



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

REGOLAMENTO DIDATTICO DEL CORSO

LM-60 SCIENZE E GESTIONE DELLA NATURA

Sede di Bologna

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ART. 1 REQUISITI PER L'ACCESSO AL CORSO

a. Conoscenze richieste per l'accesso

Per essere ammessi al corso di laurea magistrale in Scienze e Gestione della Natura occorre essere in possesso di una laurea o del diploma universitario di durata triennale, ovvero di altro titolo di studio conseguito all'estero, riconosciuto idoneo.

Occorre, altresì, il possesso di requisiti curriculari e il superamento di una verifica dell'adeguatezza della personale preparazione.

Per frequentare proficuamente il corso di Laurea Magistrale in Scienze e Gestione della Natura è necessaria la padronanza del metodo scientifico e sperimentale avendo acquisito adeguate conoscenze di ambito matematico-statistico, fisico-chimico, bio-ecologico ed economico-sociale in proporzioni variabili sulla base della laurea di provenienza.

Occorre, altresì, il possesso dei seguenti requisiti curriculari:

1. Avere conseguito la Laurea in una delle seguenti classi o possedere altro titolo di studio conseguito all'estero, riconosciuto idoneo:

ex D.M. 270:

- Scienze e Tecnologie per l'Ambiente e la Natura (L-32)
- Scienze Biologiche (L-13)
- Scienze Geologiche (L-34)
- Scienze e Tecnologie Agrarie e Forestali (L-25)

ex. D.M. 509/99:

- Scienze e Tecnologie per l'Ambiente e la Natura (Classe 27)
- Scienze Biologiche (Classe 12)
- Scienze della Terra (Classe 16)
- Scienze e Tecnologie Agrarie, Agroalimentari e Forestali (Classe 20)

Previgente ordinamento quadriennale/quinquennale:

- Scienze Ambientali
- Scienze Biologiche
- Scienze Geologiche
- Scienze Naturali
- Scienze Agrarie
- Scienze Forestali

oppure

2. Avere acquisito almeno 36 CFU così ripartiti nei seguenti settori scientifico-disciplinari:

- MAT/01-09; INF/01, ING-INF/05, SECS-S/01-02, FIS/01-08, almeno 12 CFU
- CHIM/01/02/03/06/12, almeno 6 CFU
- BIO/01-19, GEO/01-12, almeno 18 CFU

Per l'accesso al corso di studio è inoltre richiesta la conoscenza della lingua inglese di livello B1. La competenza linguistica in ingresso di livello B1 è verificata contestualmente all'idoneità di livello B2.

Per l'accesso al curriculum internazionale è richiesta la conoscenza della lingua inglese di livello B2.

L'ammissione al corso di laurea magistrale è subordinata, infine, al superamento di una verifica dell'adeguatezza della personale preparazione che avverrà secondo le modalità definite nel punto modalità di ammissione.

b. Modalità di ammissione

La verifica dell'adeguatezza della personale preparazione è eseguita da apposita Commissione nominata dal corso di studio sulle conoscenze a livello universitario nei seguenti ambiti:

- Matematico-statistico
- Fisico-Chimico

- Bio-Ecologico
- Economico-sociale

e verrà svolta attraverso accurata analisi del curriculum e per tutti i casi individuati dalla Commissione sulla base di un eventuale colloquio integrativo secondo modalità, criteri e procedure fissate dal Consiglio di corso di studio e rese note tramite pubblicazione sul portale di Ateneo.

ART. 2 REGOLE DI MOBILITÀ FRA I CURRICULA DEL CORSO DI STUDIO

Il corso di studio è articolato in curricula.

Lo studente può effettuare le scelte indicate nel piano didattico, con le modalità indicate nel piano stesso e nei termini resi noti tramite il Portale di Ateneo.

È consentito il passaggio tra i curricula previsti entro i termini resi noti tramite il Portale di Ateneo.

ART. 3 PIANI DI STUDIO INDIVIDUALI

È prevista la possibilità di presentazione di piani di studio individuali con le modalità, i criteri e i termini resi noti tramite il Portale di Ateneo.

I piani di studio individuali, approvati dal Consiglio di corso di studi, non possono comunque prescindere dal rispetto dell'ordinamento e delle linee guida definite dagli Organi competenti.

Qualora il piano di studio preveda la scelta di attività formative attivate presso corsi di studio a numero programmato, l'ammissione alle stesse deve essere previamente approvata anche dal Consiglio di corso di studio a numero programmato sulla base di criteri da questo preventivamente individuati.

ART. 4 MODALITÀ DI SVOLGIMENTO DELLE ATTIVITÀ FORMATIVE E TIPOLOGIA DELLE FORME DIDATTICHE

Il piano didattico allegato indica le modalità di svolgimento delle attività formative e la relativa suddivisione in ore di didattica frontale, di esercitazioni pratiche o di tirocinio, nonché la tipologia delle forme didattiche.

Eventuali ulteriori informazioni in merito saranno rese note annualmente sul Portale di Ateneo.

ART. 5 PERCORSO FLESSIBILE

Lo studente può optare per il percorso flessibile che consente di completare il corso di studio in un tempo superiore o inferiore alla durata normale secondo le modalità definite nel Regolamento Didattico di Ateneo.

Le attività formative previste dal percorso di studio, in caso di necessaria disattivazione, potranno essere sostituite, per garantire la qualità e la sostenibilità dell'offerta didattica.

ART. 6 PROVE DI VERIFICA DELLE ATTIVITÀ FORMATIVE

Il piano didattico allegato prevede i casi in cui le attività formative si concludono con un esame con votazione in trentesimi ovvero con un giudizio di idoneità.

Le modalità di svolgimento delle verifiche sono stabilite annualmente dal Consiglio di corso di studio in sede di presentazione della programmazione didattica e rese note agli studenti prima dell'inizio delle lezioni tramite il Portale di Ateneo.

ART. 7 ATTIVITÀ FORMATIVE A SCELTA DELLO STUDENTE

Il Corso di studio considera coerenti con il progetto formativo tutte le attività formative attivate in Ateneo.

Se lo studente sceglie un'attività formativa diversa da quelle considerate coerenti, secondo i suddetti criteri predeterminati, deve fare richiesta al Consiglio di corso di studio nei termini previsti annualmente e resi noti tramite pubblicazione sul Portale di Ateneo.

Il Consiglio valuterà la coerenza della scelta con il percorso formativo dello studente.

ART. 8 CRITERI DI RICONOSCIMENTO DEI CREDITI ACQUISITI IN CORSI DI STUDIO DELLA STESSA CLASSE

I crediti formativi universitari acquisiti sono riconosciuti per non meno della metà e fino a concorrenza dei crediti dello stesso settore scientifico disciplinare previsti dal piano didattico allegato.

Qualora, effettuati i riconoscimenti in base alle norme del presente regolamento, residuino crediti non utilizzati, il Consiglio di corso di studio può riconoscerli valutando il caso concreto sulla base delle affinità didattiche e culturali.

Il riconoscimento è relativo alle attività formative svolte nella medesima lingua di erogazione del corso di studio.

ART. 9 CRITERI DI RICONOSCIMENTO DEI CREDITI ACQUISITI IN CORSI DI STUDIO DI DIVERSA CLASSE, PRESSO UNIVERSITÀ TELEMATICHE E IN UNIVERSITÀ ESTERE

I crediti formativi universitari acquisiti sono riconosciuti dal Consiglio di corso di studio sulla base dei seguenti criteri:

- analisi del programma svolto;
- valutazione della congruità dei settori scientifico disciplinari e dei contenuti delle attività formative in cui lo studente ha maturato i crediti con gli obiettivi formativi specifici del corso di studio e delle singole attività formative da riconoscere, perseguendo comunque la finalità di mobilità degli studenti.

Il riconoscimento è effettuato fino a concorrenza dei crediti formativi universitari previsti dal piano didattico allegato.

Qualora, effettuati i riconoscimenti in base alle norme del presente regolamento, residuino crediti non utilizzati, il Consiglio di corso di studio può riconoscerli valutando il caso concreto sulla base delle affinità didattiche e culturali.

Il riconoscimento è relativo ad insegnamenti impartiti o alle attività formative svolte in lingua inglese.

ART. 10 CRITERI DI RICONOSCIMENTO DELLE CONOSCENZE E ABILITÀ EXTRAUNIVERSITARIE

Possono essere riconosciute competenze acquisite fuori dall'Università nei seguenti casi:

- conoscenze e abilità professionali certificate ai sensi della normativa vigente in materia;
- conoscenze e abilità maturate in attività formative di livello post secondario alla cui realizzazione e progettazione abbia concorso l'Università.

