finanziato dall'Unione Europea - NextGenerationEU a valere sul Piano Nazionale di Ripresa e Resilienza (PNRR) - Missione 4 Istruzione e ricerca - Componente 2 Dalla ricerca all'impresa - Investimento 1.1, Avviso PRIN 2022 PNRR indetto con DD N. 1409 del 14/09/2022, dal titolo "Plant Biodiversity and Ecosystem Change in protected Areas: land-Use impacts and Scenario Evaluation", codice progetto MUR P2022JM3RZ - CUP J53D23013800001

Activity Plan

Call for a 24-month Post-Doc fellowship (Assegno di Ricerca) within the framework of the PRIN 2022 PNRR project "P2022JM3RZ"- Plant Biodiversity and Ecosystem Change in protected Areas: land-Use impacts and Scenario Evaluation (BECAUSE)

The winning candidate will:

- Support the other Research Units during in the identification of spatio-temporal gaps in the study areas (Lagorai and Velino massifs, Foreste Casentinesi NP) and creation of the study design for field survey
- Support data collection in the study areas, in team with the other project research units
- Analyze existing and newly-collected vegetation plot data and fit quali-quantitative statistical models of historical land-cover change effects on vegetation
- Gather predictors of biodiversity change and reconstruct land cover history of the study areas
- Calibrate spatially-explicit plant biodiversity models and create maps of maximum compositional change
- Elicit stakeholder participation and capture local expert knowledge on changes in biodiversity
- Complement the other Research Units during the activities aimed at identifying how climate contributes to the observed temporal trends, at assessing vulnerability and exposure of different vegetation communities and at creating maps of climate change related risk for vegetation
- Prepare scientific manuscripts for publication in international peer-reviewed journals
- Support the coordination of the project, contribute to the organization of project meetings, and lead the reporting and outreach activities

Expertise and skills required:

- Proved experience in biodiversity modelling in R or other programming environments. The use of *dplyr* syntax and the other *tidyverse* packges in R is a plus
- Understanding of the most commonly used statistical approaches to biodiversity analysis (multivariate analysis, GLMM, spatial statistics). Previous knowledge of Generalized Dissimilarity Models and\or temporal time series is a plus.
- Expertise in the use of Geographical Information Systems (QGis, ArcGis), or equivalent spatial data manipulation in R
- Experience on the best practices for reproducible data science (e.g., git, github) and reporting (RMarkdown, Jupiter, Quarto, LaTex) is highly desirable
- Experience in vegetation plot data collection in the field and vascular plant identification
- Previous experience on stakeholder engagement or other approaches from social geography, or willingness to learn, is a plus

Finanziato dall'Unione europea
NextGenerationEU

Ministero dell'Università e della Ricerca

Segretariato Generale

Direzione Generale della Ricerca

PRIN: PROGETTI DI RICERCA DI RILEVANTE INTERESSE NAZIONALE – Bando 2022 PNRR
Prot. P2022JM3RZ

PART A

1. Line of intervention

Main line/Linea Principale

2. Research project title

Plant Biodiversity and Ecosystem Change in protected Areas: land-Use impacts and Scenario Evaluation

3. Duration of the project (months)

24 months

4. Strategic emerging Topics - 5. Related Cluster

Strategic emerging topic: BIODIVERSITY AND ECOSYSTEM SERVICES
Cluster: Food, Bioeconomy, Natural Resources, Agriculture and Environment
Sub Cluster: 2. Biodiversity decline is halted and ecosystems are preserved and restored on land and at sea through improved knowledge and innovation.

6. Main ERC field

LS - Life Sciences

7. Other ERC field

8. ERC subfields

1.	LS8_1 Ecosystem and community ecology, macroecology
2.	LS8_3 Conservation biology
3.	LS8_2 Biodiversity

9. Keywords

nº	Testo inglese
1.	biodiversity loss
2.	climate change scenarios
3.	conservation biology
4.	land-use change
5.	rewilding
6.	vegetation survey

10. Principal Investigator

SABATINI (Surname)	**FRANCESCO MARIA** (Name)
Ricercatore a t.d. - t.pieno (art. 24 c.3-b L. 240/10) (Qualification)	
15/09/1984 (Date of birth)	**SBTFNC84P15L182O** (Personal identification code)
Università degli Studi di BOLOGNA (Organization)	
(Phone number)	**FRANCESCOMARIA.SABATINI@UNIBO.IT** (E-mail address)

Declarations

☑ I declare that I have not participated as PI in PRIN 2022 call (n. 104 02/02/2022)

☐ I declare that I have participated as associated PI in PRIN 2022 call (n. 104 02/02/2022)

Current funding and applications submitted

Age limits derogation

The principal investigator and the substitute are both under 40 at the time of the publication of the call. They intend to benefit from the derogations to the age limits for the amount allocated to under 40 PI;

11. List of research units (RU)

nº	Associated Investigator	Qualification	University/ Research Institution	Registered office (address)	e-mail address
1.	SABATINI Francesco Maria	Ricercatore a t.d. - t.pieno (art. 24 c.3-b L. 240/10)	Università degli Studi di BOLOGNA	Via Zamboni, 33 - BOLOGNA (BO)	FRANCESCOMARIA.SABATINI@UNIBO.IT
2.	DI MUSCIANO Michele	Ricercatore a t.d. - t.defin. (art. 24 c.3-a L. 240/10)	Università degli Studi dell'AQUILA	Palazzo Camponeschi, Piazza Santa Margherita 2 - L'AQUILA (AQ)	michele.dimusciano@univaq.it
3.	BONARI Gianmaria	Ricercatore a t.d. - t.pieno (art. 24 c.3-a L. 240/10)	Libera Università di BOLZANO	Piazza Università 1 - BOLZANO (BZ)	gianmaria.bonari@gmail.com

12 - Substitute Principal Investigator (PI) (To be identified among one of the associated PIs participating in the project).*

DI MUSCIANO (Surname)	**MICHELE** (Name)
Ricercatore a t.d. - t.defin. (art. 24 c.3-a L. 240/10) (Qualification)	
22/08/1991 (Date of birth)	**DMSMHL91M22L103G** (Personal identification code)
Università degli Studi dell'AQUILA (Organization)	
(Phone number)	**michele.dimusciano@univaq.it** (E-mail address)

13. Brief description of the proposal

Mountain areas of Italy experienced substantial socio-ecological changes over the last decades. Partly due to outmigration, traditional agro-forestry activities and cultural landscapes were progressively abandoned and forest expanded substantially. Concurrently, the introduction of the Habitats Directive and the Italian Framework Law on Protected Areas led to the designation of a

vast network of protected areas. Abandonment and protection triggered profound changes. Many areas underwent a process of spontaneous rewilding, whose ecological consequences are still to be fully understood. These areas can therefore be seen as a quasi-experimental benchmark for assessing how passive rewilding, an increasingly invoked Nature-Based Solution, performs in tackling biodiversity loss and improving the resilience of natural ecosystems to climate change.
BECAUSE ("plant Biodiversity and Ecosystem Change in protected Areas: land-Use impacts and Scenario Evaluation") proposes an interdisciplinary, data-driven approach to understand historical and future trends of plant biodiversity in Italian rewilded mountain areas. We will produce spatially explicit assessments of vegetation change between 1990 and 2020 in three mountain protected areas spanning the Italian Peninsula: 1) Eastern Alps (Lagorai mountain range); 2) Northern Apennines (Foreste Casentinesi Monte Falterona e Campigna NP), and 3) Central Apennines (Velino Massif). To do so, we will use generalized dissimilarity modelling (GDMs) to model the dissimilarity of plant assemblages as a function of their geographical distances, ecological dissimilarities, and differences in land cover derived by remote sensing. After calibrating the GDMs with historical and newly collected vegetation plot data, we will create wall-to-wall maps of predicted species composition at different times, whose comparison will allow highlighting areas where change in land cover induced the largest changes in species composition, and quantifying the consequences for regional plant diversity.
By comparing the relative importance of land cover and other predictors including climate, we will disentangle the drivers of historical vegetation change and understand the consequences of landscape abandonment on plant biodiversity. To interpret past trends, quantitative modelling will be integrated with qualitative methods from social geography. We will employ go-along walking methods with stakeholders to capture local knowledge in a structured way, allowing a more thorough characterization of the underlying drivers of vegetation change. Finally, we will create predictions of vegetation change under different climate-change scenarios, and produce maps of 1) vegetation vulnerability and 2) vegetation exposure to climate change. By combining these two maps, we will produce an assessment of vegetation risk to climate change so to inform ecosystem-level conservation decisions and develop tailored resilience strategies in the study areas.

14. Total cost of the research project identified by items

Associated Investigator	item A.1	item A.2	item B	item C	item D	item E	item F	Total
SABATINI Francesco Maria	39.315	69.750	1.222	0	16.360	0	16.000	**142.647**
DI MUSCIANO Michele	41.975	49.089	1.222	0	13.660	0	11.000	**116.946**
BONARI Gianmaria	26.175	0	0	0	3.926	0	10.000	**40.101**
Total	**107.465**	**118.839**	**2.444**	**0**	**33.946**	**0**	**37.000**	**299.694**

N.B. The Item D and TOTAL columns will be filled in automatically

- item A.1: enhancement of months/person of permanent and temporary employees
- item A.2: cost of contracts of non-employees, specifically to recruit
- item B: cost of equipment and tools
- item C: cost of consulting and other services
- item D: overhead
- item E: materials cost
- item F: other costs

PART B

B.1

1. State of the art

Climate change and biodiversity loss have an intertwined nature, and threaten the resilience of the Earth and its inhabitants [1,2]. Given Nature's essential role for planetary well-being, tackling these crises is the most urgent challenge of our time and is crucial for meeting UN Sustainable Development Goals (SDG)[1]. To foster transformative change of the economic, social and political systems, however, we need to increase our capacity to understand and predict the consequences of global change on ecosystems and prepare for it [3].
Thirty years after the introduction of the Habitats Directive, the Natura 2000 network is a keystone of EU's response to global change and is at the core of the EU Biodiversity Strategy for 2030 [4]. Natura 2000 sites host large swaths of natural and semi-natural ecosystems, whose contribution to combat global change cannot be understated. Such ecosystems store huge amounts of carbon, are mostly net carbon sinks, and their positive contributions to climate change adaptation spill over outside of the

protected areas themselves, for instance by dampening the effect of catastrophic hydrological events downstream.
Notwithstanding the importance of the Habitats Directive, its focus is skewed on conserving species and habitats, rather than natural processes. This 'static' approach to conservation is currently being challenged by the promotors of rewilding [5,6], a Nature-Based Solution aiming at restoring functioning, self-sustaining ecosystems complete with fully occupied trophic levels that are nature-led across the landscape [7]. Since its conception rewilding acquired high policy relevance to the UN SDGs, the UN Decade on Ecosystem Restoration, and the post-2020 CBD Global Biodiversity Framework [8]. While rewilding promises to enhance biodiversity, ecological resilience, and ecosystem service delivery, its long-term effects on biodiversity and climate benefits remain unquantified, especially in Natura 2000 sites [5].
Italian Mountain ranges represent an ideal scenario for testing these effects. Once densely populated, these areas became economically marginal after WWII and underwent the cessation of traditional agro-forestry activities, widespread land abandonment and profound habitat changes [9,10]. After the inclusion in the Natura 2000 network in the 90s, many of these areas evolved with little human interventions, essentially undergoing a process of spontaneous rewilding. This led to challenges related to the loss of cultural landscapes, including (semi-)natural habitats and biodiversity that is explicitly protected by the Habitats Directive [9]. But also opportunities, related to the expansion of forest, restored landscape connectivity, and the return of large carnivores [11].
Rewilding had far-reaching effects on all the domains of biodiversity, especially vegetation, but many questions remain unanswered. Did rewilding increase overall plant and habitat diversity in Natura 2000 areas? How did these changes affect landscape mosaics? Did semi-natural ecosystems gain in resilience to climate change? Answering these questions is crucial for understanding the applicability of rewilding to other mountain areas of Europe.
Understanding the decadal impacts of rewilding is challenging, however. It requires biodiversity monitoring data, but these are scant, scarcely integrated and scattered [12]. Some vegetation plot time-series do exist, but they are essentially point observations in space. Achieving a complete picture of biodiversity change requires integrating different data, expertise, and mostly, viewpoints. Integrating biodiversity surveys with data that is available with complete spatial coverage, such as remote sensing, is a necessary first step. But interpreting biodiversity changes also requires considering people's perceptions and knowledge. Only a quali-quantitative approach allows understanding not only the patterns and trends of biodiversity change, but also the reasons why it changed.
Biodiversity trends observed during the last 30 years of rewilding are unlikely to continue under climate change. Climate change is expected to rapidly increase in importance as a driver of biodiversity loss [1,13]. Proactive conservation is therefore needed, to identify species at greater risk of extinction, as well as the most vulnerable habitats and ecosystems [14]. Climate changes at different pace in different areas, and the impacts will likely vary across communities, some being more exposed than others [15]. Spatially-explicit modelling allows predicting biodiversity trends under a range of plausible climate scenarios, but most research focused on spatial scales (e.g., [13]), which are too coarse to inform conservation planning in local protected areas, and seldom separated the two dimensions of risk: exposure and vulnerability. Yet this would be crucial to provide Natura 2000 managers with conservation-relevant information on climate change impacts on biodiversity.

