University Academic Curriculum Vitae

Personal information

Name: Ilaria Fracasso
Nationality: Italian

Education since leaving school

- **2018 – 2022 - Ph.D.** in Mountain Environment and Agriculture. Faculty of Science and Technology, Free University of Bozen-Bolzano – Italy. Title of the Thesis: Use of peatlands as natural archives for palaeoecological and palaeoclimatic reconstructions.
- **2016 – 2018 – Master's degree** in Biotechnology for the health and environment. Grade 110/110 cum Laude. University of Ferrara – Italy.
- **2012 – 2016 – Bachelor's degree** in Biotechnology. Grade 103/110. University of Turin – Italy

Present appointment

- **2025 – 2027 – Postdoc** at the Faculty of Agricultural, Environmental and Food Sciences, Free University of Bozen-Bolzano – Italy. Title of the Project: Tipping points della biodiversità e sostenibilità in sistemi tradizionali di pascolo in Alto Adige (BIOPAS).

Professional experience

From - to	Job title	Name of the company	Work level	Responsibilities
2025 – 2027	Research Assistant	Free University of Bozen - Bolzano	Postdoctoral researcher	
2023 – 2025	Research Assistant	Free University of Bozen - Bolzano	Postdoctoral researcher	Sampling and transferring of soil monoliths from the field site, located at 2500 m altitude, to the ecotron facilities. Samples preparation for chemical and biological analyses intended to study the effects of simulated increases in temperature and atmospheric CO2 concentration on alpine habitats, thus contributing to the

				understanding of the impact of climate change in these environments.
2018 – 2022	PhD grant	Free University of Bozen - Bolzano, Faculty of Science and Technology, Italy AND Fondazione Edmund Mach	PhD student	Reconstruction of peatland's plant and arthropods communities using the eDNA metabarcoding with a focus on the optimization of extraction and amplification protocols.

Collaborations with other organizations

1) **11/2020 – 03/2021 – PhD period abroad at the GLOBE institute, University of Copenhagen - Section for Geogenetics (Supervisor: Dr. Tobias Guldberg Frøslev):** I carried out the DNA amplification of plants and arthropods from my peatland samples, and I prepared the Illumina libraries for the metabarcoding analysis. I learned how to perform the bioinformatic analysis using DADA2.

2) **11/2019 – 12/2019 – GLOBE institute, University of Copenhagen – Section for Hologenetics (collaboration with Dr. Marta Maria Ciucani. Supervisor: Prof. Tom Gilbert):** I carried out the DNA extraction from invasive wolf samples and the preparation of libraries for shotgun sequencing. The aim of the project was to determine the genetic evolution of the species by making comparisons between modern and ancient populations.

3) **10/2019 – 11/2019 – CNR of Florence, Instituto per la protezione sostenibile delle piante (collaboration with Dr. Federico Sebastiani):** I conducted the extraction of DNA from beech (*Fagus sylvatica*) samples coming from an Apennine and an Alpine population, and I participated in the reconstruction of the genomes following shotgun sequencing. The objective of the project was to highlight the genetic differences between the two populations and any specific adaptations.

Technical skills

• **Fieldwork activity and skills**

Sampling experience from different environmental matrices: soil, rhizosphere, sediment and feces in mountain environment.

Main sampling campaigns: hazel grouse feces from Paneveggio Pale di San Martino Nature Park, Trentino - Alto Adige, Italy (2016) for a population study (no. of individuals, no. of males and females, parental relationships) and the study of the diet of the species by eDNA metabarcoding. Peat samples from the peat bogs of Tonale, Vivione and Mortirolo, Parco Naruale Adamello Brenta, Trentino - Alto Adige, Italy (2019), for a study of the evolution of plant and animal communities over time as a function of climate change and human impact using eDNA. Soil samples at different altitudes along the Oberholz

Obereggen ski slope, Trentino - Alto Adige (2023) to study the impact of artificial snow and snow compactors on micro- and mesofauna. Soil sampling and transport from Miage Glacier, Courmayeur, Valle D'Aosta (2023) to study the impact of climate change on chemical and biological components.