La richiesta di riconoscimento sarà valutata dal Consiglio di corso di studio tenendo conto delle indicazioni date dagli Organi Accademici e del numero massimo di crediti riconoscibili fissato nell'ordinamento didattico del corso di studio.

Il riconoscimento potrà avvenire qualora l'attività sia coerente con gli obiettivi formativi specifici del corso di studio e delle attività formative che si riconoscono, visti anche il contenuto e la durata in ore dell'attività svolta.

ART. 11 TIROCINIO CURRICULARE

Il Corso di studio prevede un tirocinio curriculare, da svolgersi secondo le procedure stabilite dal Regolamento generale tirocini di Ateneo e dai programmi internazionali di mobilità. Su richiesta dello studente, è inoltre possibile attivare un ulteriore tirocinio collegato alla preparazione della prova finale.

ART. 12 MODALITÀ DI SVOLGIMENTO DELLA PROVA FINALE

a. Caratteristiche della prova finale

La prova finale per il conseguimento della laurea magistrale consiste nella redazione e nella discussione pubblica di una tesi scritta in modo originale dallo studente su un argomento coerente con gli obiettivi del corso di studio, sotto la guida di un relatore.

La dissertazione deve dimostrare la padronanza degli argomenti, capacità critica, l'attitudine a operare in modo autonomo e una capacità di comunicazione di buon livello.

b. Modalità di svolgimento della prova finale

La prova finale consiste nella verifica della capacità del laureando di lavorare in modo autonomo e di esporre e di discutere con chiarezza e piena padronanza i risultati di un progetto originale di ricerca, di natura sperimentale o teorica, su un tema specifico.

La valutazione della commissione è espressa in centodecimi (110). In caso di valutazione positiva, la prova s'intende superata con una votazione minima di 66/110 e massima di 110/110. La Commissione in caso di votazione massima può concedere la lode su decisione unanime.

I criteri per la valutazione della tesi sono:

- originalità dell'argomento
- correttezza metodologica
- livello di approfondimento
- adeguatezza della scrittura e redazione dell'elaborato
- capacità espositiva e di presentazione dell'elaborato.

La commissione potrà assegnare fino ad un massimo di 7 punti a giudizio del relatore e del controrelatore e per la qualità della presentazione.

La Commissione di laurea, tenuto conto della discussione della tesi e del curriculum del laureando, deciderà il voto finale che sarà proclamato in sede di seduta di laurea.

La Commissione Paritetica docenti-studenti ha espresso parere favorevole sulla coerenza dei crediti assegnati alle singole attività formative e gli specifici obiettivi formativi programmati, ai sensi dell'articolo 12 comma 3 del DM 270/04.

Anno Accademico 2024/2025
Scuola Scienze
Classe LM-60-SCIENZE DELLA NATURA
Corso 9257-SCIENZE E GESTIONE DELLA NATURA
CURRICULUM SCIENZE E GESTIONE DELLA NATURA (B32)

Primo Anno di Corso

Gruppo: 1) Attività formative obbligatorie

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 09464 - 0 - BIOMETRIA E STATISTICA	CON	SECS-S/01		6	32/0/24/0	No	Voto
Ambito: 1246 - Discipline chimiche, fisiche, matematiche ed informatiche Obiettivi: Al termine del corso, lo studente possiede conoscenze sui metodi statistici uni- e multivariati dedicati alla sperimentazione naturalistica. In particolare, lo studente è in grado di: - programmare esperimenti di biologia in campo e in laboratorio; - programmare campionamenti in natura; - elaborare dati sperimentali da rilevamenti in natura e laboratorio.			B				
9257 000 000 B5567 - 0 - CONSERVATION PALEOBIOLOGY: L'USO DEI FOSSILI PER MONITORARE GLI ECOSISTEMI ATTUALI	CON	GEO/01		6	40/0/12/0	No	Voto
Ambito: 402 - Discipline di scienze della Terra Obiettivi: Il corso introduce gli studenti alla disciplina emergente della paleobiologia della conservazione (Conservation Paleobiology), ovvero l'uso dei dati storici e dei fossili per coadiuvare gli sforzi per la conservazione di ecosistemi e delle specie attuali. Il corso illustra gli obiettivi e casi studio fondamentali della disciplina relativi alle sue applicazioni al ripristino degli habitat (shifting baselines), alla documentazione della naturale variabilità degli ecosistemi in funzione dei cambiamenti climatici e alla caratterizzazione degli stessi in contesti di scarso o nullo impatto antropico. Alla fine del corso, lo studente avrà acquisito le conoscenze sull'importanza della prospettiva temporale nella biologia della conservazione e le competenze necessarie per mettere al lavoro la documentazione storica e fossile per la scienza della conservazione in termini di strumenti utilizzati (es., tracce isotopiche, paleobiogeografia, analisi quantitative multivariate). Obiettivi inglese: This course is designed to introduce students to the emerging discipline of Conservation paleobiology. It involves the use of historical data and fossil records to address questions related to biological conservation. Paleocological data can provide highly detailed records of ecosystem changes and variations over a long period of time, which is beyond the limits of ecological monitoring. This helps in the reconstruction of ecological baselines and the long-term trajectories of ecosystem states. Through this course, students will learn about the fundamental concepts of conservation paleobiology and its applications to habitat restoration, invasion biology and biodiversity management. They will also gain knowledge of the importance of the time perspective in conservation biology and acquire the necessary skills to utilize the historical and fossil records for conservation science.			B				

9257 000 000 72910 - 0 - LABORATORIO DI CARTOGRAFIA NUMERICA E GIS	GEO/03	6	24/0/36/0	No	Voto
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Ambito: 402 - Discipline di scienze della Terra

B

Obiettivi: Al termine del corso, lo studente possiede tutte le conoscenze relative al corretto utilizzo della cartografia di base, è in grado di orientarsi e possiede le conoscenze necessarie per la lettura, l'interpretazione e l'utilizzo della cartografia topografica, tecnica e tematica. Ha a disposizione le nozioni pratiche elementari per l'utilizzo del sistema GPS finalizzato al rilevamento ed alla restituzione del lavoro di campagna. E' in grado di realizzare un sistema informativo geografico mediante l'uso di tecnologie GIS.

9257 000 000 88336 - 0 - STRUMENTI DI FINANZIAMENTO PER LA CONSERVAZIONE DELLA NATURA	CON	SECS-P/01	6	48/0/0/0	No	Voto
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Ambito: 1247 - Discipline agrarie, gestionali e comunicative

B

Obiettivi: Al termine del corso, lo studente acquisisce le conoscenze teoriche e pratiche per conoscere e reperire gli strumenti di finanziamento per sostenere progetti di tutela della natura e dell'ambiente e le loro modalità di applicazione. In particolare, lo studente è in grado di:

- conoscere le caratteristiche dei principali strumenti di finanziamento ed esempi di successo della loro applicazione nel settore della tutela della natura;
- distinguere lo strumento finanziario più adatto al quale ricorrere a seconda della problematica ambientale da trattare.
- saper impostare domande di finanziamento di iniziative di conservazione della natura in risposta a bandi pubblici e privati attraverso le metodologie più utilizzate;
- saper proporre a enti pubblici e privati coinvolti nella gestione della natura (parchi, comuni, associazioni, etc.) la partecipazione a bandi o a iniziative di finanziamento per sostenere progetti pilota di conservazione della natura.

Obiettivi inglese: By the end of the course, the student will have the theoretical and practical knowledge of the funding tools that can be used to support projects for the protection of nature and the environment, as well as their methods of application. In particular, the student will:

- understand the main financing instruments and be familiar with successful examples of their application in the field of nature conservation;
- be able to identify the most suitable financial instrument for the specific environmental problem to be treated;
- know how to develop funding applications for nature conservation initiatives in response to public and private opportunities through the most successful methodologies;
- understand best approach for funding proposals to public and private bodies involved in the management of nature (parks, municipalities, associations, etc.);
- be able to participate in calls for tenders or funding initiatives to support pilot nature conservation projects.

Gruppo: 2) Gruppo Discipline Biologiche

TAF: B Ambito: 042 - Discipline biologiche

Cfu min: 12 Cfu max: 12

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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9257 000 000 08211 - 0 - ECOFISIOLOGIA VEGETALE	BIO/04	6	40/0/12/0	No	Voto
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Ambito: 042 - Discipline biologiche

B

Obiettivi: Al termine del corso, lo studente avrà acquisito una visione critica ed approfondita delle principali tematiche dell'ecofisiologia vegetale riguardanti la fotosintesi, il metabolismo, i rapporti pianta-terreno, piante-radiazione luminosa e pianta-atmosfera, nonché elementi di fisiologia degli stress biotici e abiotici e di risposte difensive delle piante. Pertanto, lo studente sarà in grado di valutare in senso generale lo stato fisiologico di una vegetazione e di comprenderne i meccanismi di funzionamento e adattamento all'ambiente, giovandosi anche di un laboratorio personalizzato intensivo.