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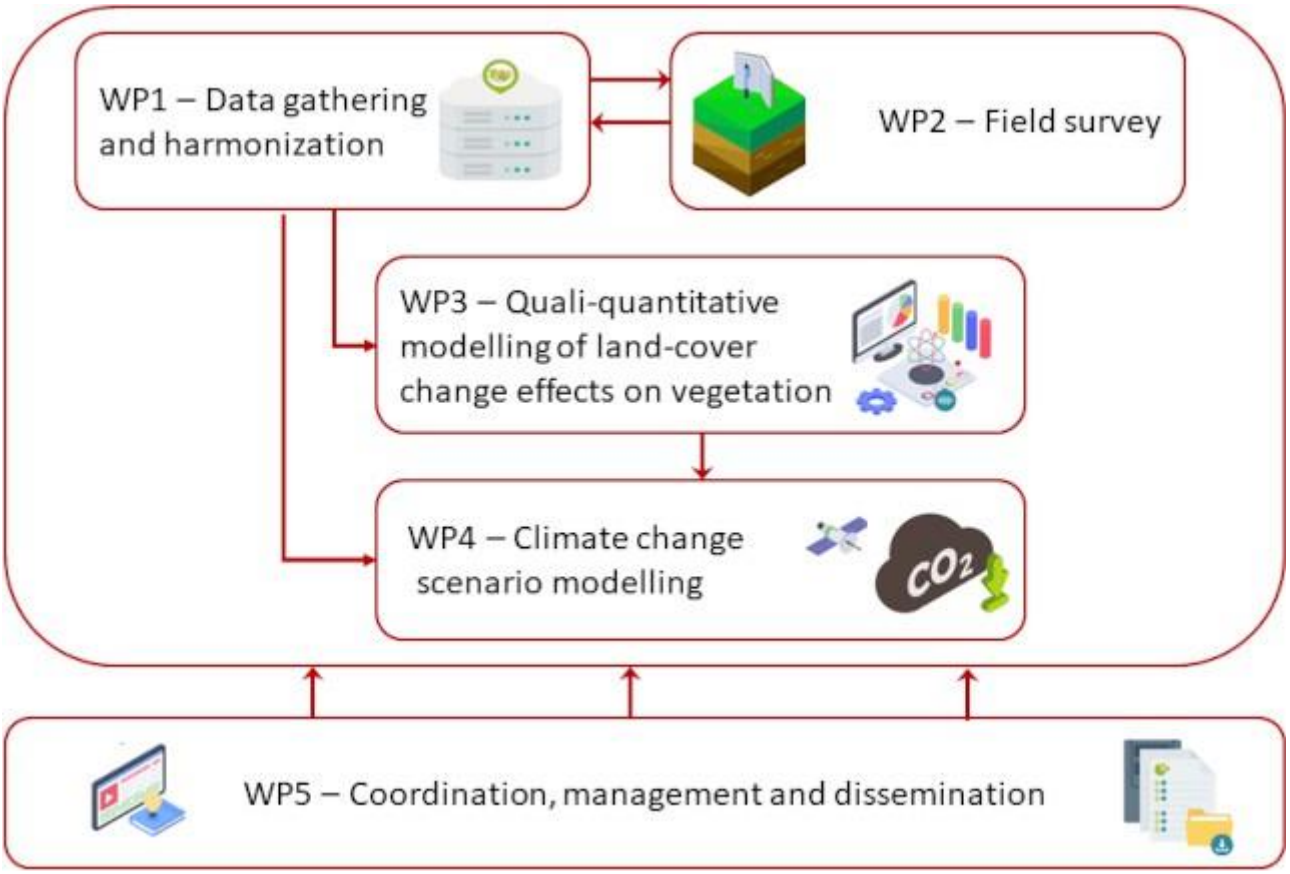
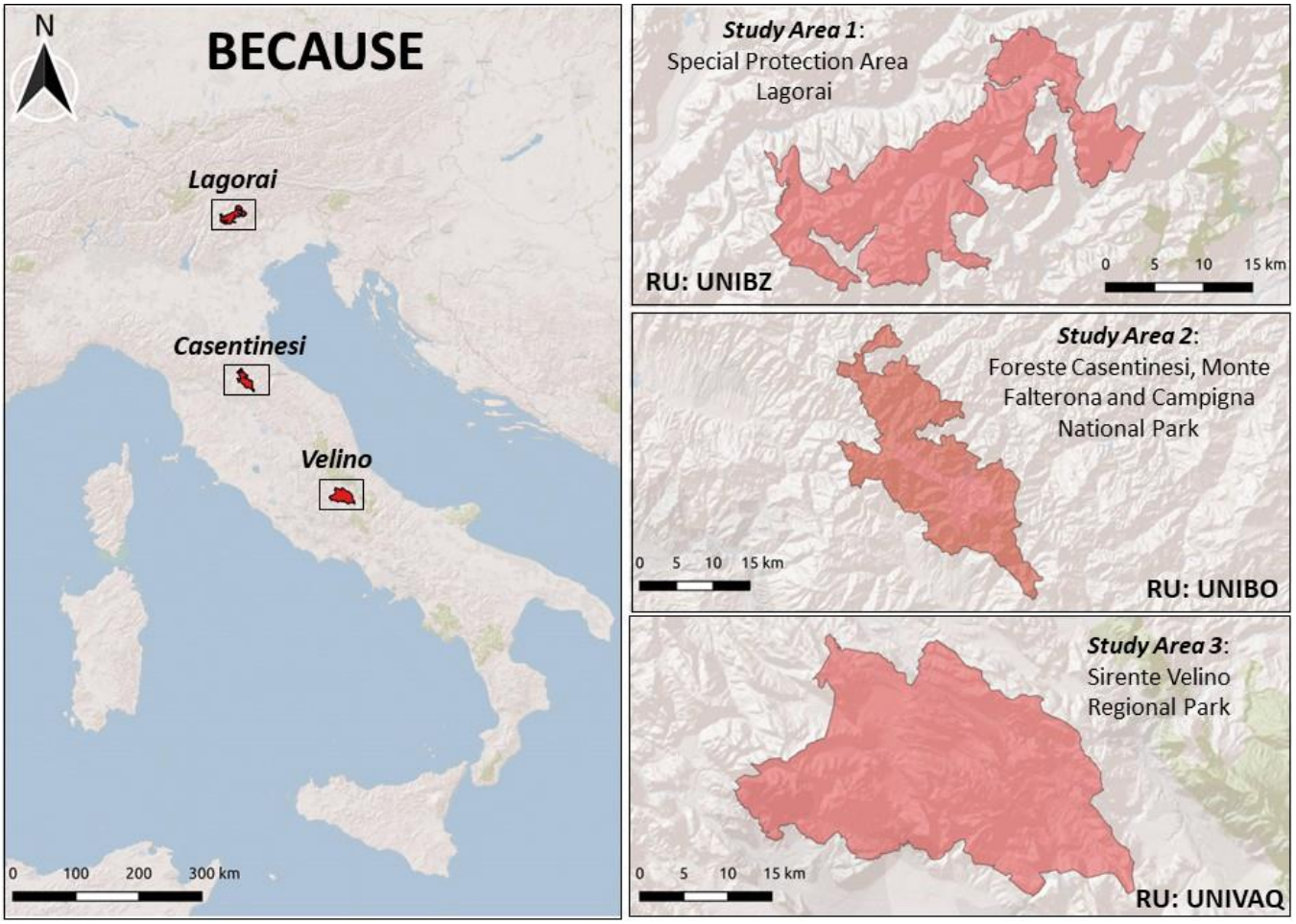
2. Detailed description of the project: methodologies, objectives, and results that the project aims to achieve; indicate deliverables and milestones outlining the project coherence as to the strategic themes, indicating clear and innovative objectives, setting out the project sector relevance and its positioning with reference to the state of art, describing the role and contribution of each research unit

OBJECTIVES
The overall objective of BECAUSE is to understand historical trends and future outlooks of plant diversity and ecosystems in Natura 2000 mountain areas undergoing spontaneous rewilding. The specific objectives are to:
- Assess how temporal changes in land cover affected the composition and spatial distribution of plant biodiversity, highlight areas of maximum compositional change and quantify the proportion of species for which rewilding substantially improved or worsened the conservation outlook;
- Disentangle and characterize the multiple pressures driving habitats and biodiversity changes and develop narratives for interpreting these changes;
- Predict the impacts of different climate change scenarios on the future distribution of vegetation, combining vegetation vulnerability and exposure to future climate change to identify the areas with the higher risk of vegetation change.

METHODOLOGY
BECAUSE will try to tackle these objectives in three Italian mountain protected areas covering a wide latitudinal gradient from Northern to Southern Italy, chosen for having similar environmental features and experiencing analogous socio-economic trends. BECAUSE is composed of five Work Packages (WPs). WP1 is devoted to gathering and harmonizing all existing vegetation plot data in the study areas. WP2 complements WP1 and aims at collecting additional field data to fill potential data gaps, and at resurveying historical vegetation plots to facilitate multi-temporal comparisons. WP3 will use data from WP1 and WP2 together with climate and land cover change variables, to fit a time-invariant, spatially explicit model quantifying the impact of rewilding-induced change in land cover on vegetation. Qualitative data collected by interacting with local stakeholders will help interpreting model results. WP4 will build on WP3, testing whether biodiversity trends observed in the last thirty years will continue under climate change, and producing a spatially explicit assessment of the vulnerability and exposure of vegetation and ecosystems to climate change, by borrowing concepts and approaches from risk science. WP5 deals with coordination, management and dissemination.



