	14	0	28			57
recruitment						6	6
losses	40	32	10	23		2	107
final population	48	46	39	53	4	11	201
<i>Lambda</i>	0,81	0,90	1,08	1,26			1,01
<i>reproduction rate</i>	2,30	2,20	1,90	1,50			2,00

In the course of the 15th human-led migration, 29 juveniles were released last year. Of these, 15 are assigned to the Kuchl colony and 14 to the Burghausen colony. Another 28 juveniles were released in Rosegg (see also chapter 2). The number of recruited birds has also increased. Another six birds from the sedentary colony of Fagagna in northern Italy have independently joined our wild population (Tab.1).

2. HAND-RAINING, HUMAN-LED MIGRATION AND RELEASE 2022

This year, hand rearing already began on 2 April. The two foster mothers Helena Wehner and Lisa Kern took over 29 chicks (17 females, 12 males) from the Rosegg Zoo for rearing. They were supported in particular by our camp leader Jakob Rinnagl. The hand-rearing initially took place in a proven way at Zoo Vienna. The presentation of the hand-rearing to zoo visitors was possible again, after limitations in the past two years due to COVID-19 requirements.



Figure 1 (a) Northern Bald Ibis chick. Photo: D. Zupanc. **(b)** Foster mothers Helena Wehner and Lisa Kern with ibis chicks. Photo: D. Zupanc.

However, in the end, the COVID-19 pandemic did have an impact on the hand-rearing. The illness of a foster mother and the potential infection of other team members forced us to move the chicks from the zoo to a training camp in Seekirchen am Wallersee, Land Salzburg as early as 21 April. The need for the rush transfer prevented the original plan to take the birds to a camp in Baden-Württemberg. Thus, the pandemic prevented us again from releasing another group of juveniles for the Überlingen colony. Instead, these birds raised in Seekirchen will be integrated into the two breeding colonies Burghausen and Kuchl.



Figure 2 Human-led migration 2022, Po Valley. Photo: Helena Wehner.

After a successful training, the 15th human-led migration started on 16 August. This year it comprised 29 juveniles, 14 people, two aircraft, four vehicles and three trailers. The first flight leg led to Gerlos in Tyrol. There, bad weather and unfavourable wind conditions prevented us from continuing the flight for seven days. Finally, we were able to continue the migration on 24 August and reached the wintering area on 2 September. On arrival, the group consisted of 26 birds. Three birds were lost during the

migration. One of them could be brought to the wintering area later. Another flew to Bosnia-Herzegovina and is currently staying at the EUFOR site in Sarajevo. The third bird returned to the northern foothills of the Alps, where it was equipped with a transmitter. From there, it continued on its own to Spain. It stayed near Malaga for a long time and was transferred to Vejer de la Frontera at the end of January 2023, joining the sedentary colony of the project *Proyecto eremita* (see Chapter 8).

Already since 2019, juveniles from the colony at Rosegg Zoo have been released every year and integrated into the migrating population. For this purpose, we implement a new method of colony establishment. Juveniles are brought into contact with migrating adults of our population, which they follow to the wintering site. A total of 111 juveniles have already been released, 28 in 2022 alone (Table 1). Last year, successful breeding occurred for the first time in this newly established colony Rosegg (Tab.1). Juveniles of this colony winter in Tuscany, but some join the sedentary colony in Fagagna, northern Italy, and spend the winter there.

3. MIGRATION UND REPRODUCTION

In spring 2022, 30 Northern Bald Ibises migrated from the wintering area to the breeding areas Burghausen and Kuchl, another 18 to Überlingen and six to Rosegg - a total of 57 spring migrants.

A total of 46 juveniles fledged in 23 nests last year (Table 1). This corresponds to a reproduction rate of 2.0 juveniles per nest. This value is relatively low for our population. This is mainly due to the fact, that in Rosegg only six chicks fledged in four nests, which corresponds to a reproduction rate of 1.5.