• **Wet-lab skills**
Biological analyses: culture media preparation; isolation and identification of culturing bacteria; cloning and screening for genes; gel electrophoresis; protein electrophoresis; capillary electrophoresis; DNA extraction and purification from different matrix (i.e. ice/water, soil/rhizosphere, sediments, vegetable tissue and seeds, animal tissue, blood, faeces, milk) and DNA quantification; RNA extraction and quantification; qPCR/ddPCR for the analysis of bacteria, fungi, plants, micro- and mesofauna, and mycorrhiza, and of genes related to biogeochemical cycles; next-generation sequencing library preparation; work in ancient DNA laboratory.
Physical and chemical analysis: soil texture, bulk density, water content, soil fractionation, pH measurement, element concentration through the use of ICP-MS, measurement of TOC, TN, DOC and available phosphorus.

• **Statistic skills**
"R" environment; Shapiro-Wilk test, t-test, ANOVA, Mann-Whitney U test, Kruskal-Wallis test, Wilcoxon signed-rank test, Tukey's post hoc test; PCA, PCoA, NMDS, Canonical Analysis of Principal Coordinates (CAP); Alpha and Beta diversity, Multivariate Association with Linear Models (MaAsLin 2); Genome assembly, taxonomic composition analysis, network analysis.

• **Informatic and bioinformatics skills**
•LINUX operating system (command line language); Python; “R” environment.
•Clustal X (Multiple Alignment of Nucleic Acid and Protein sequences); GeneMapper (for STRs allele sequence correction); Microchecker (for alleles quality check); GenAlex (Genetic Analysis in Excel); ClustalW (Multiple Sequence Alignment); MEGA (Molecular Evolutionary Genetics Analysis); FaBox (haplotypes identification); Sequencer (for haplotypes quality check); Arlequin (population Genetic Data Analysis); PopART (Population Analysis with Reticulate Trees); bioinformatics database (BLAST, MIDORI, BOLD).
•Bioinformatics analysis of next-generation sequencers outputs using pipelines such as Qiime 2, MICCA, and DADA2; SAMtools (Sequence Alignment/Map); VSEARCH (a Versatile Open-Source Tool for Metagenomics).

• **Writing skills**
Scientific paper and report.

Tutoring and laboratory supervision

1) Master student Nadia Marinchel: Fondazione Edmund Mach (2018-2019).
2) PhD student Sahra Riviere: Free University of Bozen (2023-2025).
3) PhD student Rita Noto: Free University of Bozen (2023-2025)
4) Master student Ekaterina Timofeeva: Free University of Bozen (2024-2025)

Experience in academic teaching

Teaching assistant for laboratory activities in the Elements of chemistry and biochemistry applied to food and wine course of Professor Luigimaria Borruso, first semester of academic year **2024-2025 (12h)**.

Academic seminars

Seminar on "The DNA as an instrument to study food quality." The seminar was about the use of molecular techniques to monitor and study food quality. The seminar was held during Professor Luigimaria Borruso's Elements of chemistry and biochemistry applied to food and wine sciences course, first semester academic year **2023-2024**; first semester academic year **2024-2025**.

Seminar on "Peatlands: Important biological archives for palaeo-reconstructions". The seminar was about the use of peatland sediments for temporal reconstruction of physicochemical and biological alterations of peatlands and their surroundings, with a focus on the molecular techniques used in this type of study. The seminar was held during Professor Luigimaria Borruso's Soil Ecology course, first semester, academic year **2023-2024**; first semester academic year **2024-2025**.

Seminar on "Peatlands: Important biological archives for palaeo-reconstructions". The seminar was about the use of peatland sediments for temporal reconstruction of physicochemical and biological alterations of peatlands and their surroundings as a result of climate change and the impact of human activities. The seminar was held during Professor Tanja Mimmo's Principle of Pedology course, second semester, academic year 2022-2023.

Oral presentations

Fracasso I, Celva R, Crestanello B, Girardi M, Marchesimi A, Partel P, Pedrini P, Scridel D, Tenan S, Forti A, Anderle M, Vernesi C (2019) Conservation genetic and eDNA metabarcoding approaches to study the elusive species *Tetrastes bonasia*. Selected oral presentation at the 8th Congress of the Italian Society of Evolutionary Biology (SIBE), Padova, Italy, September 1st-4th 2019.

Poster presentations

Fracasso I, Foley E. R, Buzzini P, Augusti A, Gavrichkova O, Zucconi L, Cesco S, Montagnani L, Borruso LM, Mimmo T (2024) Impact of elevation on soil organic carbon and the associated microbial communities in Alpine ecosystems. Selected poster presentation at the Centennial Celebration and Congress of the International Union of Soil Science (IUSS), May 19th-21st 2024.