We will work in three study areas:
1) The Lagorai mountain range (responsible: UNIBZ) is placed in eastern Trentino and represents the southwesternmost outpost of the Dolomites. It extends for about 70 km and is considered the best wilderness area of the entire Alps. Though traditional agropastoral activities are still taking place, mainly in the submontane belt, these decreased substantially in the last three decades. Most of Lagorai is a Special Area of Conservation containing 35 Annex I habitats. The highest peak, Cima di Cece, reaches 2,754 m asl. Vegetation is characterized by sparse woodlands of Pinus cembra and Larix decidua at lower elevations, while Carex curvula grasslands, Salix herbacea snow beds and heaths of Rhododendron ferrugineum and Vaccinium spp. dominate at higher elevations.
2) Foreste Casentinesi, Monte Falterona and Campigna National Park (Foreste Casentinesi NP, hereafter for brevity; Responsible: UNIBO) is located in the Northern Apennines. It spans over 36,800 ha, 1,320 of which are under strict protection including 'Sasso Fratino', an old-growth forest recently included in the UNESCO world heritage list. The area of the NP overlaps with 12 Natura 2000 sites. The NP encompasses an elevational range comprised between ca. 500 m and 1,657 m asl and is largely covered by Fagus sylvatica forests, with large areas locally dominated by Abies alba. On the northern side, the dominant land uses were croplands and pastures until the mid of the 20th century, when mountain settlements were gradually abandoned, forest harvesting decreased and Quercus and Ostrya carpinifolia forests expanded substantially [16].
3) The Velino Massif (Responsible: UNIVAQ) is located within the Sirente Velino Regional Park, one of the largest regional parks in the Central Apennines, which partially overlaps with a Natura 2000 site. The massif encompasses an elevational range from ca. 1,000 m to 2,487 m asl, and has a complex orographic structure partly determined by quaternary glaciations. This complexity offers a wide range of microclimatic conditions, resulting in very high plant and habitat diversity: the massif hosts more than 650 plant species and 20+ Natura 2000 Habitats. The area was intensely grazed for centuries and is still almost totally treeless.



DETAILED DESCRIPTION OF THE WPs

WP1 – Gathering and harmonization of existing vegetation plot data

Lead participant: UNIBZ

Contributors: UNIVAQ, UNIBO

Start Month: 1

End Month: 14

Objectives:

1) Build a vegetation-plot database for the study areas; 2) Retrieve, aggregate and georeference vegetation plot data from (un)published sources; 3) Create a workflow for taxonomic standardization.

Task 1.1: Retrieve vegetation plot data for the study areas from existing databases

As a first step for building an electronic database of georeferenced vegetation-plot data for the study areas we will perform a fine-tuned search for already-digitized data by querying the main Italian vegetation-plot repositories (i.e. VegItaly, AMS-VegBank, VPD-Sapienza, CircumMed), and negotiating with database holders the conditions for accessing the data.

Task 1.2: Retrieve and georeference vegetation-plot data from published sources

We will then retrieve additional vegetation plot data from published sources, including grey literature, but not yet digitized. For each vegetation plot, we will assign the geolocalization as well as the positional uncertainty, to allow a reliable matching of vegetation data with spatial predictors from WP3. The most plausible geographic position will be assigned to plots without explicit coordinates combining toponym databases and existing vegetation maps.

Task 1.3: Aggregate all data into a workable electronic database

After defining the database and metadata structure, all data from Tasks 1.1 and 1.2, as well as unpublished vegetation-plot data already in the availability of the Research Units (RUs), will be harmonized and aggregated into a workable electronic database according to the most recent techniques of data storing. This preliminary database will be used in WP2 for prioritizing areas for collecting additional vegetation plots in the field (Task 2.1).

Task 1.4: Integrate newly collected data from WP2 into the database and standardize taxonomic nomenclature

Newly collected data from WP2 (Task 2.3) will then be included and harmonized in the database, finalizing the data collection process. The final step will be developing a workflow for standardizing the taxonomic nomenclature, and applying this workflow to the database, therefore finalizing data preparation for the subsequent WPs (Deliverable D1.1).

WP2 – Collection of additional vegetation plot data in the field

Lead participant: UNIVAQ

Contributors: UNIBO, UNIBZ

Start Month: 7

End Month: 14
Objectives:
1) Identify the spatial and temporal gaps in the data gathered in WP1; 2) Define a survey scheme for collecting additional data; 3) Collect data in the field to increase the spatial and temporal coverage of existing vegetation plot data.
Task 2.1: Identify the spatio-temporal gaps in the vegetation data
This task will check whether the vegetation data aggregated in WP1 (Task 1.1, 1.2, 1.3) are representative of the three study areas, both in terms of geographic distribution, and habitats sampled. Maps of land cover (e.g., Corine Land Cover) or habitat distribution (e.g., EUNIS) will be used as a benchmark. We will then create maps of well sampled and undersampled areas in each study region (D2.1). We will also prioritize for resampling a representative subset of historical vegetation plots sampled in the 90s or earlier, among those having sufficient positional accuracy.
Task 2.2: Define survey protocols and a sampling design for the three study areas
After the identification of the areas to sample, and historical plots to resurvey, we will define a standard field survey protocol to be employed by all the RUs. A statistically sound sampling design will be developed to maximize the compositional and environmental variability of the areas to sample. The sampling effort will be defined as a function of: a) the size of the study areas, b) the number of vegetation plots available, and c) the spatial and habitat representativeness of existing data.
Task 2.3: Collection of new vegetation plot data in the field
Based on the sampling design and survey protocols from Task 2.2, we will collect new vegetation plots in the field. Compatibly with the available resources, we will sample a minimum of 40 new vegetation plots and resample a minimum of 20 historical vegetation plots across all areas. All vegetation plots will be sampled at the peak of the vegetative season.

WP3 – Quali-quantitative modelling of historical land cover change effects on vegetation
Lead participant: UNIBO
Contributors: UNIVAQ, UNIBZ
Start Month: 9
End Month: 24
Objectives:
1) Model biodiversity changes since the 90s; 2) Highlight areas of maximum compositional change; 3) Disentangle the relative contribution of different drivers of biodiversity change; 4) Combine qualitative and quantitative data and develop narratives for interpreting these changes.
Task 3.1: Gather predictors of biodiversity change and reconstruct land cover history of the study areas
For each study area, we will gather a set of potential predictors of biodiversity change, making use of available data such as SoilGrid and CHELSA [17,18], but also historical maps and aerial photography, where available. Decadal collections of remote sensing imagery will be obtained by the COPERNICUS and LANDSAT archives through Google Earth Engine. All vegetation plots from WP1 and WP2 will be matched to their corresponding pixel or set of pixels in the satellite images of the year these plots were sampled, as a proxy for land cover.
Task 3.2: Calibrate spatially explicit biodiversity models and create maps of maximum compositional change
For each study area, we will calibrate a spatially explicit, time-invariant generalized dissimilarity model (GDM)[19] linking plot-to-plot compositional dissimilarity, to the dissimilarities in terms of environmental predictors and spectral response. We will then pinpoint the most important drivers of change for the study areas. Model outputs will be used to predict the compositional dissimilarity over the entire study areas, based on pixel-to-pixel environmental and spectral dissimilarities from satellite images, and to infer plant species composition for each pixel at the year 1992 (i.e., introduction of the Habitats Directive) and 2022. By spatializing and comparing these predictions, we will produce maps of maximum compositional change (D3.1), and quantify the consequences for regional plant diversity, i.e., assessing whether rewilding substantially decreased the proportion of plant species committed to extinction as in [13,20].
Task 3.3: Elicit stakeholder participation and capture local expert knowledge on changes in biodiversity
To achieve a deeper understanding of the multiple pressures driving environmental and biodiversity change in the study areas, we will integrate quantitative estimations from Task 3.2 to stimulate stakeholder participation and capture qualitative expert opinions on the accuracy and interpretation of our results. To do this, we will implement innovative go-along walking methods, an increasingly used research tool for capturing data relating to people's experience, knowledge and attitudes to surrounding landscapes [21].
Task 3.4: Manuscript preparation
Quali-quantitative results from Task 3.2 and 3.3 will then be used to prepare three scientific manuscripts describing the impacts of rewilding-induced land cover change over the last thirty years on the study areas in the Foreste Casentinesi NP (D3.2), in the Lagorai range (D3.3), and one summarizing the lessons learnt and ways forwards across all areas (D3.4).

WP4 – Climate change scenario modelling
Lead participant: UNIVAQ
Contributors: UNIVBO, UNIBZ
Start Month: 9
End Month: 24
Objectives:
1) Assess temporal trends in vegetation plot time series; 2) Create spatial predictions of temporal trend indices and combine them to map vegetation vulnerability; 3) Estimate vegetation exposure to climate change; 4) Combine vulnerability with exposure to map climate change related risks for vegetation.
Task 4.1: Analyse temporal changes of plant communities through vegetation plot time series

For all vegetation plots from WP1 and WP2 where more than one temporal survey is available, we will calculate the change in species richness, identify gained and lost species and estimate temporal changes in Shannon's index of diversity, Pielou's index of evenness, and plot's rank abundance curves [22], defining a set of Temporal Trend Indices (TTI) at plot-level to quantify vegetation change over time. Finally, we will identify winners and losers at species level, i.e., species that significantly increased in occurrence or abundance over time, as well as the most vulnerable plant species. The Velino study area will be used as a benchmark and will be the subject of a dedicated manuscript (D4.1).

Task 4.2: Gather future climatic predictors under alternative scenarios and calculate climate change velocity

We will integrate the variables gathered in Task 3.1, with a set of bioclimatic variables for years 2030, 2050, and 2070 [17]. To obtain alternative future predictions, two distinct Shared Socio-economic Pathways (SSPs) will be considered. For each SSP we will use three different General Circulation Models (the GFDL-ESM4, the IPSL-CM6A-LR and the MRI-ESM2-0) to account for predictions' uncertainties across GCMs. These data will be used to create maps of climate change velocity under different scenarios using four time frames (current, 2030, 2050 and 2070) [15], as a proxy of vegetation exposure to climate change.

Task 4.3: Spatial downscaling of current and projected bioclimatic variables

Bioclimatic variables are only available at a relatively coarse spatial resolution (250-1000 m), much coarser than the resolution of typical vegetation plots (4-100 m). To avoid this scale mismatch, we will downscale all the spatial predictors to a 20 m of resolution using geographically weighted regression models.

Task 4.4: Fit statistical models to identify how climate contributes to the observed temporal trends

Vegetation adjust slowly to climate variation, so that past climate conditions might be better predictors of vegetation changes, than current climate. We will test whether the climatic conditions of a vegetation plot when originally sampled (T0, e.g., in the 90s) are useful for predicting the observed TTIs between T0 and T1 (Task 4.1) using established statistical models (e.g, GLMs, GAM). The relative contribution of single climate predictors will be assessed using variation partitioning, and model accuracy through root mean square error. In this way, we will highlight areas of maximum vegetation change (D4.2).

Task 4.5: Create maps of climate change related risk for vegetation

Models from Task 4.4 will then be used to predict TTI to the near future using current bioclimatic variables as predictors, and provide a spatially explicit estimation of vegetation change over time. By highlighting areas where vegetation is predicted to change the most under climate change, we will create maps of vegetation vulnerability. These will be combined with maps of exposure to climate change from Task 4.2. We will then produce maps of risk of vegetation changes under alternative climate change scenarios, as the combination of vulnerability and exposure, which will be described in a dedicated manuscript (D4.3).

WP5 – Coordination, Management and Dissemination

Lead participant: UNIBO

Contributors: UNIVAQ, UNIBZ

Start Month: 1

End Month: 24

Objectives:

1) Coordinate and supervise the project research according to the work plan; 2) monitor and ensure quality and timing of project deliverables; 3) carry out the overall administrative and financial management and reporting; 4) establish effective internal and external communication; 5) resolve possible conflicts; 6) manage the data generated by the project.

Task 5.1: Coordination, project meetings and reporting. Ethical compliance

The PI working closely with the co-PI will coordinate activities and periodic reporting, and monitor the activities. The PI will organize, implement and follow up a kick-off meeting and periodic meetings, online whenever possible. The PI, in close collaboration with the partners, will ensure compliance of research activity with the fundamental principles of research integrity. Special attention will be paid to equal opportunities in the recruitment procedures, informed consent procedures, and protection of personal data.

Task 5.2: Overall legal and contractual management

The PI, assisted by the WP leaders, will supervise and guarantee the coherence between the project activities and the workplan, and lead discussion on amendments and revisions of the workplan if necessary. The PI will manage the financial reporting and guarantee assistance to the consortium on administrative and financial issues.

Task 5.3: Communicationm dissemination and outreach activities

The PI, in cooperation with the WP leaders, will carefully review the results of the project. Results will be communicated and shared in accordance with the dissemination and communication strategy. Actions under this task will be carried out with the assistance of the Co-PI paying a particular attention to monitoring, management and exploitation of those results having a higher innovation potential.