Compared to other populations, however, the reproduction rates in our project are constantly high and tend to increase (see also chapter 5). We attribute this in particular to the good food availability in the breeding areas. In Wehner et al. (2022), satellite-based data (remote sensing) were used to analyse the availability of feeding habitats in the entire northern Alpine foothills. This study confirms the widespread availability of rich foraging habitats and forms the basis for the designation of further suitable breeding areas for Northern Bald Ibises.

On 28 June, three breeding pairs with a total of eight chicks were transferred from the artificial breeding wall in Überlingen to a large rock niche in the Molasse cliffs along the shore of Lake Constance northwest of Überlingen. The handling of the birds was done by their former foster parents and with the use of a lifting platform to bring the birds into the niche at a height of a good 20 metres. However, two of the parent pairs kept flying back to the artificial breeding wall and their chicks were eventually brought back there. But one breeding pair continued raising their two chicks in the rock niche. Thus, the repopulation of this historic breeding site was initiated. We would like to thank the town of Überlingen, the Donau-Heuberg mountain rescue service, the Verein zur Erhaltung der Kulturlandschaft Hödingen e.V. and other committed local people for their active support.



Figure 3 (a) Foster mothers and a representative on the mountain rescue on a lifting platform during the nest transfer. Photo: J. Fritz. **(b)** Bald Ibis with offspring in rock niche. Photo: C. Esterer.

Autumn migration was regular for birds from the Rosegg breeding colony south of the main Alpine ridge. But only five birds from the three breeding colonies at the northern edge of the Alps crossed the Alps on their own. 28 juveniles and 27 adults had to be captured at the northern edge of the Alps and transferred to the southern edge of the Alps to avoid large losses due to the approaching winter.

This situation is alarming for the Waldrappteam, but not entirely surprising. It can clearly be attributed to a trend that we have been noticing since the Northern Bald Ibises started migrating about 10 years ago. The timing of autumn migration is increasingly varying and departures are taking place later and later. Initially, approaches towards the Alps started in early October. In 2021, however, the majority of birds crossed the Alps on 26 October and in 2022 they did not start their approaches until 31 October.

Yet the birds show a strong migration motivation. Since the end of October, they had repeatedly approached the Alps. During one of these flights, the birds from the colony Überlingen almost crossed Switzerland. In the end, however, almost all the birds returned to the northern edge of the Alps.

The increasingly delayed autumn migration is obviously directly related to the extended autumnal warm periods. The mean temperature in October 2022, for example, was higher than ever since measurements began. It is not so clear, however, why the birds find it so difficult to cross the Alps later in the year. We suspect that the birds - especially in larger flocks - need

suitable thermals to fly over the Alpine passes, and that these thermals are less and less available later in the year.

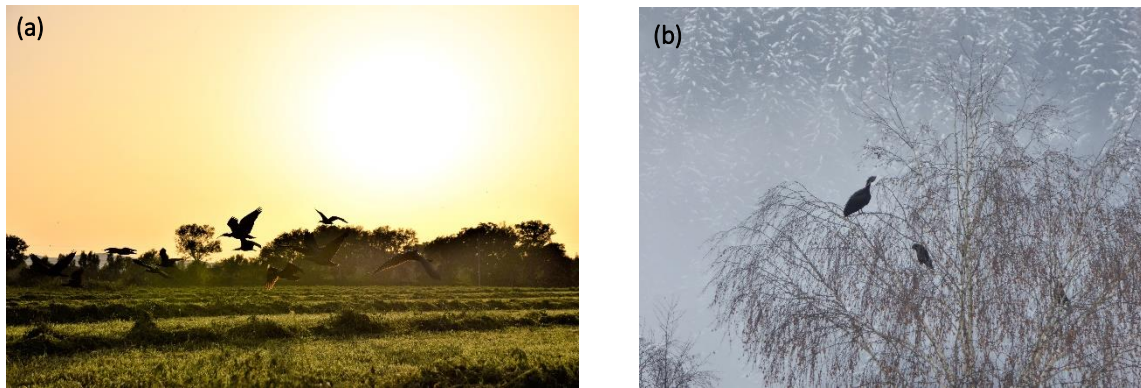


Figure 4 (a) Northern Bald Ibis in Tuscany. Photo: H. Wehner. **(b)** Northern Bald Ibis in a tree after the onset of winter.