Obiettivi inglese: At the end of the course, the student will acquire a critical and in-depth vision of the main themes of plant ecophysiology concerning photosynthesis, metabolism, plant-soil, plant-light, and plant-atmosphere relationships, as well as physiological elements of biotic/abiotic stresses and defence plant responses. Therefore, the student will be able to critically evaluate the physiological state of plants and to understand the mechanisms of functioning and adaptation to the environment, also taking advantage of an intensive experimental laboratory.

9257 000 000 45009 - 0 - LABORATORIO DI BOTANICA SISTEMATICA	BIO/02	6	16/0/48/0	No	Voto
Ambito: 042 - Discipline biologiche	B				
Obiettivi: Al termine del corso, lo studente è in grado di inquadrare in un'ottica storica i sistemi di classificazione che ordinano la biodiversità vegetale in una gerarchia tassonomica; consegue, inoltre, la capacità di identificare le specie vegetali più diffuse in regione, utilizzando chiavi analitiche dicotomiche interattive o tradizionali basate su caratteri diagnostici morfologici macro- e microscopici. Lo studente acquisisce anche informazioni sul valore scientifico delle collezioni d'erbario e competenze pratiche relative alle tecniche di preparazione e conservazione dei campioni di essiccata.					
Obiettivi inglese: At the end of the course the student is able to place in a historical perspective the classification systems which organize plant diversity in a taxonomic hierarchy; he attains, also, the ability to identify the most common plant species in the region, using dichotomous analytical keys, interactive or traditional, based on macroscopic and microscopic morphology. The student also has a thorough knowledge of the key concepts and methods in analysis and intervention pertaining to protection of plant species. The course, mainly practical, includes indoor and outdoor practices.					
9257 000 000 88338 - 0 - LABORATORY OF PLANT CONSERVATION	BIO/02	6	16/10/36/0	No	Voto
Ambito: 042 - Discipline biologiche	B				
Obiettivi: The aim of the course is to provide students with a general overview of the policies, programs and conservation strategies of plant biodiversity, specifically of rare and endangered plants, and to give competences in plant conservation biology, from a species-based approach and in a global change scenario. At the end of the course the student will gain a thorough understanding of the priorities and methods used in plant conservation. In particular, the student is able to carry out demographic surveys in the field and acquire information on plant intraspecific diversity; identify threat factors for the survival of wild plant populations; set up appropriate management /concrete intervention actions.					
Obiettivi inglese: The aim of the course is to provide students with a general overview of the policies, programs and conservation strategies of plant biodiversity, specifically of rare and endangered plants, and to give competences in plant conservation biology, from a species-based approach and in a global change scenario. At the end of the course the student will gain a thorough understanding of the priorities and methods used in plant conservation. In particular, the student is able to carry out demographic surveys in the field and acquire information on plant intraspecific diversity; identify threat factors for the survival of wild plant populations; set up appropriate management /concrete intervention actions.					
9257 000 000 94429 - 0 - LICHENOLOGIA	BIO/02	6	32/0/24/0	No	Voto
Ambito: 042 - Discipline biologiche	B				
Obiettivi: Far acquisire allo studente conoscenze avanzate sulla biologia, la diversità, l'ecologia e la distribuzione dei licheni. Sviluppare la capacità di identificare le specie licheniche e di rilevarne la presenza/abbondanza in diversi ambienti.					

Gruppo: 3) Gruppo Discipline Ecologiche**TAF: B Ambito: 069 - Discipline ecologiche****Cfu min: 12 Cfu max: 12**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 97260 - 0 - BIOGEOGRAFIA E MACROECOLOGIA	BIO/03			6	32/24/0/0	No	Voto
Ambito: 1144 - Attività formative affini o integrative	C						
Obiettivi: L'obiettivo del corso è fornire allo studente una conoscenza avanzata circa la biodiversità e la distribuzione geografica degli organismi, a diversi livelli tassonomici. Lo studente acquisirà la conoscenza sui fattori evolutivi, popolazionistici, paleogeografici, paleoclimatici ed ecologici che hanno determinato la distribuzione differenziale degli organismi sulla Terra. Inoltre, lo studente acquisirà nozioni di base circa i metodi necessari per lo studio della biogeografia attuale e storica, nonché la capacità di interpretazione dei fattori determinanti la diversità e distribuzione degli organismi in ottica previsionale.							
Obiettivi inglese: The goal of the course is to provide to students an advanced knowledge about the biodiversity and geographic distribution of organisms, at different organization levels. The student will acquire a knowledge on how evolutionary, paleogeographic, paleoclimatic, and ecological factors have determined the present differential distribution of organisms on Earth. In addition, the student will acquire basic knowledge on the methods adopted for the quantitative study of present and historical biogeography, as well as the capacity to understand the factors determining the diversity and distribution of organisms in a predictive perspective.							

9257 000 000 91435 - 0 - GESTIONE DELLE RISORSE E DEI SERVIZI ECOSISTEMICI	BIO/07	6	24/10/24/0	No	Voto
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Ambito: 069 - Discipline ecologiche

B

Obiettivi: Lo studente apprenderà il concetto di "servizio ecosistemico", come è possibile determinarne un valore economico e come questo può aiutare la gestione delle risorse naturali. Imparerà a riconoscere le diverse tipologie di monitoraggio, incluso l'utilizzo di metodologie di citizen science, sperimentando alcune di queste durante escursioni in campo per la raccolta dei dati ed esercitazioni in laboratorio per la loro elaborazione. Lo studente affronterà alcuni casi studio legati al monitoraggio della biodiversità marina e al monitoraggio delle comunità ittiche e di macroinvertebrati in ambiente fluviale. In seguito, lo studente apprenderà le procedure di impatto ambientale (VIA, VAS) previste dalla legislazione, acquisendo conoscenze sia teoriche che pratiche degli strumenti e indici utilizzati nell'identificazione, stima e valutazione degli impatti. Verrà data particolare attenzione ad argomenti di maggior pertinenza per la futura attività professionale dello studente. Lo studente sarà anche in grado di conoscere ed effettuare attività di monitoraggio degli ecosistemi di acque dolci e di identificare la comunità macrobentonica fluviale al livello tassonomico richiesto dalla normativa.

Obiettivi inglese: The student will learn the concept of "ecosystem service", how it is possible to evaluate it economically, and how it can be useful for natural resource management. The student will learn to categorize different monitoring types, including citizen science methods, and will experiment some of techniques during field trips for data collection and laboratory exercises for their elaboration. The student will face some case studies of marine biodiversity monitoring and stream fish and macroinvertebrate communities. Later, the student will learn the procedure of environmental impact assessment (VIA, VAS) foreseen by Italian legislation, thus acquiring both theoretical and practical knowledge of the tools and indexes used in the identification and assessment of impacts. The most relevant topics for future professional development of the student will be particularly considered. The student will also be able to know and perform stream ecosystem monitoring activities and to identify the macrobenthic community to the taxonomic level required by legislation.

9257 000 000 B2111 - 0 - SPATIAL ECOLOGY IN R	BIO/03	6	32/20/0/0	No	Voto
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Ambito: 069 - Discipline ecologiche

B

Obiettivi: This course mainly focuses on the application of free and open source algorithms - which ensure high reproducibility and robustness of ecological analysis - to study ecological change in space and time, due to both human impact and global change. Particular emphasis will be given to: 1) population ecology: how organisms spread in space and how to study it by point pattern analysis, 2) how community are structured and how to study such structure by multivariate analysis; 3) monitoring species distributions and their change in space and time by species distribution modelling; 4) monitoring ecosystem change in space and time by remote sensing data. The course is dramatically practical giving space to exercises and additional ecological issues provided by the professor and suggested by students. We will make use of R which is one of the main free and open source software for ecological modelling. Students will finally be able to create their own project on monitoring of spatial and temporal changes of species and ecosystems at different spatial scales.

Obiettivi inglese: This course mainly focuses on the application of free and open source algorithms - which ensure high reproducibility and robustness of ecological analysis - to study ecological change in space and time, due to both human impact and global change. Particular emphasis will be given to: 1) population ecology: how organisms spread in space and how to study it by point pattern analysis, 2) how community are structured and how to study such structure by multivariate analysis; 3) monitoring species distributions and their change in space and time by species distribution modelling; 4) monitoring ecosystem change in space and time by remote sensing data. The course is dramatically practical giving space to exercises and additional ecological issues provided by the professor and suggested by students. We will make use of R which is one of the main free and open source software for ecological modelling. Students will finally be able to create their own project on monitoring of spatial and temporal changes of species and ecosystems at different spatial scales.

No previous knowledge of R is necessary. we will start from scratch, giving us time to practice and learn, creating knowledge instead of just information.