Task 5.4: Data Management

A Data Management Plan (DMP) will be established to support the data management life cycle for all data that will be collected, processed or generated. The responsible for the data and DMP is the leader of WP1. The DMP will be a dynamic document in which all partners will actively participate throughout all the project duration, being updated according to needs, and any arising framework conditions. We will conform to "open by default" and "as open as possible" data policies, as recommended by the EU. A first DMP will be delivered at month 6 (D5.1) and regularly updated (M12, M23).

EXPECTED RESULTS

BECAUSE will deliver five scientific manuscripts to be submitted to international peer-reviewed journals in the top Quartile of their subject. Tentative titles, potential journal outlets and the link to the corresponding deliverable are listed below:

Manuscript 1: Land abandonment caused the expansion of forest area and the habitat homogenization in the Foreste Casentinesi National Park - Potential journals: Forest Ecology and Management. D3.2

Manuscript 2: Land-use change differently drives grassland succession at different elevations in the Lagorai mountain range - Potential journal: Journal of Vegetation Science. D3.3
Manuscript 3: Thirty years of spontaneous rewilding in Italian Natura 2000 mountain areas: consequences for biodiversity and conservation - Potential journals: Proceedings of the Royal Society B. D3.4
Manuscript 4: Contrasting role of land abandonment and climate change on rewilding processes in Velino Massif (central Apennines, Italy) - Potential journals: Regional Environmental Change. D4.1
Manuscript 5: Vegetation vulnerability, exposure and risk under climate change in Italian mountain areas - Potential Journals: Global Change Biology. D4.3

DELIVERABLES (AND RESPONSIBLE RU)
D1.1 Taxonomically standardized multitemporal database of historical and resurveyed relevés (UNIBZ)
D2.1 Ecosystem maps of well sampled and undersampled areas in the three study areas (UNIVAQ)
D3.1 Maps of maximum compositional change for the three study areas (UNIBO)
D3.2 Manuscript 1 (UNIBO)
D3.3 Manuscript 2 (UNIBZ)
D3.4 Manuscript 3 (UNIBO)
D4.1 Manuscript 4 (UNIVAQ)
D4.2 Maps of vegetation risk to climate change (Vulnerability x Exposure) (UNIVAQ)
D4.3 Manuscript 5 (UNIVAQ)
D5.1 Data Management Plan (UNIBZ)

MILESTONES
M1 Kickoff meeting
M2 Multitemporal database of existing vegetation plots established
M3 First semester reporting
M4 Vegetation plot data collected in the field and integrated in the database
M5 Spatial predictors and climate change scenarios collected and harmonized
M6 Statistical model of ecosystem change fitted and validated
M7 Maps of climate change-related risk for vegetation created
M8 Final meeting and report

PROJECT SECTOR RELEVANCE & POSITIONING WITH REFERENCE TO THE STATE OF THE ART
Climate change and biodiversity loss pose existential threats to human societies and are the most critical challenges for meeting UN SDGs. This urgence is well recognized in EU legislation, and it has been incorporated by the EU Biodiversity Strategy for 2030 [4], as well as by the European Green Deal (COM(2019)640) and the European Climate Law (Regulation (EU) 2021/1119).
BECAUSE strives to tackle conservation-relevant research questions, providing results that will be relevant within and beyond the study areas.
At the study area level, BECAUSE will improve the understanding of the effects of past and current drivers of biodiversity change and will produce explicit assessments of vegetation risk to climate change. This will provide protected area managers with a clearer understanding of the socio-ecological drivers at play and help them improve the allocation of resources to protect habitat and/or species through a dynamic approach to conservation, which internalizes uncertainties linked to global change.
The relevance of BECAUSE beyond the study areas relates to two main aspects. 1) It will benchmark the ecosystem-level effectiveness of rewilding in a quasi-experimental fashion, therefore providing evidence of the challenges and opportunities of applying this NBS in other mountain areas of Europe. 2) It will bring clear innovation potentials from the methodological point of view. By merging state-of-the-art statistical modelling, remote sensing, qualitative data collection methods, and an approach borrowed from risk science, BECAUSE tackles complex environmental problems and creates a multi-faceted understanding of the drivers shaping biodiversity patterns and trends.
BECAUSE's four main conceptual and methodological advances are listed below, together with the corresponding task, the relevance (local, general) and the Technological Readiness Level (TRL) (initial -> final):
1) Multitemporal database of vegetation-plot data in the three study areas. Task 1.4. Interest: local and general. TRL: 6 -> 8
2) Statistical models integrating satellite and ground vegetation data. Task 3.2. Interest: general. TRL: 7 -> 9
3) Novel mixed-methods approach to quali-quantitative interpretation of biodiversity and ecosystem trends. Task 3.3. Interest: general. TRL: 5 -> 7
4) Risk analysis of climate change impacts on vegetation. Task 4.5. Interest: general. TRL: 3 -> 6

COHERENCE WITH THE STRATEGIC THEMES
With respect to project coherence as to the strategic themes of the national plan for recovery and resilience (PNRR), BECAUSE perfectly matches the need of the PNRR with regards to "Nature conservation - monitoring pressures and threats on species and habitats and climate change", in relation with strengthening monitoring actions through advanced tools. BECAUSE also fits Mission 2 "Green revolution and ecological transition" and Component M2C4 "Protection of land and water resource". In line with EU Biodiversity Strategy for 2030, this proposal contributes to enhancing two measures of Component M2C4: for about 50% to Measure 1 "Strengthening the predictive capacity of climate change effects" for Investment 1.1 "Implementation of an advanced and integrated monitoring and forecasting system" (WP1, WP2), and for 50% to Measure 3 "Safeguarding the air quality and biodiversity of the territory by protecting green areas, soil and marine areas" for Investment 3.2 "Digitalisation of national parks and marine

protected areas" (WP3, WP4).

RUs' ROLE AND CONTRIBUTION
To maximize project success, tasks are assigned to RU partners based on their expertise. UNIBO is the Project Coordinator and leader of WP3 and WP5. In addition to coordinating the consortium (WP5), UNIBO will provide the project with multi-disciplinary competencies towards land use science, remote sensing and biodiversity modelling. UNIVAQ is the leader of WP2 and WP4 and will be in charge of coordinating the field surveys, preparing climate change scenarios and modelling vegetation impacts and risks. UNIBZ is the leader of WP1, will be responsible of data management and integrity, and will tutor all the steps related to database preparation and implementation along with the metadata infrastructure. All partners will collaborate closely during the phases of data collection, analysis, manuscript preparation and dissemination. The sampling campaigns will be conducted in close coordination across all RUs to maximize output.

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3. Detailed description of the project team and planning; indicating the research team components – PI and associated PIs - and their relative expertise/track record, gender equality of the composition, the interrelation and coherence of the team components. RUs- and the feasibility of the project, thus outlining the congruity between objectives, timing and costs

BECAUSE is formed by a core team of young scholars doing cutting-edge research in their respective fields as demonstrated by their CVs. All WP leaders are <40y old and are supported by lead professors in their field. In total, the project counts eight researchers from three RUs with a 5:3 ratio in favor of young ones (<40y old), and a 3:1 male/female ratio. The primary research interest of all RUs is vegetation science and biodiversity conservation, but the RUs are complementary in terms of skillset and expertise, and they focus on different geographical regions of Italy. Collectively, the project team can boast expertise in ecology, plant taxonomy, geoinformatics, habitat interpretation, big data analysis and management, biodiversity modelling, land use science, remote sensing, and geography. This mix of expertise is central to our interdisciplinary research ethos, and we will strive to ensure the contamination with viewpoints of actors outside of the academic sector. For example, the Botanical Section of the Museo Civico di Rovereto will be involved in WP1 by UNIBZ, while UNIBO and UNIVAQ can boast a long-lasting collaboration with the management authorities of the Foreste Casentinesi NP, and Sirente Velino Regional Park, respectively.

Although this is the first time these three RUs come together into a project, all RUs have a strong, productive history of collaboration with each other [23], in one-to-one in projects (e.g., CONplant project: UNIBZ+UNIBO), in scientific publications ([24,25]) and by the joint participation to international consortia such as sPlot – The global vegetation-plot database, the European Vegetation Archive, and ReSurvey Europe [26–28]. This will ensure productive working relationships and efficient collaboration.

As overall project leaders, UNIBO holds extensive expertise in environmental and social science, biodiversity monitoring, ecosystem modelling, climate change adaptation and mitigation, and qualitative and quantitative sociological research. This, combined with the institution's finely-tuned capabilities to conduct large-scale transdisciplinary projects (having participated to 145 funded Horizon projects), will ensure the leaders have a broad and in-depth oversight of all WPs, tasks, milestones, and deliverables. The PI, Dr. Francesco Maria Sabatini is a Rita-Levi Montalcini assistant professor (RTD-B) of "Plant Biodiversity and Landscape Ecology" with 12 years of academic age. He has a background in forest ecology and vegetation science, with a strong skill in biodiversity modelling, big data analysis, land use science and macroecology. He is a Marie Skłodowska-Curie alumnus and has a track record of international experience and collaborations, having spent six years doing research abroad, and having served for three years as coordinator of sPlot [28,29], an international consortium counting more than 150 vegetation scientists. Since 2020, FMS is associate editor for the "Journal of Vegetation Science", and "Diversity and Distribution". UNIBO's team can also boast the participation of Prof. Alessandro Chiarucci, an Italian lead scientist in ecology and conservation biology, and head of the Biogeography and Macroecology Lab (BIOME). AC published 217 papers in peer-reviewed international journals and collected 4,669 citations (Scopus. Nov 24, 2022). A pivotal role in UNIBO's RU is held by Dr. Arianna Ferrara, a promising PhD candidate, with a deep knowledge of the vegetation and land use history of Foreste Casentinesi NP and strong connections with the national park authorities.

UNIVAQ team will contribute key expertise for the modelling of the effects of climate on vegetation dynamics, and on the reconstruction of temporal trends of plant diversity based on vegetation resurveys. UNIVAQ team members are part of the LACEMOD working group, an interdisciplinary lab bringing together ecological modelists with evolutionary biologists. The Co-PI, and leader of UNIVAQ RU is Dr. Michele Di Musciano. He earned a PhD in Ecology in 2020, and he is currently fixed-term assistant professors (RTD-A). MDM is an environmental biologist with a background in alpine plant ecology, ecological modelling, and plant dispersal traits, and recognized skills in analyzing temporal patterns of plant communities, which he uses for conducting research on the contribution of protected areas to biodiversity conservation in Europe. UNIVAQ team can also rely on the contribution of Prof. Anna Rita Frattaroli, an experienced vegetation scientist and seed ecologist. She is the head of the council of the academic division for environmental science. ARF published 63 papers in peer-reviewed international journals and was cited 642 times (Scopus. Nov 24, 2022). Support for UNIVAQ's activities will be delivered by Lorenzo Ricci, a PhD candidate with extensive expertise on the biodiversity and vegetation of the Velino Massif.

UNIBZ team has international expertise in botany, and a strong background in taxonomy, ecoinformatics, vegetation science and landscape ecology. UNIBZ's team members have worked on basic and applied aspects of biodiversity conservation, restoration

ecology, ecosystem management and sustainable land use across a multitude of organizational levels, in close cooperations with colleagues from the social sciences. The RU leader, Dr. Gianmaria Bonari, is a young scholar with 8 academic years age. His academic training includes ecoinformatics, habitat interpretation, vegetation classification, biodiversity management and conservation. He is the custodian of an international database of vegetation plot data (CircumMed), a member of the Steering committee of the Italian Society for Vegetation Science and of the Steering committee of its database VegItaly database, a council member of the European Vegetation Archive and a member of sPlot. He is a lecturer for the "Protected Areas and Nature Conservation" and “Plant biodiversity” courses at UNIBZ and participated to numerous national-scale projects (CONplant - PI; BIOmen - PI; CONE - CoPI; TracEve - participant) attracting an overall budget of approximately 570k€. Since 2022, he is co-editor of “Plant Sociology” and part of the Editorial Review Boards of “Applied Vegetation Science” and “Biodiversity and Conservation”. The UNIBZ team can also benefit from the participation of Prof. Stefan Zerbe, a lead scientist in landscape ecology and restoration, and head of the working group on Interdisciplinary Landscape Ecology at UNIBZ. He published 176 papers in peer-reviewed international journals, with 3,205 citations (Scopus; Nov 24, 2022).