Cavallini G., Zucconi L., Augusti A., Bernetti A., Borruso L., Brugnoli E., Canini F., D'Alò F., **Fracasso I.,** Gavrichkova O., Mimmo T., Montagnani L., Mugnai G., Pinchuk I., Sannino C., Sarti M., Turchetti B., Buzzini P. (2023). New possible complementary approaches to study the responses of terrestrial alpine ecosystemsto climate changes in the MICROPLANTALP project. UAE Microbiome 2023, Abu Dhabi – United Arab Emirates, November 21st-22nd 2023.

Cavallini G., Zucconi L., Augusti A., Bernetti A., Borruso L., Brugnoli E., Canini F., D'Alò F., **Fracasso I.,** Gavrichkova O., Mimmo T., Montagnani L., Mugnai G., Pinchuk I., Sannino C., Sarti M., Turchetti B., Buzzini P. (2023). Microorganisms-Plant Interactions in Alpine ecosystem: a hotspot for studying the impact of climate change. XIX Congress of European Mycologists, Perugia, Italy, September 4th-8th 2023

Fracasso I, Marinchel N, Bragazza L, Giammarchi F, Lamentowicz M, Giannelle D, Tonon G, Vernesi C (2020) Turning well-known climatic archives into biological archives: an environmental DNA metabarcoding approach. Selected poster presentation at the final Life for European Forest Genetic

Monitoring System conference (LifeGenmon), September 21st-25th 2020.

Scridel, D., Tenan, S., Brambilla, M., Celva, R., Forti, A., Anderle, M., **Fracasso, I.,** Volcan, G., Dorigatti, Crestanello, B., Vernesi, C., Pedrini, P., Partel, P. (2019) Stato della popolazione, densità, dieta e utilizzo dell'habitat invernale del francolino di monte Bonasa bonasia nel Parco Naturale Paneveggio-Pale di San Martino. XX Convegno Italiano di Ornitologia, 26-29 settembre 2019, Napoli.

Publications

(*) Shared co-first authorship

Published

Valentinuzzi, F.*, **Fracasso, I.***, Bani, A. et al. Enhancing Soil-Grown Strawberry Fruit Quality through the Synergistic Influence of Beneficial Microorganisms and Digestate. J Soil Sci Plant Nutr (2024). https://doi.org/10.1007/s42729-024-02068-2

Battilani, D., Gargiulo, R., Caniglia, R., Fabbri, E., Madrigal, J. R., Fontsere, C., Ciucani, M. M., Gopalakrishnan, S., Girardi, M., **Fracasso, I.**, Mastroiaco, M., Ciucci, P., Vernesi, C. (2024). Beyond population size: whole-genome data reveal bottleneck legacies in the peninsular Italian wolf. *Journal of Heredity*, esae041. https://doi.org/10.1093/jhered/esae041

Fracasso, I., Zaccone, C., Oskolkov, N., Da Ros, L., Dinella, A., Marchesini, L. B., ... & Borruso, L. (2024). Exploring different methodological approaches to unlock paleobiodiversity in peat profiles using ancient DNA. Science of the Total Environment, 908, 168159. https://doi.org/10.1016/j.scitotenv.2023.168159

Ciucani, M. M., Ramos-Madrigal, J., Hernández-Alonso, G., Carmagnini, A., Aninta, S. G., Sun, X., Scharff-Olsen, C.H., Lanigan, L. T., **Fracasso, I.,** ... & Gopalakrishnan, S. (2023). The extinct Sicilian wolf shows a complex history of isolation and admixture with ancient dogs. Iscience, 26(8). https://doi.org/10.1016/j.isci.2023.107307

Marchesini, A., Silverj, A., Torre, S., Rota-Stabelli, O., Girardi, M., Passeri, I., **Fracasso, I.**, Sebastiani, F., Vernesi, C. (2023). First genome-wide data from Italian European beech (Fagus sylvatica L.): Strong and ancient differentiation between Alps and Apennines. *PloS one*, *18*(7), e0288986. https://doi.org/10.1371/journal.pone.0288986

Fracasso, I.*, Dinella, A.*, Giammarchi, F., Marinchel, N., Kołaczek, P., Lamentowicz, M., Marcisz, K., Łokas, E., Miecznik, M., Bragazza, L., Girardi, M., Ventura, M., Borruso, L., Tonon, G., Vernesi, C. (2022). Climate and human impacts inferred from a 1500-year multi-proxy record of an alpine peatland in the South-Eastern Alps. *Ecological Indicators*, *145*, 109737. https://doi.org/10.1016/j.ecolind.2022.109737