4. MORTALITY

Last year 105 birds died and two more had to be taken into human care due to injuries. This is a very high number of losses in absolute terms. Relative to the population size at the beginning of the year, the loss rate is 55% (Fig. 5a), which is high but not exceptional in an overall comparison. In 2022, on the other hand, the rate of population increase by reproduction and release in relation to the population size was comparatively low at 54 % (Fig. 5a). Overall, this had almost led to a stagnation of the population size.

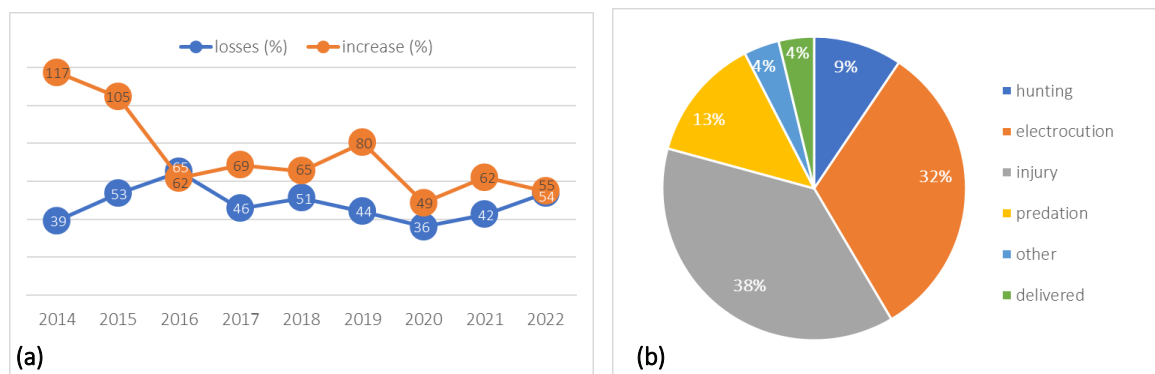


Figure 5 (a) Loss rate (blue) and gain rate (orange) in relation to population size at the beginning of the year; the increase rate includes reproduction, release and recruitment; **(b)** mortality causes in 2022 as far as known (N=53), for another 54 losses the causes are unknown.

In 54 losses (50%) the cause of death is not known. In another 53 cases, the cause of death could be determined (Fig.5b). Their percentages correspond to the long-term average. The main cause of death is injury (38%), especially various traumas in juveniles. Electrocution on unsecured medium-voltage pylons (32%) consistently causes a high proportion of losses. The proportion of illegal kills (9%; or 12% of losses in Italy) was comparatively low last year, which is probably due to the fact that the majority of migrants from the colonies in the northern Alpine foothills migrated through Italy later in the year (see also Chapter 3).



Figure 6 Final GPS positions of birds that died in the wintering area in Tuscany during the night of 21-22 November 2022. The distribution of the positions indicates that the birds were startled from their roosts by the storm.

The balance of the past year would be much better without a catastrophic event that occurred in Tuscany on 21 November. Cyclone Denise caused a wave of severe weather over Corsica, Sardinia and large parts of Italy. The wintering area of the Northern Bald Ibis was also hit badly by the storm, which caused record losses there - at least 27 birds lost their lives in a single night. Only a few of the dead birds could be found, and they were diagnosed with severe trauma.

5. HABITAT AVAILABILITY UND DEMOGRAPHY

In Wehner et al. (2022; see Chapter 8), preferred foraging habitats of Northern Bald Ibises were identified by use of GPS positions and characterised by means of seven satellite-based earth observation parameters. A suitability index was defined in a Random Forest Model and calculated for the entire northern Alpine foreland. The Alpine foothills and the large Alpine valleys, including the different breeding sites, show high proportions of areas with high suitability index (Fig.7). For example, at the breeding site Burghausen 54% of the area in a 10 km radius around the breeding site has an index >0.8 (0-1). The publication forms an essential basis for the identification of suitable breeding areas north of the Alps. Random Forest Models are also planned for the southern edge of the Alps and for wintering areas.