BECAUSE’s team is internally coherent, complementary and strongly interrelated. Coherence stems from the common cultural substrate of the three RU leaders. Complementarity relates from their different biogeographic expertise and skillsets. Interrelation depends on the main expertise of the RUs leaders: FMS will contribute expertise in forest vegetation, biodiversity modelling and remote sensing. MDM will provide key knowledge on alpine ecology, protected areas, vegetation change analysis and time series. GB has experience on plant taxonomy and identification, habitat interpretation, vegetation classification, community ecology and data management.

GENDER EQUALITY

BECAUSE embraces the gender mainstreaming approach proposed by the EU’s European Institute of Gender Equality (EIGE): first, by taking gender into account in our project’s conceptual and methodological design, and second, in ensuring gender representation in research practices through the make-up of the research team. BECAUSE strives at promoting equality across all aspects of project management, planning, implementation, and execution. Especially when hiring staff, BECAUSE will provide equal opportunities to all candidates – regardless of gender, nationality, ethnic background, age, religion or belief, sexual orientation or disability – in line with the EU directives 2000/43/EC, 2000/78/EC and 2006/54/EC. To reduce implicit biases of situated knowledge through collective/collaborative design, important gender perspectives are integrated into BECAUSE’s implementation phase. In our Research practice we will account for gender and other axes of difference and power in planning and implementation of the research program across WPs, including background research, research question design, establishing stakeholder groups, and data collection and analysis. Gender-aware and intersectional thinking (which encourages consideration of overlapping or intersecting categories such as gender, ethnicity, age, socioeconomic status, sexual orientation or geographic location) are foundational to our project design and implementation. We ensure this takes place by: 1) considering sex and gender in formulating our interview questions during stakeholder meetings; 2) ensuring fair and representative gender balance in all stakeholder meetings, and in any other project aspects which focus on citizen actor engagement; 3) taking into account gender stereotypes in the qualitative data collection methods and tools and anticipating and paying attention to social and cultural factors that may introduce gender bias into the data.

FEASIBILITY OF THE PROJECT & CONGRUITY BETWEEN REQUIREMENTS AND COSTS

There are three elements that contribute to the overall feasibility of BECAUSE: 1) the mutual understanding and synergies among RU and WP leaders; 2) the mixture of expertise and skills contributed by each RU, and 3) the fact that the study areas are well known by the RU leaders, for conducting previous research (e.g., [16,30,31]), and having an established network of collaboration with local experts, authorities, protected areas managers, and local stakeholders. Furthermore, the strong connections between RUs and their respective study area will greatly facilitate the logistics of fieldwork activities. The three RUs have also collected, over the years, a baseline of data which will be employed in the project and integrated with the activities described in WP1 and WP2. Fieldwork in WP2 has been planned to be commensurate with the allocated resources. Each RU will be responsible for the fieldwork in their respective study areas, but all field activities will be conducted in collaboration among RUs, to compensate for the fact that UNIBZ will not hire any staff specifically dedicated to the project.

The modelling part of WP3 and WP4 is the most ambitious part of BECAUSE. These tasks are under the responsibility of the PI and Co-PI, and their proven experience in working with vegetation plot and big data, as well as in modelling spatial patterns and temporal trends of vegetation, guarantees that BECAUSE will deliver the promised results. All the three RUs and their respective institutions host the necessary structures and facilities for the correct unfolding of the project, are equipped with labs for botanical sample identification and have access to servers for data storing and big data analysis.

The potential obstacles to BECAUSE´s success are listed below, together with possible solutions.

- From the management point of view, we foresee three potential risks:

1) Under- / overestimation of workload leading to congestion of the activities and delays in the planned progress

Solution: Significant attention was paid to the estimation of the workload subdivision among RUs according to the effective needs and available resources. The workload will be constantly monitored and, if needed, the tasks will be revised and/or the allocation of workload among RUs adapted to the contingent situation.

2) Unexpected delay achieving milestones/deliverables

Solution: The PI will monitor tasks against the allocated time. WP leaders will monitor WP partners to detect the onset of delays at early stages and plan measures to support (individual) RUs.

3) Inaccurate budget allocation

Solution: Identify necessary re-allocations among partners and/or between cost categories, define a new budget distribution to be

approved by all partners and to be submitted to the funding agency for approval.

- From the technical point of view, we foresee six potential risks to the achievement of the desired outcomes and impacts:
1) Insufficient vegetation plot data in the study areas
Solution: We selected case studies where we worked already, and some vegetation plot data are already in our availability. These data will be integrated with additional data from existing databases, literature search and newly collected vegetation plots in the field.
2) No access is granted to data from existing databases
Solution: GB and MDM are contributing members of the European Vegetation Archive. This fact grants they can access data from the Archive, at least those released as open and semi-restricted data (see http://euroveg.org/download/eva-rules.pdf). May additional restricted data exist, we will approach data owners negotiating case by case for the conditions to access these data, for instance offering the opportunity to contribute to BECAUSE, and potentially co-author the resulting papers.
3) Permissions to conduct biodiversity surveys in protected areas not granted
Solution: Case study responsible persons have already established contact with protected areas and land managers, and anticipated that a permission will be sought for. In case permissions cannot be granted for biodiversity conservation reasons, we will limit sampling to non-destructive methods for which permission can be issued.
4) Mismatch between project's calendar and phenological season of vegetation
Solution: Botanical surveys can only be conducted in spring-summer. May the project start too late in the vegetative season, therefore impairing the preparation of a successful field survey, we will rearrange our activities to split the field survey across two consecutive calendar years. In parallel, we will proceed with the preparation of the modelling workflows and will perform test runs based on partial datasets.
5) Non-homogeneous contributions from study areas
Solution: All field methodologies will be defined and standardized before the onset of data collection activities. Where relevant, UNIVAQ will offer capacity building workshops or on-the-field training sessions to other members to ensure data collection is harmonized across case study regions.
6) Low interest from local stakeholders to participate in the project
Solution: To minimize this risk we will: 1) work with existing stakeholder forums as much as possible, 2) closely involve stakeholders early on in BECAUSE project design, hence ensuring their motivation to participate, and 3) work on real-life case studies in which the research, and participation in it, can make a concrete difference in the way the study areas are managed by protected area authorities.

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4. Detailed description of the Project impact, as such; indicating knowledge improvements, technological innovation and/or industrial applications, scientific community reinforcement, level of research internationalization, dissemination and exploitation of the results

KNOWLEDGE IMPROVEMENTS, TECHNOLOGICAL INNOVATION AND/OR INDUSTRIAL APPLICATIONS
BECAUSE will contribute to improving the knowledge base on the pros and cons of passive rewilding, as a Nature-Based Solution, to tackle problems related to biodiversity loss and climate change impacts. We foresee the delivery of four Key Exploitable Results (KER).

KER 1: Multitemporal database of vegetation plot data in the three study areas
By gathering all available vegetation plot data on the study areas, and by integrating them with newly collected vegetation plot data in the field, the database we will produce in WP1 has the potential to become a key instrument for protected area authorities when monitoring plant biodiversity trends. Our database will also stimulate protected area authorities to digitize their procedures of biodiversity data storage and analysis (see §Coherence with the Strategic themes).

KER 2: Synthesis paper on the long-term effects of rewilding in Italian mountain areas
Rewilding is increasingly seen as a win-win solution to counter biodiversity loss, while simultaneously providing climate benefits. BECAUSE will test this assumption using three real-world examples. Our study areas were chosen among those that underwent a process of spontaneous rewilding. By integrating survey data, remote sensing, quantitative modelling and qualitative data on stakeholders' perceptions, we will create a multi-faceted understanding of the processes at play, not only by highlighting the most important determinants of vegetation change, but also creating narratives to uncover the underlying socio-economic drivers. This knowledge is crucial to understand opportunities and challenges of rewilding and inform the application of this Nature-Based Solution to other mountain areas of Europe.

KER 3: Maps of vegetation risk to climate change
To understand the impacts of climate change on vegetation, BECAUSE will borrow a key framework from risk science, i.e., considering risk as the combination of exposure and vulnerability. The application of explicit risk analysis to modelling the impacts of climate change on vegetation is a relatively new concept, with relatively few applications (e.g., [32]). If successful, our approach might configure as a new tool for creating predictions of vegetation response to climate change, which can be used by landscape managers to prioritize the conservation of those plant communities that are both vulnerable AND likely to experience higher-than-average rates of climate change.

KER 4: Stand-alone studies on the history of land-cover change in Lagorai, Foreste Casentinesi NP, and Velino Massif area
We have pinpointed a few conceptual and methodological contributions that BECAUSE is likely to have in general. Yet, BECAUSE remains an intimately national study, which is rooted in and revolves around the target study areas. And it is for these study areas that we expect BECAUSE to have the maximum impact. BECAUSE will develop a deep understanding of the socio-ecological trajectories that these areas have followed in the last thirty years, therefore creating narratives that can be used to highlight the specificity and unique nature of the coevolution between the ecological and human systems. By creating possible scenarios of ecosystem evolution under climate change, BECAUSE will help embracing all of the uncertainties linked to climate change, and serve as an inspiration for switching from a static to a dynamic approach to conservation. This will ultimately help protected area managers to improve the allocation of conservation resources.
For more details on the exploitation of each of these KER, please see the dissemination subsection below.

SCIENTIFIC COMMUNITY REINFORCEMENT
BECAUSE will strengthen synergies among RUs and team members and contribute to the cross-contamination of the research cultures at the three institutions. While the three RU leaders share a common background in vegetation science, in their daily practice they do research at different scales, in different socio-ecological context, and based on different research philosophies. All RUs leaders will encourage their team members to undertake exchange periods at the other RU institutions, as a tool for increasing knowledge exchange, maximising synergies and improving collaboration. BECAUSE represents therefore an opportunity to strengthen the ties among the RUs.
But the positive effects of BECAUSE are likely to spill over also to scientists based in institutions not involved in the project, as well as to conservation practitioners and natural protection agencies. The three WP leaders are enmeshed in a dense network of research contacts in Italy and beyond, and these contacts will most likely be leveraged for getting feedbacks on specific aspects of the project and create collaboration opportunities. For instance, in the construction of the database (WP1), GB will seek for advice from his former supervisor from Masaryk University of Brno, Prof. Milan Chytrý, one of the lead vegetation scientists in Europe and head of the European Vegetation Archive, as well as Prof. Zdeňka Lososová, an expert of European vegetation working at the same institution. When analyzing the conservation implications of our results, we will engage with colleagues from the newly established Italian Chapter of the Society of Conservation Biology, which UNIBO and UNIVAQ contributed to found. To effectively model the effects of land cover on vegetation, FMS will seek for advice from his former advisor Prof. Tobias Kuemmerle, head of the Conservation Biogeography lab at Humboldt University in Berlin, ERC fellow and renowned expert in land use science and remote sensing. Problems related to monitoring aspects will be discussed with Prof. Helge Bruelheide and Dr. Ute Jandt from iDiv, the German Center for Integrative Biodiversity Research, where FMS worked for three years, and where MDM is about to spend a short research stay. Support on how to effectively implement the qualitative aspects of our research, such as the go-along walking interviews with stakeholders, can benefit from knowledge exchange with Prof. Roger Norum, from University of Oulu, a human geographer with whom FMS is collaborating in other research projects.
Additional feedbacks will be sought for in international conferences, in particular those organized by the International Association of Vegetation Science, the Society for Conservation Biology, the Italian Botanical Society, the Italian Society of Vegetation Science, the Society for Ecological Restoration, as well as symposia organized by the Rewilding society, the IUCN thematic group on Rewilding, or workshops by supranational conventions, such as the Carpathian Convention and the Alpine Convention.
Altogether, BECAUSE will provide multiple opportunities for creating and reinforcing links both among and between RUs, and other key research institutions in Europe.