9257 000 000 B5817 - 0 - TELERILEVAMENTO GEO-ECOLOGICO IN R	BIO/03	6	32/20/0/0	No	Voto
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Ambito: 069 - Discipline ecologiche

B

Obiettivi: Al termine del corso, lo studente ha acquisito competenze sui principi e i fondamenti legati al telerilevamento da un punto di vista teorico e pratico, con applicazioni specifiche legate alla Geologia e all'Ecologia. In particolare, lo studente è in grado di:

- individuare le principali componenti legate a un'immagine telerilevata (risoluzione spaziale, radiometrica, spettrale e temporale)
- individuare le immagini ideali in funzione delle applicazioni di interesse e della scala di applicazione
- individuare le principali fonti di dati telerilevati
- interpretare le immagini telerilevate con particolare riferimento alla loro risoluzione spettrale
- derivare indici geologici ed ecologici per la caratterizzazione del paesaggio da remoto
- utilizzare software open source per la gestione e l'analisi di immagini telerilevate, mediante generazione di codice aperto.

Obiettivi inglese: At the end of the course, each student will gather knowledge on the main principles shaping remote sensing from both a theoretical and practical point of view, with specific applications to Geology and Ecology. In particular, each student will be able to:

- understand the main components related to satellite imagery (spatial radiometric, spectral and temporal resolutions),
- gather suitable data for the main theme of interest and the scale of the study,
- locate the main sources of remote sensing data,
- interpret satellite images with respect to their spectral resolution,

- calculate geological and ecological indices for characterizing landscapes,
- use free and open source software for managing and analyzing remote sensing data, by implementing open source code.

Gruppo: 4) Gruppo Discipline affini o integrative**TAF: C Ambito: 1144 - Attività formative affini o integrative****Cfu min: 18 Cfu max: 18**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 88265 - 0 - ANIMAL DIVERSITY AND DISTRIBUTION IN A CHANGING CLIMATE		BIO/05		6	32/0/24/0	No	Voto
Ambito: 042 - Discipline biologiche			B				
<p>Obiettivi: The aim of this course is to impart knowledge about animal diversity and biogeography linked to climate changes. In historical ages, in fact, animal natural distribution, as a product of evolution, has been often confused from anthropic activities. Climate changes, though, is currently boosting the process with an impact deeper than ever on animal diversity. Ranges of distribution can be either reduced or widened, promoting biodiversity loss/extinction or leading to new species relationships. Therefore, ecological equilibria can be severely modified, also because of the phenomenon – among others – of alien (invasive) species. Through the course - also based on current literature and online resources analyses – students will acquire the ability to discuss case studies of animal distribution following climate changes, to explain habitat dynamics (loss in biodiversity and alien species) and analyze methods for animal resources conservation halting biodiversity loss.</p> <p>Obiettivi inglese: The aim of this course is to impart knowledge about animal diversity and biogeography linked to climate changes. In historical ages, in fact, animal natural distribution, as a product of evolution, has been often confused from anthropic activities. Climate changes, though, is currently boosting the process with an impact deeper than ever on animal diversity. Ranges of distribution can be either reduced or widened, promoting biodiversity loss/extinction or leading to new species relationships. Therefore, ecological equilibria can be severely modified, also because of the phenomenon – among others – of alien (invasive) species. Through the course - also based on current literature and online resources analyses – students will acquire the ability to discuss case studies of animal distribution following climate changes, to explain habitat dynamics (loss in biodiversity and alien species) and analyze methods for animal resources conservation halting biodiversity loss.</p>							
9257 000 000 66505 - 0 - BIOLOGIA DELLA CONSERVAZIONE		BIO/05		6	40/10/0/0	No	Voto
Ambito: 1144 - Attività formative affini o integrative			C				
<p>Obiettivi: Al termine del corso, lo studente possiede le basi della "Biologia della Conservazione" conseguite attraverso l'esame di aspetti relativi alla Biodiversità in senso lato, al suo valore economico e alle minacce alla sua stessa esistenza: crescita popolazione umana, distruzione habitat ed ecosistemi, prelievo risorse, estinzione specie animali e vegetali, conoscenze sulla biologia di specie animali di particolare interesse naturalistico e/o conservazionistico. Sono acquisiti elementi relativi alla possibilità di conservazione e restauro di ambienti ed ecosistemi al fine di poter fronteggiare i danni prodotti dall'attività umana e dalle modificazioni climatiche globali. Alla fine del corso lo studente è anche in grado di: - conoscere biologia ed esigenze ecologiche di specie fortemente legate ad habitat particolari e di dimensioni anche esigue; - gestire l'ambiente naturale e l'ambiente urbano al fine di garantire la protezione, la conservazione e la diffusione anche di specie comprese nella Direttiva 92/43 CEE e di particolare interesse naturalistico.</p> <p>Obiettivi inglese: At the end of the course, the student has an overall view on the state of the earth's environments, its resources and its biodiversity, as well as the problems resulting from anthropogenic impacts. Furthermore, the student acquires notions about the conservation methods of species and environments at risk and the related problems.</p>							
9257 000 000 66773 - 0 - GENETICA DELLA CONSERVAZIONE		BIO/18		6	48/0/0/0	No	Voto
Ambito: 1008 - A scelta dello studente			D				
<p>Obiettivi: Al termine del corso, lo studente possiede i presupposti teorici e le conoscenze sui metodi di analisi della variabilità genetica entro e tra popolazioni di specie oggetto di programmi di conservazione. In particolare, lo studente è in grado di:</p> <ul style="list-style-type: none"> - comprendere le metodologie di quantificazione della variabilità genetica in popolazioni naturali; - valutare la struttura, la dinamica e l'utilizzo dei diversi tipi di marcatori molecolari che vengono applicati in genetica delle popolazioni; - identificare i criteri che consentono di valutare il rischio genetico di popolazioni frammentate, isolate, declinanti. <p>Obiettivi inglese: At the end of the course, the student will have theoretical knowledge on the methods describing the genetic variability within and between wildlife species or populations threatened by extinction. In particular, the student will be able to:- quantifying genetic variability in natural populations; - describing structure and gene flow in natural populations; - identifying the molecular markers applied in population genetics; - identifying the extinction risk in fragmented, isolated, and declining populations through the use of biomolecular analyses.</p>							

9257 000 000 B5825 - 0 - GLOBAL CHANGE AND EVOLUTION OF HUMAN-MODIFIED ECOSYSTEMS	BIO/07	6	48/0/0/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative	C				
Obiettivi: Students will learn the conceptual framework to understand the ecological interactions between natural and social systems in globally changing urban landscapes (terrestrial and marine), how natural systems are expected to evolve under a growing human selective pressure, and will gain analytical basic 'urban-ecology tools' to be applied in e.g. urban monitoring, planning and restoration.					
Obiettivi inglese: Students will learn the conceptual framework to understand the ecological interactions between natural and social systems in globally changing urban landscapes (terrestrial and marine), how natural systems are expected to evolve under a growing human selective pressure, and will gain analytical basic 'urban-ecology tools' to be applied in e.g. urban monitoring, planning and restoration.					

9257 000 000 81999 - 0 - RELAZIONI TRA BIODIVERSITA' E AMBIENTE	BIO/07	6	48/0/0/0	No	Voto
Ambito: 1144 - Attivita' formative affini o integrative	C				
Obiettivi: Al termine del corso, lo studente conosce come gli organismi interagiscono tra loro, in quanto componenti della struttura e della funzione degli ecosistemi, incluso lo stato e le conseguenze delle interazioni umane con l'ambiente in generale e il mare in particolare. Vengono analizzati gli effetti del cambiamento climatico globale sugli organismi chiave, sulla biodiversità e sugli ecosistemi, in particolare su quelli marini, compreso gli effetti sulle società ed economie umane. I modelli e le previsioni sono presentati prendendo in considerazione i differenti scenari futuri dell'IPCC (Intergovernmental Panel on Climate Change).					
Obiettivi inglese: After completing the course, the student will know how organisms interact, as components of the structure and function of ecosystems, including the consequences of human interactions with the environment in general, and the marine system in particular. They will know the effects of global climate change on key organisms, biodiversity and ecosystems, particularly on marine species, including the effects on human societies and economies. Models and forecasts are presented considering different ocean warming and acidification scenarios predicted by the IPCC (Intergovernmental Panel on Climate Change).					

Secondo Anno di Corso

Gruppo: A) Attività formative obbligatorie

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
CILT 000 000 26337 - 6 - IDONEITA' LINGUA INGLESE B - 2				6	25/0/50/0	No	Giudizio
Ambito: 1007 - Ulteriori conoscenze linguistiche	F						
Obiettivi: Al termine del corso lo studente acquisisce conoscenze di base per la comunicazione di dati scientifici in inglese (comunicazione orale e scrittura).							
Obiettivi inglese: At the end of the course the student acquires basic knowledge for communicating scientific data in english (oral communication and writing).							
9257 000 000 29746 - 0 - TIROCINIO				6	0/0/150/0	No	Giudizio
Ambito: 1146 - Tirocini formativi e di orientamento	F						
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.							
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.							