After years of preparation, Drenske et al. (2023; see chapter 8) published an analysis of 12 years of demographic data and a modelling of future population development (Population Viability Analysis). The data show a survival rate in the first year of life of 52% for wild offspring and 73% for released juveniles. About one third of the juveniles reach sexual maturity and the annual survival rate of adults is 78%. These are consistently above-average values compared to other populations. Also the reproduction rate in our population, with an average of 2.15 fledged juveniles per nest, is far above the values of other wild populations and zoo colonies. We attribute this to the high quality of the feeding habitats, which corresponds well with the results of Wehner et al. (2022). According to the demographic parameters, the modelling shows that the population is on its way to become self-sustaining in the coming years with continued management.

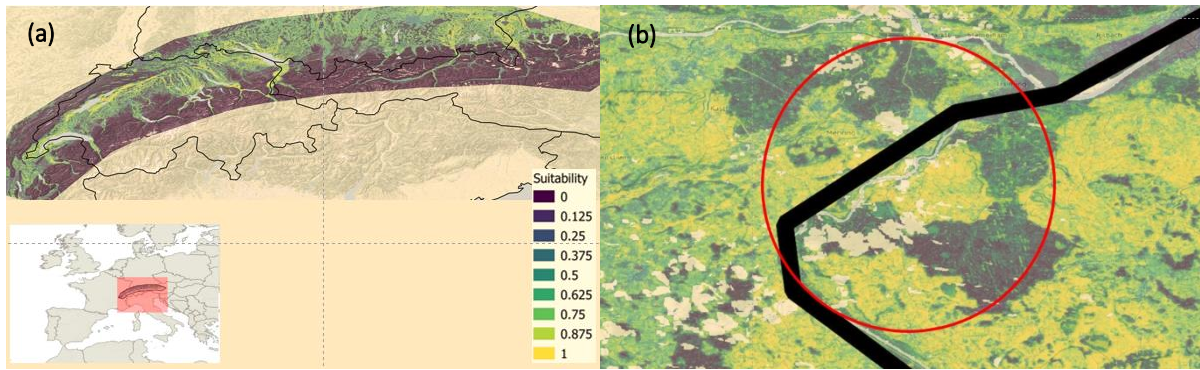


Figure 7 (a) Random Forest Model for the northern Alpine foothills, according to Wehner et al. (2022); the suitability index is colour-coded with yellow (=1) for the best foraging habitats. (b) Detailed representation of the Burghausen breeding site; 54% of the area within a 10 km radius of the breeding site has an index >0.8.

6. THE NEW LIFE PROJECT

In 2022, our second LIFE-project (LIFE20 NAT/AT/000049 - LIFE NBI; 2022-2028) started with ten partners from Austria, Germany, Italy and Switzerland under the leadership of Zoo Vienna. The continuation of the project for the next seven years is thus secured and enables us to implement the necessary measures to achieve a self-sustaining population according to the modelling of Drenske et al. (2023). The objectives and the implementation of the project are presented on the new website www.waldrapp.eu. The association Waldrappteam Conservation and Research, directed by Johannes Fritz, was assigned with the management of the project and with the implementation of five human-led migrations for further release.

7. PERSPECTIVES

It is becoming increasingly clear that climate change is forcing us to re-evaluate and adapt some objectives of the project. In particular, the increasing delay in the start of the autumn migration causes an ever greater risk that the birds from breeding sites north of the Alps fail to cross the mountain range. Therefore, we intend to establish a new migration corridor over about 2000 kilometres from the breeding areas at the northern Alpine foothills to a second wintering area in Andalusia, which the birds can reach without crossing the Alps. There, the juveniles will be released in the habitat of the sedentary Northern Bald Ibis population established by the partner project *Proyecto Eremita*. The prospect of a pan-European population has exciting implications for both projects and could significantly increase the ecological flexibility of the two populations.