LEVEL OF RESEARCH INTERNATIONALIZATION
BECAUSE is a national project with many international implications and links. Besides the one-to-one relationships between the project members and affirmed international colleagues, this project will have international relevance from at least four points of views:
1) The data collected during BECAUSE will be contributed to the European Vegetation Archive, a supranational initiative aggregating vegetation plot data of which GB is a member. Furthermore, data collected within this project will be made available to a broader scientific community by seeking synergies with existing international repositories (e.g. CircumMed DB, AMS-VegBank) of which RU leaders or team members are custodians;
2) Inclusion of the study areas within the network of ReSurveyEurope, a collaborative project aimed at compiling and analysing existing resurveyed vegetation-plot records in Europe and quantify biodiversity trends based on fine-resolution data spread over large extents. BECAUSE will represent an occasion for GB and MDM to reinforce their role as members of the ReSurvey initiative, and for FMS, who is not yet member, to join;
3) Plant specimens collected will be sent to well-established institutions, typically herbaria, that are part of international projects (e.g. JACQUES Initiative) that digitize specimen and collections for reaching a wider scientific audience;
4) Engage with the rewilding community in Europe. Rewilding is gaining increasing momentum in Europe, and there is several lead research institutions currently working on this topic. BECAUSE will help the project team members to engage with these actors, including key NGOs active on the topic such as the Rewilding Europe association, the IUCN CEM Rewilding Thematic Group, The Wildland Research Institute, and the NGO alliance Wild Europe.

DISSEMINATION AND EXPLOITATION OF THE RESULTS
The primary impact of BECAUSE is developing a deeper understanding of the long-term effects of rewilding and creating spatially-explicit predictions of the vulnerability, exposure and risk of plant communities under climate change. A multi-tier strategy will allow BECAUSE to target several stakeholder groups, directly at the case study level, and through dissemination and exploitation

activities targeting: 1) nature protection agencies; 2) protected area managers; 3) regional authorities involved in land use planning; 4) international organisations; 5) policy and decision makers; and 6) the academic community.
BECAUSE will produce various categories of results, whose dissemination measures will target a wide range of potential users. In all cases, the scientific background of such results will be published in scientific peer-reviewed journals and on the project's blog. All partners will be actively engaged in the process by producing relevant material for dissemination as well as by using their personal and institutional networks to promote the project. Key messages of the project will be tailored to different target audiences in terms of content and language. Dissemination is the key to translate BECAUSE results into specific tools and strategies, contributing to enhanced understanding of the potential of passive rewilding in delivering biodiversity benefits in European mountain areas. The following dissemination channels will be used:
1) Dedicated online blog
2) Social network profiles including Twitter, Facebook, LinkedIn, ResearchGate, podcasts and videos
3) Newsletters in electronic format
4) Press releases, interviews and broadcasts
5) Public events such as Research Days
6) Workshops with stakeholders in the protected areas as knowledge-transfer events
7) Peer reviewed scientific papers in high-impact academic journals
8) Presentation of results in scientific conferences and events organised by relevant professional and scientific societies
9) Personal websites of project´s team members

To maximize BECAUSE's impact, we will embrace an open science philosophy, which we will decline in five ways: 1) granting open access to all scientific peer-reviewed publications under Creative Commons Public Domain Dedication (CC-BY) licence; 2) managing research data according to FAIR principles, through the creation of a full Data Management Plan (DMP – D5.1), following best practice for reproducible, ethical and collaborative data science and depositing of data in a trusted European repository. Data will be shared under "open by default" and "as open as possible" policies recommended by the EU, preferably under CC:BY, CC0 or OpenDatabaseLicense (ODbL 1.0) license; 3) Including relevant data repository information on outputs and providing access to data, code and results to ensure reproducibility of research outputs and validation of publications; 4) publishing all source code for the analyses in public repositories, such as GitHub; 5) producing and disseminating findings on popular, non-academic platforms (e.g., blogs, websites, social media platforms, podcasts, and journalistic outlets) alongside the publication of scientific articles.

BECAUSE has the ambition of translating and transferring its main findings beyond relevant stakeholders, thereby stimulating uptake of the project outcomes by policy makers, landscape planners and decision makers. To ensure the optimal and rapid utilization of our main findings, we identified potential users, a dissemination strategy and the potential exploitation for the four Key Exploitable Results (KERs) listed above:
KER 1: Multitemporal database of vegetation-plot data in the three study areas (D1.1)
- Potential users: Protected area authorities, regional agency of nature protection;
- Dissemination strategy: Scientific publications and conferences, online data repositories, publication of code and workflows in GitHub;
- Potential exploitation: Collected vegetation plot data is integrated in monitoring schemes at the protected area or national level.
KER 2: Synthesis paper on the long-term effects of rewilding in Italian mountain areas (D3.4)
- Potential users: Scientific community, protected area authorities, land managers;
- Dissemination strategy: Scientific publications and conferences, online blog, workshops in the study areas;
- Potential exploitation: The biodiversity benefits of rewilding are explicitly recognized by protected area authorities and integrated in the protected area's management plans.
KER 3: Maps of vegetation risk to climate change (D4.2)
- Potential users: Landscape planners, protected area authorities, community leaders;
- Dissemination strategy: Scientific publications and conferences, online blog, newsletter;
- Potential exploitation: Conservation managers account for the vegetation vulnerability and exposure to climate change when designing conservation and restoration actions.
KER4: Stand-alone studies on the history of land-cover change in Lagorai, Foreste Casentinesi NP, and Velino Massif area (D3.2, D3.3, D4.1)
- Potential users: Local authorities, community leaders, scientific community, education sector;
- Dissemination strategy: Scientific publications, workshops with stakeholders in the study areas, press release in local newspapers;
- Potential exploitation: Community leaders and local authorities realize the pros and cons of rewilding in the study areas and embrace a multi-stakeholder viewpoint. Public acceptability of rewilding is improved.

5. Financial aspects: costs of each research unit

nº		Funds of the Ministry of University and Research (euro)
1.	SABATINI Francesco Maria	142.647
2.	DI MUSCIANO Michele	116.946

3.	BONARI Gianmaria	40.101
		299.694

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23. Alessi, N. et al. Probabilistic and preferential sampling approaches provide different pictures of forest diversity at the national scale. Journal of Vegetation Science. Under Review.
24. Cervellini, M. et al. Diversity of European habitat types is correlated with geography more than climate and human pressure. Ecology and Evolution 11, 18111–18124 (2021).
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27. Sabatini, F. M. et al. Global patterns of vascular plant alpha diversity. Nat Commun 13, 4683 (2022).
28. Sabatini, F. M. et al. sPlotOpen – An environmentally balanced, open-access, global dataset of vegetation plots. Global Ecology and Biogeography 30, 1740–1764 (2021).
29. Bruelheide, H. et al. sPlot – A new tool for global vegetation analyses. Journal of Vegetation Science 30, 161–186 (2019).
30. Tonin, R. et al. Intraspecific functional differences of subalpine plant species growing in low-altitude microrefugia and high-altitude habitats. Plant Ecol 221, 155–166 (2020).
31. Bricca, A. et al. Community assembly along climatic gradient: Contrasting pattern between- and within- species. Perspectives in Plant Ecology, Evolution and Systematics 56, 125675 (2022).
32. Xu, K. et al. Assessing the vulnerability of ecosystems to climate change based on climate exposure, vegetation stability and productivity. Forest Ecosystems 7, 23 (2020).

7. Time schedule of the research activities (GANTT CHART)

Milestone 1 Kick-off meeting

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Organize the meeting	SABATINI F	X											
Invite stakeholders	SABATINI F DI MUSCIANO M BONARI G	X											

Milestone 2 Multitemporal database of existing vegetation plot established

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Retrieve vegetation plot data for the study areas from existing databases	BONARI G	X	X										
Digitize and georeference vegetation-plot data from published sources	SABATINI F DI MUSCIANO M BONARI G		X	X									
Aggregate data into a workable electronic database	BONARI G			X									

Milestone 3 First semester reporting

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Gather timesheet and milestones reached by all the RUs	SABATINI F			X									

Prepare intermediate report	SABATINI F DI MUSCIANO M			X									
Prepare first version of Data Management Plan (D5.1)	BONARI G			X									

Milestone 4 Vegetation plot data collected in the field and integrated in the database

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Identify the spatial and temporal gaps in the vegetation data (D2.1)	DI MUSCIANO M			X	X								
Define survey protocols and a sampling design for the three study areas	DI MUSCIANO M				X								
Collection of new vegetation plot data in the field and identify plant specimen	SABATINI F DI MUSCIANO M BONARI G					X	X	X					
Integrate newly collected data from WP2 into the database and standardize taxonomic nomenclature (D1.1)	BONARI G						X	X					

Milestone 5 Spatial predictors and climate change scenarios collected and harmonized

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Gather predictors of biodiversity change and reconstruct land cover history of the study areas	SABATINI F				X	X							
Gather future climatic predictors under	DI												

alternative scenarios and calculate climate change velocity	MUSCIANO M					X							
Spatial downscaling of current and projected bioclimatic variables	DI MUSCIANO M					X	X						

Milestone 6 Statistical model of ecosystem change fitted and validated

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Calibrate spatially explicit biodiversity models and create maps of maximum compositional change (D3.1)	SABATINI F						X	X	X				
Elicit stakeholder participation and capture local expert knowledge on changes in biodiversity	SABATINI F							X	X				

Milestone 7 Maps of climate change-related risk for vegetation created

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Analyse temporal changes of plant communities through vegetation plot time series	DI MUSCIANO M							X	X				
Fit statistical models to identify how climate contributes to shape the observed temporal trends	DI MUSCIANO M								X	X			
Create maps of climate change related risk for vegetation	SABATINI F DI MUSCIANO M									X	X		

Milestone 8 Final meeting and final report

ACTIVITY	ASSIGNED TO	I year						II year					
		BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
Manuscript 1 preparation (D3.2)	SABATINI F							X	X	X			
Manuscript 2 preparation (D3.3)	BONARI G							X	X	X			
Manuscript 3 preparation (D3.4)	SABATINI F DI MUSCIANO M BONARI G								X	X	X	X	X
Manuscript 4 preparation (D4.1)	DI MUSCIANO M								X	X	X		
Manuscript 5 preparation (D4.3)	SABATINI F DI MUSCIANO M BONARI G									X	X	X	X
Prepare final report	SABATINI F DI MUSCIANO M BONARI G												X
Organize final meeting	SABATINI F												X

8. Time schedule of the expenses

nº	Research Units	Expenses	I year						II year					
			BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6	BIM. 1	BIM. 2	BIM. 3	BIM. 4	BIM. 5	BIM. 6
1.	SABATINI Francesco Maria	item A1	X	X	X		X	X	X	X	X	X	X	X
2.	SABATINI Francesco Maria	item A2				X	X	X	X	X	X	X	X	X
3.	SABATINI Francesco Maria	item B				X								