Gruppo: B) Corsi a libera scelta dello studente - regolamento

TAF: D Ambito: 1008 - A scelta dello studente

Cfu min: 12 Cfu max: 12

Num. Esami: 1 Num. Idoneità: 0

La Scuola garantisce che, ai fini del rispetto del limite massimo di 12 esami/5 idoneità i CFU a scelta saranno acquisibili con 1 esami e 0 idoneità

Note: I corsi a libera scelta possono essere anticipati al primo anno.

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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Qualsiasi attività dell'Ateneo (010)

Ambito:

Gruppo: C) PROVA FINALE E PREPARAZIONE DELLA PROVA FINALE (30 CFU)

TAF: Ambito:

Cfu min: 30 Cfu max: 30

Note: Lo studente dovrà scegliere di svolgere la sola prova finale (Gruppo 1) oppure la prova finale e una delle altre attività indicate nei rispettivi gruppi (Gruppo 2, 3 e 4).

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
GRUPPO 1				0-30			
9257 000 000 17268 - 0 - PROVA FINALE				30	0/0/0/0	No	
Ambito: 1018 - Per la prova finale			E				
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.							
GRUPPO 2				0-30			
9257 000 000 87471 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE				24	0/0/0/0	No	Giudizio
Ambito: 1018 - Per la prova finale			E				
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.							
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.							
9257 000 000 91427 - 0 - PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO				24	0/0/0/0	No	Giudizio
Ambito: 1018 - Per la prova finale			E				
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.							
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.							
9257 000 000 86360 - 0 - PROVA FINALE (6 CFU)				6	0/0/0/0	No	
Ambito: 1018 - Per la prova finale			E				
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.							

9257 000 000 81354 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO	24	0/0/0/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
GRUPPO 3	0-30			
9257 000 000 94531 - 0 - PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (18 CFU)	18	0/0/0/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.				
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 86331 - 0 - PROVA FINALE (12 CFU)	12	0/0/0/0	No	
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e biotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.				
9257 000 000 88054 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE (18 CFU)	18	0/0/450/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 88058 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (18 CFU)	18	0/0/450/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
GRUPPO 4	0-30			
9257 000 000 94530 - 0 - PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.				
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				

9257 000 000 94532 - 0 - PROVA FINALE (18 CFU)	18	0/0/0/0	No	
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine della prova finale, lo studente possiede le basi scientifiche necessarie all'esercizio delle professioni naturalistiche nei settori ambientali. E' capace di analizzare, ripristinare e conservare componenti biotiche e abiotiche di ecosistemi naturali e artificiali e di operare come esperto in centri didattici. Possiede inoltre le basi metodologiche e culturali per la formazione permanente e i fondamenti metodologici della ricerca scientifica nel settore naturalistico.				
9257 000 000 88053 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 88057 - 0 - TIROCINIO IN PREPARAZIONE DELLA PROVA FINALE ALL'ESTERO (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: Al termine dell'attività, lo studente, dopo un percorso personalizzato di formazione finalizzato a soggiorni presso strutture pubbliche e private di ricerca o del mondo produttivo, in Italia o all'estero, acquisisce gli strumenti operativi spendibili nel mondo del lavoro o presso strutture di ricerca, ed eventualmente individua l'argomento di studio per la prova finale.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				

Anno Accademico 2024/2025
Scuola Scienze
Classe LM-60-SCIENZE DELLA NATURA
Corso 9257-SCIENZE E GESTIONE DELLA NATURA

CURRICULUM GLOBAL CHANGE ECOLOGY AND SUSTAINABLE DEVELOPMENT GOALS (B33)

Primo Anno di Corso

Gruppo: 1) Compulsory Learning Activities

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 88263 - 0 - STATISTICAL ANALYSIS AND MODELLING		SECS-S/01		6	32/0/24/0	No	Voto

Ambito: 1246 - Discipline chimiche, fisiche, matematiche ed informatiche

Obiettivi: By the end of the course, the student will learn the main statistical methods to deal with ecological, economical and social data, both using univariate and multivariate approaches. The student will have the capacity to deal with the practical applications of several statistical methods to real world cases and data.

Obiettivi inglese: By the end of the course, the student will learn the main statistical methods to deal with ecological, economical and social data, both using univariate and multivariate approaches. The student will have the capacity to deal with the practical applications of several statistical methods to real world cases and data.

Gruppo: 2) Discipline Group: Biology

TAF: B Ambito: 042 - Discipline biologiche

Cfu min: 12 **Cfu max:** 12

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 88267 - 0 - ANIMAL ADAPTATION TO CLIMATE CHANGE		BIO/09		6	48/0/0/0	No	Voto

Ambito: 042 - Discipline biologiche

Obiettivi: At the end of the course students will demonstrate knowledge and understanding of the physiological mechanisms (at the molecular, cellular and systemic levels) through which animals - including humans - can adapt to changes in temperature, pH, osmolarity, water scarcity, etc. in the surrounding environment. On the other hand, students will know the limits of adaptation, thus being able to evaluate the risks related to climate changes. Students will have the ability to integrate knowledge and formulate hypothesis, and clearly communicate their achievements.

Obiettivi inglese: At the end of the course students will demonstrate knowledge and understanding of the physiological mechanisms (at the molecular, cellular and systemic levels) through which animals - including humans - can adapt to changes in temperature, pH, osmolarity, water scarcity, etc. in the surrounding environment. On the other hand, students will know the limits of adaptation, thus being able to evaluate the risks related to climate changes. Students will have the ability to integrate knowledge and formulate hypothesis, and clearly communicate their achievements.

9257 000 000 88265 - 0 - ANIMAL DIVERSITY AND DISTRIBUTION IN A CHANGING CLIMATE	BIO/05	6	32/0/24/0	No	Voto
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Ambito: 042 - Discipline biologiche

B

Obiettivi: The aim of this course is to impart knowledge about animal diversity and biogeography linked to climate changes. In historical ages, in fact, animal natural distribution, as a product of evolution, has been often confused from anthropic activities. Climate changes, though, is currently boosting the process with an impact deeper than ever on animal diversity. Ranges of distribution can be either reduced or widened, promoting biodiversity loss/extinction or leading to new species relationships. Therefore, ecological equilibria can be severely modified, also because of the phenomenon – among others – of alien (invasive) species. Through the course - also based on current literature and online resources analyses – students will acquire the ability to discuss case studies of animal distribution following climate changes, to explain habitat dynamics (loss in biodiversity and alien species) and analyze methods for animal resources conservation halting biodiversity loss.

Obiettivi inglese: The aim of this course is to impart knowledge about animal diversity and biogeography linked to climate changes. In historical ages, in fact, animal natural distribution, as a product of evolution, has been often confused from anthropic activities. Climate changes, though, is currently boosting the process with an impact deeper than ever on animal diversity. Ranges of distribution can be either reduced or widened, promoting biodiversity loss/extinction or leading to new species relationships. Therefore, ecological equilibria can be severely modified, also because of the phenomenon – among others – of alien (invasive) species. Through the course - also based on current literature and online resources analyses – students will acquire the ability to discuss case studies of animal distribution following climate changes, to explain habitat dynamics (loss in biodiversity and alien species) and analyze methods for animal resources conservation halting biodiversity loss.

9257 000 000 88266 - 0 - HUMAN ADAPTIVE INTERACTIONS TO CHANGING ENVIRONMENTS	BIO/08	6	48/0/0/0	No	Voto
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Ambito: 042 - Discipline biologiche

B

Obiettivi: At the end of the course, students will acquire knowledge on the distribution of human biodiversity all over the world and on the main adaptive processes that have influenced it by shaping patterns of phenotypic and molecular variation of human populations. In particular, it will be explored how the occupation of different and changing environments by modern humans has prompted ecological and cultural shifts that introduced novel selective pressures impacting on the human genome. Moreover, special attention will be deserved to the discussion of cases in which ecological and cultural contexts have changed so rapidly in the modern era to trigger adaptive traits previously shaped by natural selection into maladaptive ones. Accordingly, the course will also provide to the students elements useful for the understanding of the evolutionary causes of differential susceptibilities of human populations to complex diseases.