8. SCIENTIFIC PUBLICATIONS

In 2022, nine scientific publications were published, one paper was published in early 2023 and another one is in press.

Mizrahy-Rewald O, Winkler N, Voelkl B, Grogger H, Ruf T & Fritz J (in press) The impact of shape and attachment position of biologging devices in Northern Bald Ibises. *Animal Biotelemetry*.

Drenske S, Radchuk V, Scherer C, Esterer C, Kowarik I, Fritz J & Kramer-Schadt S (2023) On the road to self-sustainability: reintroduced migratory European northern bald ibises *Geronticus eremita* still need management interventions for population viability. *ORYX*. <https://doi.org/10.1017/S0030605322000540>

- Perinot E, Fritz J, Fusani L, Voelkl B & Nobile MS (2023) Characterization of bird formations using fuzzy modelling. *Journal of the Royal Society Interface*. 20: 20220798. <https://doi.org/10.1098/rsif.2022.0798>
- Fritz J & Janák J (2022) Tracing the fate of the Northern Bald Ibis over five millennia: An interdisciplinary approach to the extinction and recovery of an iconic bird species. *Animals*. <https://doi.org/10.3390/ani12121569>
- Mizrahy-Rewald O, Perinot E, Fritz J, Vyssotski AL, Fusani L, Voelkl B & Ruf T (2022) Empirical evidence for energy efficiency using intermittent gliding flight in Northern Bald Ibises. *Frontiers in Biology*. <https://doi.org/10.3389/fevo.2022.891079>
- Wehner H, Fritz J, & Voelkl B. (2022) Soaring and intermittent flap-gliding during migratory flights of Northern Bald Ibis. *Journal of Ornithology*, 671–681. <https://doi.org/10.1007/s10336-022-01978-1>
- Gauld JG, Fritz J et al. (2022) Hotspot in the grid: avian sensitivity and vulnerability to collision risk from energy infrastructure interactions in Europe and North Afrika. *Journal of Applied Ecology*. <http://dx.doi.org/10.1111/1365-2664.14160>
- Perinot E, Fritz J, Fusani L, Voelkl B & Nobile MS (2022) Characterizing the flying behaviour of bird flocks with fuzzy reasoning. WILF 2021 – The 13th International Workshop on Fuzzy Logic and Applications, Dec. 2021, Italy. Workshop Proceedings, 1-10; CEUR-WS.org.
- Grogger H, Gossar M, Makovec M, Fritz J, Voelkl B, Neugebauer K, Amann F. (2022) A low-cost wind tunnel for bird flight experiments. *Journal of Ornithology*, 163, 599–610. <https://doi.org/10.1007/s10336-021-01945-2>
- Wehner H, Huchler K, Fritz J, et al. (2022) Quantification of Foraging Areas for the Northern Bald Ibis (*Geronticus eremita*) in the Northern Alpine Foothills: A random forest model fitted with data fusion of optical and actively sensed earth observation data. *Remote Sensing*, 14, 1-13. <https://doi.org/10.3390/rs14041015>

9. MEDIA PRODUCTIONS

Last year, 13 television productions and other media productions took place (Tab.2). In addition, 56 project-related contributions were counted in international print media. Since no professional media clipping took place, it can be assumed that the actual number is significantly higher.

Table 2 Media productions 2022.