4.	SABATINI Francesco Maria	item C											
5.	SABATINI Francesco Maria	item D	X	X	X	X	X	X	X	X				X
6.	SABATINI Francesco Maria	item E												
7.	SABATINI Francesco Maria	item F	X			X	X	X	X	X	X	X	X	X
8.	BONARI Gianmaria	item A1	X	X	X			X	X	X			X	X
9.	BONARI Gianmaria	item A2												
10.	BONARI Gianmaria	item B												
11.	BONARI Gianmaria	item C												
12.	BONARI Gianmaria	item D	X	X	X			X	X	X				X
13.	BONARI Gianmaria	item E												
14.	BONARI Gianmaria	item F	X			X	X	X	X	X	X	X	X	X
15.	DI MUSCIANO Michele	item A1	X	X	X	X	X	X		X	X	X	X	X
16.	DI MUSCIANO Michele	item A2				X	X	X	X	X	X	X	X	X
17.	DI MUSCIANO Michele	item B				X								
18.	DI MUSCIANO Michele	item C												
19.	DI MUSCIANO Michele	item D	X	X	X	X	X	X	X	X	X			X
20.	DI MUSCIANO Michele	item E												
21.	DI MUSCIANO Michele	item F	X				X	X	X	X		X	X	X

B.2

1. Scientific Curriculum of the Principal Investigator

- Researcher unique identifier: ORCID Id	0000-0002-7202-7697
- URL for web site:	https://www.unibo.it/sitoweb/francescomaria.sabatini
Academic age (years from the beginning of scientific activity, i.e. years from first publication or from the beginning of PhD or Medical Specialisation School)	12
Previous positions	2021 - 2022: Assistant Professor (RTD-b), Alma Mater Studiorum - University of

	Bologna, Italy 2018 - 2021: Wissenschaftlicher Mitarbeiter (Post-Doc), German Centre for Integrative Biodiversity Research (Halle-Jena-Leipzig), Germany 2017 - 2018: Wissenschaftlicher Mitarbeiter (Post-Doc), Humboldt University in Berlin, Germany 2015 - 2017: Marie-Curie Fellow (Post-Doc), Humboldt University in Berlin, Germany 2014 - 2015: Assegnista di Ricerca (Post-Doc), Sapienza, University of Rome, Italy
Prizes and awards	2019: Rita Levi Montalcini fellowship - Awarded by: Italian Ministry of University and Research 2019: Kongressreisen #57445178 - Awarded by: German Academic Exchange Service 2016: The Reviewer Prize - Winner - Awarded by: Peerage of Science 2015: Marie Sklodowska-Curie actions fellowship - Grant No. 658876 - Awarded by: European Commission 2014: Research start-up grant - C26N14JZMA - Awarded by: Sapienza, University of Rome 2012: Research start-up grant - C26N12ESSE - Awarded by: Sapienza, University of Rome 2010: International Post-degree Scholarship - Awarded by: Sapienza, University of Rome
Visiting academic positions	Feb 2014: Visiting Scholar. Masaryk University Brno (CZ). Host: Prof. Milan Chytry Jan 2013 - May 2013: Visiting PhD Student. University of Turku (FI). Host: Prof. Hanna Tuomisto Jan 2010 - Sep 2010: Visiting Scholar. University of Wisconsin-Madison (USA). Host: Prof. David Mladenoff
Teaching activities and PhD supervision	2022-2023: Plant Ecosystems, Protected Habitats and Environmental Restoration. Lecturer. Alma Mater Studiorum University of Bologna 2021-2023: Plant Biodiversity and Landscape Ecology. Lecturer. Alma Mater Studiorum University of Bologna 2021-2022: Plant-Environment Interactions & Biomonitoring. Lecturer. Alma Mater Studiorum University of Bologna 2021-2022: European Natural Forest School. Co-Lecturer. Frankfurter Zoological Society 2018-2021: Ecological data evaluation in R. Co-Lecturer. Martin-Luther Universität Halle 2017-2018: Introduction to Biogeography. Teaching assistant. Humboldt-Universität zu Berlin 2016-2017: Conservation Biogeography. Teaching assistant. Humboldt-Universität zu Berlin 2015-2017 Field Methods in Biogeography. Teaching assistant. Humboldt-Universität zu Berlin 2012-2014 Landscape Ecology. Guest lecturer. Sapienza, University of Rome now: Co-Supervisor of 1 PhD student
Other work experience (e.g. consultancy if any)	Feb 2019 - Sep 2020: Scientific Consultant. FZS - Frankfurter Zoological Society Frankfurt, Germany (contract: ETN-WIE-GR1-001) May 2009 - Feb 2010: Scientific and Technical Advisor. SBI - Società Botanica Italiana ONLUS Rome, Italy Apr 2009 - Jul 2009: Trainee. eGeos s.p.a. Rome, Italy Dec 2007 - Jun 2008: Trainee. Telespazio s.p.a. Rome, Italy
- Administrative role and position responsibility	National Italian habilitation to Associate Professorhip in 05/A1 Botany National Italian habilitation to Associate Professorhip in 05/C1 Ecology EDUCATION 2010 - 2014: PhD in Ecology, Sapienza, University of Rome, Italy 2007 - 2009: MSc in Environmental Sciences, Sapienza, University of Rome, Italy 2003 - 2007: BSc in Environmnetal Sciences, Sapienza, University of Rome, Italy
- Scientific organisations/Coordination of academic activities	2013-2014 PhD student representative of the departmental board Sapienza, University of Rome

	Member of sPlot - The global vegetation-plot database
Editorial activity	2021 now: Associate Editor. Journal of Vegetation Science 2021 now: Associate Editor. Diversity and Distribution 2019 - 2020: Guest Editor for Special Issue 'MACROECOLOGY OF VEGETATION'. Journal of Vegetation Science 2019 - now: Member of the editorial board. Silva Fennica REFEREE (number of papers reviewed) 20 Peerage of Science; 11 iForest; 7 Journal of Vegetation Science; 4 Forest Ecology and Management; 3 Folia Geobotanica; 2 Diversity and Distribution; 2 Silva Fennica; 2 Ecological Applications; 2 Journal of Applied Ecology; 2 Vegetation Classification and Survey; 2 Landscape Ecology; 2 Scientific Reports; 2 Journal of Biogeography; 2 Plant Ecology; 2 Forests; 1 Nature Communications; 1 Ecology Letters; 1 BMC Ecology; 1 Journal of Ecology; 1 Plant Biosystems; 1 Plos One; 1 Acta Oecologica; 1 Animal Biology; 1 Forest Ecosystems; 1 Applied Vegetation Science; 1 Ecosphere; 1 Ecological Indicators; 1 Nature Sustainability; 1 Global Ecology and Biogeography; 1 Ecology and Evolution
Membership of scientific societies	since 2010 Società Botanica Italiana - SBI since 2011 Società Italiana di Scienze della Vegetazione - SISV since 2015 International Association for Vegetation Science - IAVS

Funding (current and past)

Anno	Project title	Person months	Funding organisation
2021	Wood resource, carbon sinks or climate refugia? Reconciling economic gains, climate change mitigation and biodiversity conservation in forests during global change	36	Rita-Levi Montalcini. Italian Ministry of University and Research
2015	FORESTS and CO - Co-Benefits and Conflicts between CO2 sequestration and biodiversity conservation in European Forests	24	Marie Sklodowska-Curie actions fellowship - Grant No. 658876. European Commission

Significant career breaks	none
- H-Index (in Scopus):	22
- Total number of publications in peer-reviewed journals	44
- Total IF	352,5
- n. and total IF of publications where the candidate is first author or equivalent (for the disciplines where the position in the list of authors correspond to the role in the work presented)	14 and 84,5
- N. and total IF of the publications where the candidate is last or corresponding author (for the disciplines where the position in the list of authors correspond to the role in the work presented)	17 and 103,8

2. Scientific Curriculum of the associated PIs

1. DI MUSCIANO Michele

- Researcher unique identifier: ORCID Id	0000-0002-3130-7270
- URL for web site:	https://www.univaq.it/rubrica.php?id=1000&docente=on
Academic age (years from the beginning of scientific activity, i.e. years from first publication or from the beginning of PhD or Medical Specialisation School)	6
Previous positions	2020 - 2022: Assegnista di Ricerca (Post-Doc), University of L'Aquila, Italy
Prizes and awards	2022 Research start-up grant - Decreto Rettorale Rep.n.649 del 4/5/2022 - Awarded by: University of L'Aquila
Visiting academic positions	Mar 2020: Visiting PhD Student. Cibio, research centre in biodiversity and genetic resources. Host: Prof. Antigoni Kaliontzopoulou Oct 2017 - Dec 2017: Visiting PhD Student. University of Lausanne (Unil) (CH). Host: Prof. Antoine Guisan Sep 2015 - Feb 2016: Visiting Scholar. Université Claude Bernard Lyon 1 (FR). Host: Prof. Frédéric Menu
Teaching activities and PhD supervision	2022-2023 Systematic botany. Lecturer. University of L'Aquila 2022-2023 Management of biological and environmental data with r studio. Lecturer. University of L'Aquila. 2021-2023 Introduction to data management in R. Lecturer at the Ph.D. program. University of L'Aquila. 2021-2023 Applied Botany. Lecturer. University of L'Aquila. 2021/2022 Statistical analysis and modelling – Module 2 Use of R – Teaching assistant. Alma-Mater Studiorum University of Bologna. 2018-2020 Optional course: Introduction to R. Lecturer. University of L'Aquila 2016 - 2020 Plant ecology. Guest lecturer. University of L'Aquila 2016 - 2020 Applied Botany. Guest lecturer. University of L'Aquila now: Co-Supervisor of 1 PhD student - Project title: The role of protected areas in plant biodiversity conservation in Europe
Other work experience (e.g. consultancy if any)	Apr 2015 - Jul 2015: Trainee. Maiella National Park. Abruzzo, Italy.
- Administrative role and position responsibility	2016 - 2020 PhD in Life and Environmental Sciences, Sapienza, University of L'Aquila, Italy 2014 - 2016 MSc in Environmental Biology, University of L'Aquila, Italy 2011 - 2014 BSc in Environmental Science and Technology, University of L'Aquila, Italy
- Scientific organisations/Coordination of academic activities	2022 Members of the scientific and organizing committee of the 54° International Conference of the Italian society for vegetation science (SISV) 2022-2023 Members of the scientific committee of CYBO - Conference for Young Botanists.
Editorial activity	2022 - now: Managing Guest Editor for Special Issue 'Perspectives and applications of free and open source software in ecology'. Ecological Informatics Reviewer for 10+ international scientific journals. Participation in 23 national and international conferences.
Membership of scientific societies	since 2016 Società Botanica Italiana - SBI since 2016 Società Italiana di Scienze della Vegetazione - SISV since 2021 International Association for Vegetation Science - IAVS

	since 2021 Society for conservation biology Italy chapter - SCB Italy

Funding (current and past)	**Anno**	**Project title**	**Person months**	**Funding organisation**
	2022	Comprendere, predire e gestire gli effetti dei cambiamenti climatici sulla biodiversità d'alta quota dell'Appennino centrale tramite un approccio multitaxon	1	University of L'Aquila

Significant career breaks	none
- H-Index (in Scopus):	10
- Total number of publications in peer-reviewed journals	29
- Total IF	87,043
- n. and total IF of publications where the candidate is first author or equivalent (for the disciplines where the position in the list of authors correspond to the role in the work presented)	6 and 17,26
- N. and total IF of the publications where the candidate is last or corresponding author (for the disciplines where the position in the list of authors correspond to the role in the work presented)	2 and 9,226

2. BONARI Gianmaria

- Researcher unique identifier: ORCID Id	0000-0002-5574-6067
- URL for web site:	https://www.researchgate.net/profile/Gianmaria-Bonari
Academic age (years from the beginning of scientific activity, i.e. years from first publication or from the beginning of PhD or Medical Specialisation School)	8
Previous positions	October 2017 – December 2019 Post-Doc position Department of Botany and Zoology, Masaryk University, Brno (CZ) Supervisor: Prof. Milan Chytrý
Prizes and awards	Award: 1st place. Habitat validation Hackathon. 1-week capacity building at ETC-UMA (ES) about "Remote Sensing and Artificial Intelligence for Environmental Applications", 2022 Award: 1st place. Young Scientist Award for researchers working on Conservation of Biodiversity, Department of Biology & Biotechnology "Charles Darwin" University La Sapienza Rome and Daikin Applied Europe S.p.A., given for the relevance of my PhD thesis in the field of Conservation of Biodiversity, 2019 Young Scientist Travel Award: 59th Annual Symposium of International Association for Vegetation Science Travel Award: "Conservation of Plant