Obiettivi inglese: At the end of the course, students will acquire knowledge on the distribution of human biodiversity all over the world and on the main adaptive processes that have influenced it by shaping patterns of phenotypic and molecular variation of human populations. In particular, it will be explored how the occupation of different and changing environments by modern humans has prompted ecological and cultural shifts that introduced novel selective pressures impacting on the human genome. Moreover, special attention will be deserved to the discussion of cases in which ecological and cultural contexts have changed so rapidly in the modern era to trigger adaptive traits previously shaped by natural selection into maladaptive ones. Accordingly, the course will also provide to the students elements useful for the understanding of the evolutionary causes of differential susceptibilities of human populations to complex diseases.

9257 000 000 88848 - 0 - PLANT INTERACTIONS WITH GLOBAL CHANGE	BIO/01	6	48/0/0/0	No	Voto
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Ambito: 042 - Discipline biologiche

B

Obiettivi: At the end of the course, students will have acquired knowledge on the main morphological, physiological and molecular responses of higher plants to environmental cues and the basic mechanisms of tolerance and adaptation to adverse conditions. They will learn about how plants contribute to air quality by the release of biotic particulates and by interfering with air pollutants derived from anthropogenic activities. Due to changes in plant distribution in relation to climate change, students shall become acquainted with the contribution of alien species to the release of such biotic particulates. Students will also learn about methods employed in aerobiology for the quantitative and qualitative assessment of pollen and other air-borne allergens. They will gain the capacity to interpret data and critically read scientific literature relating to this topic.

Obiettivi inglese: At the end of the course, students will have acquired knowledge on the main morphological, physiological and molecular responses of higher plants to environmental cues and the basic mechanisms of tolerance and adaptation to adverse conditions. They will learn about how plants contribute to air quality by the release of biotic particulates and by interfering with air pollutants derived from anthropogenic activities. Due to changes in plant distribution in relation to climate change, students shall become acquainted with the contribution of alien species to the release of such biotic particulates. Students will also learn about methods employed in aerobiology for the quantitative and qualitative assessment of pollen and other air-borne allergens. They will gain the capacity to interpret data and critically read scientific literature relating to this topic.

Gruppo: 3) Discipline Group: Ecology

TAF: B Ambito: 069 - Discipline ecologiche

Cfu min: 12 Cfu max: 12

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ. VER.
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9257 000 000 88270 - 0 - BIOGEOGRAPHY AND MACROECOLOGY	BIO/03	6	32/0/24/0	No	Voto
B					
<p>Ambito: 069 - Discipline ecologiche</p> <p>Obiettivi: At the end of the course, students will have acquired knowledge on the development and distribution of the diversity of life on Earth, with a special emphasis on plants. They will learn about the spatial scaling of biodiversity, the role of biogeography, and the different levels of assembly organisation, from the local to the global scales. Students shall become acquainted with methods for the measurement of biodiversity and its partitioning across scales, as well as the role of biodiversity for ecosystem functioning and stability and relations between biodiversity and climate. Students will also learn about the use of biogeographical and macroecological theories and methods to understand the present strategies for biodiversity conservation. They will gain the capacity to investigate natural systems by means of data collection and analyses and preparation of a written report.</p> <p>Obiettivi inglese: At the end of the course, students will have acquired knowledge on the development and distribution of the diversity of life on Earth, with a special emphasis on plants. They will learn about the spatial scaling of biodiversity, the role of biogeography, and the different levels of assembly organisation, from the local to the global scales. Students shall become acquainted with methods for the measurement of biodiversity and its partitioning across scales, as well as the role of biodiversity for ecosystem functioning and stability and relations between biodiversity and climate. Students will also learn about the use of biogeographical and macroecological theories and methods to understand the present strategies for biodiversity conservation. They will gain the capacity to investigate natural systems by means of data collection and analyses and preparation of a written report.</p>					
9257 000 000 88272 - 0 - CLIMATE CHANGE IMPACTS ON COASTAL SOCIETY AND MARINE ECOSYSTEMS	BIO/07	6	48/0/0/0	No	Voto
B					
<p>Ambito: 069 - Discipline ecologiche</p> <p>Obiettivi: Students will know the effects of global climate change on key organisms, biodiversity and ecosystems, particularly on marine species, including the effects on human societies and economies. Models and forecasts are presented considering different scenarios predicted by the IPCC (Intergovernmental Panel on Climate Change). Students will know how organisms interact, as components of the structure and function of ecosystems, including the consequences of human interactions with the environment. Marine organisms are traced from the Earth's primordial oceans, to their response to the warming and acidifying oceans.</p> <p>Obiettivi inglese: Students will know the effects of global climate change on key organisms, biodiversity and ecosystems, particularly on marine species, including the effects on human societies and economies. Models and forecasts are presented considering different scenarios predicted by the IPCC (Intergovernmental Panel on Climate Change). Students will know how organisms interact, as components of the structure and function of ecosystems, including the consequences of human interactions with the environment. Marine organisms are traced from the Earth's primordial oceans, to their response to the warming and acidifying oceans.</p>					
9257 000 000 B5825 - 0 - GLOBAL CHANGE AND EVOLUTION OF HUMAN-MODIFIED ECOSYSTEMS	BIO/07	6	48/0/0/0	No	Voto
C					
<p>Ambito: 1144 - Attivita' formative affini o integrative</p> <p>Obiettivi: Students will learn the conceptual framework to understand the ecological interactions between natural and social systems in globally changing urban landscapes (terrestrial and marine), how natural systems are expected to evolve under a growing human selective pressure, and will gain analytical basic 'urban-ecology tools' to be applied in e.g. urban monitoring, planning and restoration.</p> <p>Obiettivi inglese: Students will learn the conceptual framework to understand the ecological interactions between natural and social systems in globally changing urban landscapes (terrestrial and marine), how natural systems are expected to evolve under a growing human selective pressure, and will gain analytical basic 'urban-ecology tools' to be applied in e.g. urban monitoring, planning and restoration.</p>					
9257 000 000 B2111 - 0 - SPATIAL ECOLOGY IN R	BIO/03	6	32/20/0/0	No	Voto
B					
<p>Ambito: 069 - Discipline ecologiche</p> <p>Obiettivi: This course mainly focuses on the application of free and open source algorithms - which ensure high reproducibility and robustness of ecological analysis - to study ecological change in space and time, due to both human impact and global change. Particular emphasis will be given to: 1) population ecology: how organisms spread in space and how to study it by point pattern analysis, 2) how community are structured and how to study such structure by multivariate analysis; 3) monitoring species distributions and their change in space and time by species distribution modelling; 4) monitoring ecosystem change in space and time by remote sensing data. The course is dramatically practical giving space to exercises and additional ecological issues provided by the professor and suggested by students. We will make use of R which is one of the main free and open source software for ecological modelling. Students will finally be able to create their own project on monitoring of spatial and temporal changes of species and ecosystems at different spatial scales.</p> <p>Obiettivi inglese: This course mainly focuses on the application of free and open source algorithms - which ensure high reproducibility and robustness of ecological analysis - to study ecological change in space and time, due to both human impact and global change. Particular emphasis will be given to: 1) population ecology: how organisms spread in space and how to study it by point pattern analysis, 2) how community are structured and how to study such structure by multivariate analysis; 3) monitoring species distributions and their change in space and time by species distribution modelling; 4) monitoring ecosystem change in space and time by remote sensing data. The course is dramatically practical giving space to exercises and additional ecological issues provided by the professor and suggested by students. We will make use of R which is one of the main free and open source software for ecological modelling. Students will finally be able to create their own project on monitoring of spatial and temporal changes of species and ecosystems at different spatial scales.</p> <p>No previous knowledge of R is necessary. we will start from scratch, giving us time to practice and learn, creating knowledge instead of just information.</p>					

Gruppo: 4) Discipline Group: Earth Science**TAF: B Ambito: 402 - Discipline di scienze della Terra****Cfu min: 12 Cfu max: 12**