Year	Medium		Production / Broadcasting
2022	TV	Terra X-press: Waldrapp Brutkolonie Burghausen	ZDF
2022	TV	Life - Menschen, Momente, Geschichten	RTL
2022	TV	Documentary on the relationship between humans and birds	Italy
2022	TV	hundkatzemaus für Vox	Docma TV, VOX
2022	TV	Europe from Above	National Geographic
2022	TV	Neulandfilm & Medien GmbH	ORF
2022	TV	Inn-Salzach-Well Journal	Regionalfernsehen
2022	TV	Jane Goodall in Kuchl	Landesmedienzentrum Salzburg
2022	TV	Zoonosen – tierische Krankheiten, vom Menschen gemacht	ZDF Magazin Royale
2022	TV	GNVP: Comeback der Tiere	BR, ARTE
2022	TV	Back from the Brink	divers European
2022	TV	Michael Schottenberg zu "Niederösterreich für Entdecker"	ORF
2022	TV	Warmer Herbst durchkreuzt Flugpläne der Waldrappen	TV Südstschweiz
2022	cinema	IMAX: Jane Goodall's Reasons for Hope	IMAX; Science Nord
2022	theater	Waldrapp 4+	Dschungel Wien; Schall und Rauch Agency
2022	book	Kinderbuch Natural World	
2022	book	Superkräfte der Vögel	
2022	art	Infrastructure of a Migratory Bird	Hochschule für Gestaltung und Kunst Zürich
2022	other	Scientific Interview	BOKU Wien
2022	podcast	Dokureihe "Erlebnis Erde": Orientierung: Flugschule für Zugvögel...	Spotify

A media highlight of the past year was the continued filming for an IMAX movie with Jane Goodall (Fig.8). Her and a Canadian film crew were in Salzburg for several days. The team filmed

at the breeding colony Kuchl and the training camp in Seekirchen am Wallersee. In this context, Jane Goodall also attended a press conference.



Figure 8 Filming and press conference with Jane Goodall; **(a)** Jane Goodall at the press conference; **(b)** from left J Rinnagl, H Wehner, M Unsöld, L Kern, O Habel, J Goodall, J Fritz, H Kalies, L Siebert-Lang; **(c)** from left J Fritz, E Liechtenstein, T Freylinger, J Goodall, S Hering-Hagenbeck, D Gutschi.

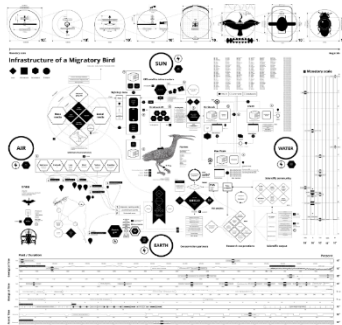


Figure 9 Infrastructure of a Migratory Bird.

A very special cooperation took place with artists from the Zurich University of Art and Design (ZHDK), as part of the research project "Latent Spaces: Performing Ambiguous Data", funded by the SNSF (Swiss National Science Foundation). A complex Infrastructure of a Migratory Bird map was presented on a poster, which was exhibited in Zurich. It is also available as an interactive online map: <https://latentspaces.zhdk.ch/imb>.

The Viennese theatre group *Schall und Rauch* has produced the play *Waldrapp 4+* and premiered it in 2022 at the Dschungel event centre in Vienna. The play depicts the reintroduction of the Northern Bald Ibis in a very creative way for children aged 4 and older. The play is performed with great success in Vienna and elsewhere (Fig.10).



Figure 10 *Waldrapp 4+*. Performance by the theatre group *Schall und Rauch* in Vienna. Photo: J.Fritz

The reduction of the ecological footprint and in particular the reduction of climate-relevant emissions are important objectives within the framework of the second LIFE-project. For this purpose, a project-internal Climate and Environmental Monitoring Group was founded, which records the footprint in five categories and defines measures for successive reduction.

Climate friendly traveling

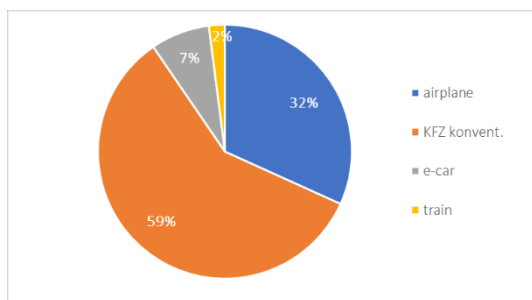


Figure 11 Shares of Co2 equivalents by mobility type; project year 2022

Tab.3 and Fig.11 show the evaluation of the Co2 equivalents (Co2E) for mobility in the project year 2022. A total of almost 24 tonnes of Co2E were recorded. Conventional cars dominate in terms of distance travelled and emissions. Flights cause 32% of the emissions for only 10% of the route. Train transport is by far the lowest emitting mode. Savings potential results in particular from the reduction of flights and the switch to

electric cars. Already in 2022, 17% of the distance was covered the one electric car available so far. The purchase of further e-cars is planned for the near future.