Scridel, D., Tenan, S., Brambilla, M., Celva, R., Forti, A., **Fracasso, I.**, ... & Partel, P. (2022). Early-succession secondary forests following agropastoral abandonment are key winter habitats for the conservation of a priority bird in the European Alps. *European Journal of Forest Research*, *141*(6), 1029-1043. https://doi.org/10.1007/s10342-022-01485-1

In preparation

Signorini M.*, Noto R.*, **Fracasso, I.,** Genova G., Bani A., Niedrist G., Hilpold A., Dumbrell A.J., Tappeiner U., Cesco S., Mimmo T. and Borruso L. (????). Soil composition, along with animal and microbial diversity, tells the agricultural history of past cultivations. *In preparation*.

Courses and workshop

- *Time Series Data Analysis (online):* course organized by PR Statistic, December 14th-17th 2021.
- *Introduction to Phyton for Scientific Computing (online):* course organized by PR Statistic, December 2nd-3rd 2020.
- *Introduction to Phyton (online):* course organized by PR Statistic, November 18th-19th 2020.
- *Data Visualization in R with GGPLOT2 (online)*: course organized by Physalia, November 9th-13th 2020.
- *ENMTools (online):* course organized by Transmitting Science, August 10th-12th 2020.
- *Advanced Programming in R (online)*: course organized by Physalia, July 6th-10th 2020.
- *Introduction to R for ecologists and evolutionary (online):* course organized by PR Statistic, May 20th-21st 2020.
- *Analysis of metagenetic data for macroecology (in presence)*: workshop organized by iBioGen, University of Cyprus, Cyprus, October 1st-8th 2019.
- *Eukaryotic Metabarcoding (in presence)*: course organized by Physalia, Berlin, March 3rd-9th 2019.

Statement of interest

The project is of great interest to me and represents an opportunity to contribute to the study of the evolution of landscapes, agriculture and ecosystems in South Tyrol, in particular in relation to sustainability practices. The perspective of investigating interactions between plants, soil, and livestock in a dynamic environment fits deeply with my academic and professional background.
During my doctoral studies and current postdoc position, I have mainly focused on alterations of microbial and micro/mesofauna communities due to climate change and human activities. I have gained significant experience in the extraction of RNA and DNA from different matrices, mainly from soil. I have adapted PCR and qPCR protocols for the qualitative and quantitative analysis of these groups of organisms and of genes involved in biogeochemical cycles for the projects in which I have been involved in. Furthermore, I have developed skills in physicochemical analysis with the aim of obtaining data that can integrate and explain the observed biological variations.
Data analysis further allowed me to improve my statistical knowledge and progress in the use of Linux and R Studio environments.

Specifically, my experiences concern skills in:
i) Analysis of the interactions between plants, invertebrates and microorganisms from DNA extracted from environmental samples, with focus on the temporal alterations resulting from the connection of the variations with human activities and climate changes.

ii) Analysis of the mitochondrial, plastidial and nuclear genomes of plants invasive samples (e.g. beech) for comparison between different populations, highlighting the genetic differences and genes related to the different

phenotypes or mutations.

iii) Analysis of animal population using non-invasive samples (e.g. feces) to identify the number of individuals and males and females, determine the movements and use of the territory by individuals and its subdivision into various spatial areas, establish their parental relationships and genetic variability, as well as diet and gut microbiota.

iv) Analysis of DNA from soil monoliths treated in ecotrons simulating three different climatic scenarios to study the impacts of climate change on the chemical-physical composition of the soil, on the microbiological community, on plant cover and on gas exchange.

I have also acquired crucial laboratory skills, particularly in ancient DNA and environmental/non-invasive DNA laboratories, managing samples of various types, developing extraction and amplification protocols, and competent bioinformatics skills. My proficiency with the Linux operating system and the R environment is solid and I have taken numerous courses, particularly focusing on R and other bioinformatics tools.

My experience of collaboration with the CNR in Florence and with the GLOBE Institute in Copenhagen during my doctorate, including a period abroad, provided me with valuable guidance for working within different research groups, and participating in this project at the Free University of Bolzano would represent for me not only significant professional growth but also personal enrichment.

Language competence

Italian – Mother tongue
English – C1 (Exam certifications organized by the Free University of Bozen-Bolzano Language Center, 05.2024)

Driving license

Type of driving license B

Date

04/12/2024

Signature

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