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 95988 - 0 - COASTAL SYSTEMS AND GLOBAL CHANGE		GEO/02		6	40/10/0/0	No	Voto
Ambito: 402 - Discipline di scienze della Terra			B				
<p>Obiettivi: The aim of the course is to introduce students to the main impacts of global change on coastal systems in the past, present and future. Climate changes in the geological time (and particularly in the Late Quaternary) will be taken into account for contextualizing recent/current trends in coastal behavior, and for better understanding the role of the anthropogenic component. Key processes interacting at different temporal and spatial scales on coastal systems and driving their dynamic evolution will be considered. The effects of global change on modern coastal systems will be discussed, with emphasis on major threats due to sea-level rise, to the occurrence of extreme events, coastal erosion and flooding. Possible mitigation and adaptation strategies, enhancing resilience and reducing vulnerability of coastal systems, are also introduced.</p> <p>Obiettivi inglese: The aim of the course is to introduce students to the main impacts of global change on coastal systems in the past, present and future. Climate changes in the geological time (and particularly in the Late Quaternary) will be taken into account for contextualizing recent/current trends in coastal behavior, and for better understanding the role of the anthropogenic component. Key processes interacting at different temporal and spatial scales on coastal systems and driving their dynamic evolution will be considered. The effects of global change on modern coastal systems will be discussed, with emphasis on major threats due to sea-level rise, to the occurrence of extreme events, coastal erosion and flooding. Possible mitigation and adaptation strategies, enhancing resilience and reducing vulnerability of coastal systems, are also introduced.</p>							
9257 000 000 B5827 - 0 - GEOSYSTEMS RESPONSE TO QUATERNARY CLIMATE CHANGES		GEO/01		6	40/0/12/0	No	Voto
Ambito: 402 - Discipline di scienze della Terra			B				
<p>Obiettivi: Under the threat of sea-level rise and global warming, data preserved within the recent sedimentary record are playing an increasingly important role in conservation biology practice and policy. The aim of this course is to promote understanding of how past patterns of variability can aid the development of more effective biodiversity conservation strategies and ecosystem management in the face of climate change. In this course, we will introduce elements of paleoecology, stratigraphy and paleoclimatology in order to analyze how the Quaternary record can be used to understand the ecological and environmental responses to climate changes. This course will also highlight the utility of fossils in providing a reference baseline for evaluating severity and significance of the anthropogenic impact on present-day ecosystems and their biodiversity. Methods and best practices to integrate paleontological, ecological and sedimentological data for a multidimensional view of past ecosystems are presented and discussed. Finally, the course is integrated by laboratory training on the field and will be offered an opportunity to analyze environmental dynamics in response to past climatic-eustatic perturbations directly on outcrops and/or cores.</p> <p>Obiettivi inglese: Under the threat of sea-level rise and global warming, data preserved within the recent sedimentary record are playing an increasingly important role in conservation biology practice and policy. The aim of this course is to promote understanding of how past patterns of variability can aid the development of more effective biodiversity conservation strategies and ecosystem management in the face of climate change. In this course, we will introduce elements of paleoecology, stratigraphy and paleoclimatology in order to analyze how the Quaternary record can be used to understand the ecological and environmental responses to climate changes. This course will also highlight the utility of fossils in providing a reference baseline for evaluating severity and significance of the anthropogenic impact on present-day ecosystems and their biodiversity. Methods and best practices to integrate paleontological, ecological and sedimentological data for a multidimensional view of past ecosystems are presented and discussed. Finally, the course is integrated by laboratory training on the field and will be offered an opportunity to analyze environmental dynamics in response to past climatic-eustatic perturbations directly on outcrops and/or cores.</p>							
9257 000 000 88274 - 0 - PROTECTION AND CONTAMINATION OF GROUNDWATER RESOURCES		GEO/05		6	40/0/12/0	No	Voto
Ambito: 402 - Discipline di scienze della Terra			B				
<p>Obiettivi: The aim of this course is to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on the role of groundwater inside the hydrologic cycle, on how groundwater affects ecosystems and how groundwater is impacted by anthropogenic drivers or climate change. In the Module 1 the discussion focuses on the knowledge of the functionality of groundwater flow systems, how they react to precipitation and temperature regime from the local to the regional scales. Methods for groundwater quantitative assessment and for evaluation of the interactions between groundwater, surface waters and ecosystems are presented and discussed. Ecosystemic services provided by groundwater are defined and analyzed. The interactions between groundwater and climate change are emphasized along with the resilience of groundwater to droughts. In the Module 2 the students gets the main concepts of contamination of groundwater by anthropic sources along with the knowledge about fate and transport of contaminants in the ground and waters. The students gets knowledge about the paradigm of sanitary risk assessment and eco-toxicological impacts deriving from contaminated sites. One credit of field activity will integrate the lessons with practical activity of hydrogeological monitoring in groundwater dependent ecosystems.</p> <p>Obiettivi inglese: The aim of this course is to impart knowledge about the importance and physical distribution of groundwater resources at the global scale with a special emphasis on the role of groundwater inside the hydrologic cycle, on how groundwater affects ecosystems and how groundwater is impacted by anthropogenic drivers or climate change. In the Module 1 the discussion focuses on the knowledge of the functionality of groundwater flow systems, how they react to precipitation and temperature regime from the local to the regional scales. Methods for</p>							

groundwater quantitative assessment and for evaluation of the interactions between groundwater, surface waters and ecosystems are presented and discussed. Ecosystemic services provided by groundwater are defined and analyzed. The interactions between groundwater and climate change are emphasized along with the resilience of groundwater to droughts. In the Module 2 the students gets the main concepts of contamination of groundwater by anthropic sources along with the knowledge about fate and transport of contaminants in the ground and waters. The students gets knowledge about the paradigm of sanitary risk assessment and eco-toxicological impacts deriving from contaminated sites. One credit of field activity will integrate the lessons with practical activity of hydrogeological monitoring in groundwater dependent ecosystems.

9257 000 000 91412 - 0 - VOLCANIC HAZARDS AND ENVIRONMENTAL IMPACT	GEO/08	6	32/0/24/0	No	Voto
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Ambito: 402 - Discipline di scienze della Terra B
Obiettivi: Volcanism is one of the most dramatic and rapid agent of geologic change. Even though less frequent and devastating than earthquakes, any kind of volcano can produce hazardous or deadly phenomena, whether during an eruption or in quiescence conditions, thus inducing risks for densely populated areas around the world. Some eruptions can have a meaningful global impact on Earth's climate, either with cooling or warming effects, through the ejection of large amounts of ash particles and gases into the atmosphere. Understanding the eruptive behaviour of a volcano is the first step in mitigating volcanic hazards (and risk), eventually taking into consideration some elements of unpredictability inherent to these natural systems. At the end of the course, students will acquire knowledge on the main eruptive processes (lava flows, explosive eruptions, volcano-tectonic collapses, lahars) and their effects on persons, properties and resources and the environment, with a particular focus on the eruptive phenomena that can potentially affect (global) climate changes (ash dispersal, gas emission). Moreover, students will learn about the main parameters for the monitoring of volcanoes, i.e. deformation of the soil, seismicity, and fluid geochemistry, particularly implementing the monitoring techniques based on gas emission in volcanic-hydrothermal systems by means of laboratory experiments on analytical methods. Laboratory activities will also concern the most important models used for volcanic hazards and risk assessment and the mathematical and statistical methods for processing data in terms of volcanic plume dynamics and atmospheric transport of volcanic ash, gravity-driven phenomena (lava flows, pyroclastic currents and lahars) and dispersal of volcanic and hydrothermal gases into the air. The course will be integrated by a field excursion in Italian active volcanic areas (Etna, Stromboli, Vulcano, Vesuvius and Campi Flegrei), including visits to volcanic observatories and seminars of researchers from other institutions about their monitoring.

Obiettivi inglese: Volcanism is one of the most dramatic and rapid agent of geologic change. Even though less frequent and devastating than earthquakes, any kind of volcano can produce hazardous or deadly phenomena, whether during an eruption or in quiescence conditions, thus inducing risks for densely populated areas around the world. Some eruptions can have a meaningful global impact on Earth's climate, either with cooling or warming effects, through the ejection of large amounts of ash particles and gases into the atmosphere. Understanding the eruptive behaviour of a volcano is the first step in mitigating volcanic hazards (and risk), eventually taking into consideration some elements of unpredictability inherent to these natural systems. At the end of the course, students will acquire knowledge on the main eruptive processes (lava flows, explosive eruptions, volcano-tectonic collapses, lahars) and their effects on persons, properties and resources and the environment, with a particular focus on the eruptive phenomena that can potentially affect (global) climate changes (ash dispersal, gas emission). Moreover, students will learn about the main parameters for the monitoring of volcanoes, i.e. deformation of the soil, seismicity, and fluid geochemistry, particularly implementing the monitoring techniques based on gas emission in volcanic-hydrothermal systems by means of laboratory experiments on analytical methods. Laboratory activities will also concern the most important models used for volcanic hazards and risk assessment and the mathematical and statistical methods for processing data in terms of volcanic plume dynamics and atmospheric transport of volcanic ash, gravity-driven phenomena (lava flows, pyroclastic currents and lahars) and dispersal of volcanic and hydrothermal gases into the air. The course will be integrated by a field excursion in Italian active volcanic areas (Etna, Stromboli, Vulcano, Vesuvius and Campi Flegrei), including visits to volcanic observatories and seminars of researchers from other institutions about their monitoring.