The emissions of the two UL-aircraft for the human-led migration 2022 were recorded, but are not yet included in this evaluation.

Table 3: Co2 equivalents for mobility in the project year 2022; the calculations are based on the key figures of the Austrian Federal Environment Agency (Nov. 2022); the Co2 equivalents for the UL aircraft of the HLM 2022 are not listed.

mobility type	route (km)	route (%)	Co2 equivalent total (kg)	Co2 equivalent kg/km
airplane	12450 (10%)	10	7 557	0,61
car conventional	64355 (52%)	52	13 965	0,22
car electro	20797 (17%)	17	1 789	0,09
train	25476 (21%)	21	484	0,02
TOTAL	123 078	100	23 795	

Green procurement

The project team has been instructed to select products with the EU-Eco label and/or the EU-Bio label whenever possible. From 2023 onwards, purchases will be quantified in this regard in order to be able to evaluate them.

Some measures implemented in this category are: climate-neutral printed project flyers, climate-neutral produced information boards made of sustainable bamboo, roll-ups made of recycled material.

➤ Green office

The project team is encouraged to use recycled paper for printouts whenever possible and to avoid printing documents altogether. In addition, the temperature in offices should be reduced as much as possible.

Some measures implemented and planned in this category are: Purchases of recycled mobile phones and recyclable headphones; conversion of websites to green hosting (<https://greenwebspaces.com/greenhosting/>).

➤ Green events

The organisation of events should be based on the Eco-Event Criteria of the City of Vienna (https://www.umweltberatung.at/download/?id=kriterienliste_oekoevent.pdf). Participants in physical meetings are encouraged to travel by train if possible. Common meals are vegetarian or vegan.

➤ Waste management

Waste is generated especially in the context of hand-rearing and human-led migration. Therefore, special attention is paid to waste avoidance and waste separation in this context. The amount of waste in the different categories is measured. The Monitoring Group works out proposals to successively reduce the amount of waste.

11. PARTNERS & SUPPORTERS 2022*

AJS Förderstiftung | Artenschutzstiftung Zoo Karlsruhe | BUND Naturschutz in Bayern e.V. - Kreisgruppe Altötting | Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie (BMK) | Burghausen Touristik GmbH | Deutsche Postcode Lotterie | Deutsche Wildtier Stiftung | FH Joanneum Graz | Fondazione A.R.C.A. | Gesellschaft für Arterhaltende Vogelzucht (GAV) e.V. | Grovni-Stiftung | Hans und Helga Maus-Stiftung | HIT Umweltstiftung | Kärnten Netz GmbH | Land Salzburg | LaSelva Toskana Feinkost Vertriebs GmbH | Lions Club Altötting-Burghausen | Leibniz-Institut für Zoo- und Wildtierforschung | Lions Club Altötting-Burghausen | Münchener Tierpark Hellabrunn AG | Natur- und Tierpark Goldau | Netz Oberösterreich GmbH | Parco Natura Viva | Schweizerische Vogelwate Sempach | Stadt Burghausen | Stadt Überlingen | Tiergarten Heidelberg GGmbH | Tiergarten Schönbrunn | Tierpark Rosegg | Verein für Tier- und Naturschutz in Österreich | Verein zur Erhalt der Kulturlandschaft Hödingen e.V. | Veterinärmedizinische Universität Wien | WWF Deutschland | WWF Oasi Italy | ZooSchweiz

* For data protection reasons, only an excerpt of persons and institutions is mentioned.

**We want to thank
all our sponsors, staff, volunteers, helpers and patrons
for their active and valuable support in 2022!**



Photo: L. Kern