	Communities: From Environmental Drivers to Ecosystems Services", 2016 Poster competition: 2nd place. 110th International Plant Science Conference - Italian Botanical Society, 2015 Young Scientist Poster Award: Honourable Mention. 58th International Symposium of the International Association for Vegetation Science, 2015
Visiting academic positions	Visiting Scientist/researcher on Short-term April 2022 University of Oviedo, IMIB Biodiversity Research Institute, Oviedo (ES) Visiting Scientist May 2019 İstanbul University - Cerrahpaşa Faculty of Forestry Funded by The Scientific and Technological Research Council of Turkey (Tübitak) (TR)
Teaching activities and PhD supervision	Teaching staff council - doctorate school MOUNTAIN ENVIRONMENT AND AGRICULTURE (AGRICULTURE AND MOUNTAIN ENVIRONMENT) - (a.y. 2021/2022 cycle XXXVII 37°) Free University of Bozen-Bolzano Teaching staff council - doctorate school MOUNTAIN ENVIRONMENT AND AGRICULTURE (AGRICULTURE AND MOUNTAIN ENVIRONMENT) - (a.y. 2020/2021 cycle XXXVI 36°) Free University of Bozen-Bolzano Course title: Plant biodiversity and environmental impact assessment A.Y.: 2022-23 Scientific Sector: BIO/03 Credits: 6 Teaching language: English Status: on-going Course title: Nature conservation and protected areas A.Y.: 2021-22 Scientific Sector: BIO/03 Credits: 3 Teaching language: English Status: finished (100% positive responses) Course title: Nature conservation and protected areas A.Y.: 2020-21 Scientific Sector: BIO/03 Credits: 3 Teaching language: English Status: finished (100% positive responses) (Co-)supervision of 20 theses (14 Bachelor, 5 Master, 3 PhD theses)
Other work experience (e.g. consultancy if any)	30/08/2017 – 08/09/2017 Fixed-term contract Department of Life Sciences, University of Siena, Siena (IT) Vegetation survey June 2017 Fixed-term contract Fisiocritici Academy, Siena (IT) Plant biodiversity investigation February 2017 Fixed-term contract Department of Life Sciences, University of Siena, Siena (IT) Vegetation survey November 2016 Fixed-term contract Ministry of Agriculture, Food and Forestry, Office for Biodiversity of Siena (IT) Technical advice and support

	June 2016 Fixed-term contract Italian Society for Vegetation Science Monitoring for Habitat 6220* 26/08/2013 – 20/09/2013 Fixed-term contract Department of Life Sciences, University of Siena, Siena (IT) Rare species census in Natura2000 sites
- Administrative role and position responsibility	National Italian Habilitation to Associate Professorship in 05/A1 Botany Sector (Evaluation 5/5) 12 October 2020 January 2020 – January 2023 Fixed-term position as researcher (RTDa) Free University of Bozen-Bolzano, Bolzano (IT) October 2017 - October 2019 Post-Doc position Department of Botany and Zoology, Masaryk University, Brno (CZ) January 2014 - June 2017 PhD Programme in Life Sciences - XXIX course - A.Y. 2013/2014 Department of Life Sciences, University of Siena, Siena (IT) Doctor Europaeus cum laude January 2015 - March 2015 Erasmus for Traineeship Programme Department of Botany and Zoology, Masaryk University, Brno (CZ) November 2010 - October 2012 Master Degree in Biodiversity and Nature Conservation (BIOCON) University of Siena, Siena (IT) 110/110 cum laude March 2012 - June 2012 Erasmus Programme Department of Botany and Zoology, Masaryk University, Brno (CZ) October 2007 - October 2010 Bachelor Degree in Natural Science Curriculum in Conservation of Nature and its Resources University of Siena, Siena (IT)
- Scientific organisations/Coordination of academic activities	Steering committee member of the Italian Society for Vegetation Science Member of the Steering committee of VegItaly database – Official Database of the Italian Society for Vegetation Science Member of the European Vegetation Archive council Member of sPlot - The Global Vegetation Database International conference: Scientific and organising committee of CYBO 2023, Free University of Bozen-Bolzano, Bolzano (IT), 9-10 Feb 2023 International activity: Cultural Landscapes Summer School Maremma 2022 University of Hildesheim and Free University of Bozen-Bolzano 3-10 September 2022 International conference: Local organizing committee of the 34th Plant Population Biology Conference (POPBIO) "All Facets of Diversity, Free University of Bozen-Bolzano, Bolzano (Italy), 19-21 May 2022 National activity: Local organizing committee of the field workshop organized by the Italian Botanical Society - Ecology Working Group, San Martino di Castrozza

	(Italy), 26-30 July 2021 National activity: Scientific and organizing committee of the National Online workshop Italian Society for Vegetation Science, 9th October 2020 International conference: Local organizing committee of the 60th Annual Symposium of the International Association for Vegetation Science. Vegetation patterns in natural and cultural landscapes. Palermo (Italy), 19-24 June 2017 International conference: Local organizing committee of the 58th Annual Symposium of the International Association for Vegetation Science. Brno (Czech Republic), 19-24 July 2015
Editorial activity	2022 Editorial Review Board of Applied Vegetation Science (Q1 in Ecology) Co-Editor of Plant Sociology Journal (Q2 in Plant Science) Editor of Biodiversity and Conservation Journal (Q1 in Ecology) 2021 Guest Editor for the Topical Collection "Species and community variability in vegetation dynamics and plant biodiversity conservation" Plant Sociology Journal (Q2 in Plant Science) Reviewer for 20+ international scientific journals. Reviewer of 60 papers (8 in the last 12 months), with a review to publication rate of 1.0:1. Participation in 47 national and international conferences
Membership of scientific societies	Member 2020-2022 Society for Ecological Restoration Member 2015-2022 International Association for Vegetation Science Member 2017-2022 Società Italiana di Scienza della Vegetazione Member 2014-2022 Società Botanica Italiana Member 2015-2022 Società Toscana di Scienze Naturali Member 2021-2022 Society for Conservation Biology

Funding (current and past)

Anno	Project title	Person months	Funding organisation
2022	Tracing the evergreen broad-leaved species and their spread	1	FWF Der Wissenschaftsfonds
2021	Biodiversity in national parks: coupling scientific data with human perceptions	4	Free University of Bozen-Bolzano
2020	Ecology, genetics and conservation of endemic plant species of the Eastern Alps	1	Free University of Bozen-Bolzano
2020	A biogeographical approach for nature conservation: plant community saturation across Italian forests	3	Free University of Bozen-Bolzano

Significant career breaks	n.a.
- H-Index (in Scopus):	18
- Total number of publications in peer-reviewed journals	76
- Total IF	152,265
- n. and total IF of publications where the	

candidate is first author or equivalent (for the disciplines where the position in the list of authors correspond to the role in the work presented)	11 and 42,017
- N. and total IF of the publications where the candidate is last or corresponding author (for the disciplines where the position in the list of authors correspond to the role in the work presented)	15 and 51,232

3. Main Principal Investigator's scientific publications (Max. 20)

1. Sabatini, Francesco Maria, Jiménez-Alfaro, Borja, Jandt, Ute, Chytrý, Milan, Field, Richard, Kessler, Michael, Lenoir, Jonathan, Schrodt, Franziska, Wiser, Susan K, Arfin Khan, Mohammed A S...(2022). Global patterns of vascular plant alpha diversity. NATURE COMMUNICATIONS, vol. 13, p. 1-16, ISSN: 2041-1723, doi: 10.1038/s41467-022-32063-z - **Articolo in rivista**
2. Ute Jandt, Helge Bruelheide, Florian Jansen, Aletta Bonn, Volker Grescho, Reinhard A. Klenke, Francesco Maria Sabatini, Markus Bernhardt-Römermann, Volker Blüml, Jürgen Dengler, Martin Diekmann, Inken Doerfler, Ute Döring, Stefan Dullinger, Sylvia Haider, Thilo Heinken, Peter Horchler, Gisbert Kuhn, Martin Lindner, Katrin Metze...(2022). More losses than gains during one century of plant biodiversity change in Germany. NATURE, vol. n.a., p. 1-11, ISSN: 1476-4687, doi: 10.1038/s41586-022-05320-w - **Articolo in rivista**
3. Wolf S., Mahecha M. D., Sabatini F. M., Wirth C., Bruelheide H., Kattge J., Moreno Martinez A., Mora K., Kattenborn T. (2022). Citizen science plant observations encode global trait patterns. NATURE ECOLOGY & EVOLUTION, vol. n.a., p. 1-10, ISSN: 2397-334X, doi: 10.1038/s41559-022-01904-x - **Articolo in rivista**
4. Munteanu, Catalina, Senf, Cornelius, Nita, Mihai D, Sabatini, Francesco Maria, Oeser, Julian, Seidl, Rupert, Kuemmerle, Tobias (2022). Using historical spy satellite photographs and recent remote sensing data to identify high-conservation-value forests. CONSERVATION BIOLOGY, vol. 36, p. 1-11, ISSN: 0888-8892, doi: 10.1111/cobi.13820 - **Articolo in rivista**
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5. Main staff involved (max 10 professors/researchers for each research unit, in addition to the PI or associated PIs), highlighting the expected time commitment

List of the Research Units

Unit 1 - SABATINI Francesco Maria

Personnel of the research unit

nº	Surname Name	Qualification	University/ Research Institution	e-mail address	Months/person expected
1.	SABATINI Francesco	Ricercatore a t.d. - t.pieno (art. 24 c.3-b	Università degli Studi di	FRANCESCOMARIA.SABATINI@UNIBO.IT	7,0

	Maria	L. 240/10)	BOLOGNA		
2.	CHIARUCCI Alessandro	Professore Ordinario (L. 240/10)	Università degli Studi di BOLOGNA	alessandro.chiarucci@unibo.it	2,0
3.	FERRARA Arianna	Dottorando	Università degli Studi di BOLOGNA	arianna.ferrara93@gmail.com	2,0

Unit 2 - DI MUSCIANO Michele

Personnel of the research unit

nº	Surname Name	Qualification	University/ Research Institution	e-mail address	Months/person expected
1.	DI MUSCIANO Michele	Ricercatore a t.d. - t.defin. (art. 24 c.3-a L. 240/10)	Università degli Studi dell'AQUILA	michele.dimusciano@univaq.it	4,8
2.	FRATTAROLI Anna Rita	Professore Associato (L. 240/10)	Università degli Studi dell'AQUILA	annarita.frattaroli@univaq.it	5,0
3.	RICCI Lorenzo	Dottorando	Università degli Studi dell'AQUILA	lorenzric1996@gmail.com	2,0

Unit 3 - BONARI Gianmaria

Personnel of the research unit

nº	Surname Name	Qualification	University/ Research Institution	e-mail address	Months/person expected
1.	BONARI Gianmaria	Ricercatore a t.d. - t.pieno (art. 24 c.3-a L. 240/10)	Libera Università di BOLZANO	gianmaria.bonari@gmail.com	4,4
2.	ZERBE Stefan	Professore Ordinario	Libera Università di BOLZANO	stefan.zerbe@unibz.it	1,0

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6. Information on the new contracts for personnel to be specifically recruited

nº	Associated or principal investigator	Number of expected research contracts	Number of expected PhD scholarships	Overall expected time commitment (months)
1.	SABATINI Francesco Maria	1	0	18
2.	DI MUSCIANO Michele	0	1	18
3.	BONARI Gianmaria	0	0	0

	Total	**1**	**1**	**36**

7. PI "Do No Significant Harm (DNSH)" declaration, in compliance with article n. 17, EU Regulation 852/2020. (upload PDF)

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MUR also has the right to the dissemination of the main economic and scientific data related to the funded projects.".

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