Gruppo: 5) Discipline Group: Agriculture, Management and Communication

TAF: B Ambito: 1247 - Discipline agrarie, gestionali e

Cfu min: 12 Cfu max: 12

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
9257 000 000 47311 - 0 - CORPORATE SOCIAL RESPONSIBILITY	CON	SECS-P/07		6	30/0/0/0	No	Voto

Ambito: 1247 - Discipline agrarie, gestionali e comunicative B
Obiettivi: The course aims to clarify the meaning of Corporate Social Responsibility (CSR), to identify its strategic implications in terms of: sustainability of business models, need for innovative managerial paradigms based on stakeholder engagement and cooperation; measurement of the economic, social and environmental impact of company activities; life cycle assessment; strategic planning of the United Nations 2030 agenda; communication and reporting methods. The course develops the aforementioned themes with applications to companies, public administrations and non-profit organizations.

Obiettivi inglese: The course aims to clarify the meaning of Corporate Social Responsibility (CSR), to identify its strategic implications in terms of: sustainability of business models, need for innovative managerial paradigms based on stakeholder engagement and cooperation; measurement of the economic, social and environmental impact of company activities; life cycle assessment; strategic planning of the United Nations 2030 agenda; communication and reporting methods. The course develops the aforementioned themes with applications to companies, public administrations and non-profit organizations.

9257 000 000 88268 - 0 - ENVIRONMENTAL AND RESOURCE ECONOMICS	CON	SECS-P/01	6	30/0/0/0	No	Voto
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Ambito: 1247 - Discipline agrarie, gestionali e comunicative

B

Obiettivi: The purpose of the course is to introduce students with a background in Science to the methods and policy tools used in environmental and resource economics in order to achieve efficient management of pollution and environmental resources. More specifically, the course will introduce the concept of environmental externalities as the main source of environmental degradation, and the policy instruments used to correct these externalities. The course will also include an introduction to climate change economics and climate policy. Student having successfully completed the course are expected have a good understanding of issues and economic policies related to controlling environmental pollution and climate change.

Obiettivi inglese: The purpose of the course is to introduce students with a background in Science to the methods and policy tools used in environmental and resource economics in order to achieve efficient management of pollution and environmental resources. More specifically, the course will introduce the concept of environmental externalities as the main source of environmental degradation, and the policy instruments used to correct these externalities. The course will also include an introduction to climate change economics and climate policy. Student having successfully completed the course are expected have a good understanding of issues and economic policies related to controlling environmental pollution and climate change.

9257 000 000 87167 - 0 - INTERNATIONAL DEVELOPMENT ECONOMICS	CON	SECS-P/01	6	30/0/0/0	No	Voto
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Ambito: 1247 - Discipline agrarie, gestionali e comunicative

B

Obiettivi: This is a course is an applied course on international development economics, organised around a few selected topics. The aim of the course is to offer the theoretical and analytical tools is to understand the different interpretations of social and economic development - in its evolving features - both at the country and at the international level. With the objective of providing the basic context for correctly framing the Sustainable Development Goals, the course focuses on issues such as poverty, hunger, inequality, migration and unbalanced development. The experience of the so-called emerging countries will be one of the privileged points of view. Students will be able to acquire the ability to tackle the problems of economic development and competition in an applied and comparative perspective, with thematic in-depth applications.

Obiettivi inglese: This is a course is an applied course on international development economics, organised around a few selected topics. The aim of the course is to offer the theoretical and analytical tools is to understand the different interpretations of social and economic development - in its evolving features - both at the country and at the international level. With the objective of providing the basic context for correctly framing the Sustainable Development Goals, the course focuses on issues such as poverty, hunger, inequality, migration and unbalanced development. The experience of the so-called emerging countries will be one of the privileged points of view. Students will be able to acquire the ability to tackle the problems of economic development and competition in an applied and comparative perspective, with thematic in-depth applications.

9257 000 000 88269 - 0 - POLITICS AND SOCIETY IN THE GLOBAL WORLD	CON	SPS/08	6	48/0/0/0	No	Voto
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Ambito: 1247 - Discipline agrarie, gestionali e comunicative

B

Obiettivi: The course aims to give students n in-depth understanding of global events and of the causes and consequences of globalisation in a variety of political and social domains. At the end of the course, students will be able to discuss and learn about: the most pressing problems in the global political economy (inequalities, poverty, migration); the major political and societal forces at work in the world system; the actions of governments and other decision-makers within world politics; how the distribution of economic resources is influencing both politics and society; the prospects for global governance.

Obiettivi inglese: The course aims to give students n in-depth understanding of global events and of the causes and consequences of globalisation in a variety of political and social domains. At the end of the course, students will be able to discuss and learn about: the most pressing problems in the global political economy (inequalities, poverty, migration); the major political and societal forces at work in the world system; the actions of governments and other decision-makers within world politics; how the distribution of economic resources is influencing both politics and society; the prospects for global governance.

Gruppo: 6) Elective Learning Activities

TAF: C Ambito: 1144 - Attivita' formative affini o integrative

Cfu min: 12 Cfu max: 12

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ.	VER.
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9257 000 000 88648 - 0 - AGRICULTURAL AND FOOD POLICIES		AGR/01		6	30/0/0/0	No	Voto
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Ambito: 1144 - Attivita' formative affini o integrative

C

Obiettivi: The course reviews the political landscape of food and farming in industrialized and developing countries. At the end of the course the student is able to: identify the different stakeholders operating in the food and farming sectors; understand and evaluate objectives, policy instruments and strategies that characterize an agricultural policy; identify policy interventions that address food security (SDG2); outline and design policies for sustainable farming and consumption patterns (SDG12); understand the food&energy nexus; identify strategies to address food losses and waste (SDG12.3).

Obiettivi inglese: The course reviews the political landscape of food and farming in industrialized and developing countries. At the end of the course the student is able to: identify the different stakeholders operating in the food and farming sectors; understand and evaluate objectives, policy instruments and strategies that characterize an agricultural policy; identify policy interventions that address food security (SDG2); outline and design policies for sustainable farming and consumption patterns (SDG12); understand the food&energy nexus; identify strategies to address food losses and waste (SDG12.3).

9257 000 000 70040 - 0 - RESOURCES AND RECYCLING	ING-IND/29	6	24/10/12/0	No	Voto
C					
<p>Ambito: 1144 - Attivita' formative affini o integrative</p> <p>Obiettivi: The aim of this course is to develop cultural, scientific and technical aspects for the enhancement and sustainable use and recycling of both raw materials and primary-secondary resources. Moreover, they will be developed the design aspects and feasibility of Appropriate Technologies for the developing countries, particularly with regard to water supply, wastewater treatment and solid waste management. The course is deeped on principles of Circular Economy (dry waste for recycling and organic waste for composting), on the circularity as tool for saving raw material, water and natural resources and to reduce waste production.</p> <p>Obiettivi inglese: The aim of this course is to develop cultural, scientific and technical aspects for the enhancement and sustainable use and recycling of both raw materials and primary-secondary resources. Moreover, they will be developed the design aspects and feasibility of Appropriate Technologies for the developing countries, particularly with regard to water supply, wastewater treatment and solid waste management. The course is deeped on principles of Circular Economy (dry waste for recycling and organic waste for composting), on the circularity as tool for saving raw material, water and natural resources and to reduce waste production.</p>					

9257 000 000 88276 - 0 - SUSTAINABLE FOOD TECHNOLOGIES	AGR/15	6	32/20/0/0	No	Voto
C					
<p>Ambito: 1144 - Attivita' formative affini o integrative</p> <p>Obiettivi: The objective of this course is to impart knowledge on the food technologies and unit operations having the potential to optimize the preservation of the nutritional and sensory properties, thus ensuring healthy, tasty, and sustainable food, even once it is processed. A deepening will regard the small and medium scale operations (minimal processing) that can be easily used also by farmers, small enterprises and in developing countries, in strict relation with the SDGs 2. A special focus will be on the innovative food technologies able to increase competitiveness, sustainability, circularity and diversity of local and typical foods. The teaching course will benefit of a strict connection with food companies, thanks to the planning of educational visit to plants, lab-scale production laboratories and training placements.</p> <p>Obiettivi inglese: The objective of this course is to impart knowledge on the food technologies and unit operations having the potential to optimize the preservation of the nutritional and sensory properties, thus ensuring healthy, tasty, and sustainable food, even once it is processed. A deepening will regard the small and medium scale operations (minimal processing) that can be easily used also by farmers, small enterprises and in developing countries, in strict relation with the SDGs 2. A special focus will be on the innovative food technologies able to increase competitiveness, sustainability, circularity and diversity of local and typical foods. The teaching course will benefit of a strict connection with food companies, thanks to the planning of educational visit to plants, lab-scale production laboratories and training placements.</p>					

9257 000 000 B5828 - 0 - URBAN AND TERRITORIAL PLANNING IN A CHANGING CLIMATE	ICAR/20	6	48/0/0/0	No	Voto
C					
<p>Ambito: 1144 - Attivita' formative affini o integrative</p> <p>Obiettivi: According with UN 2030 SDG n. 11, our cities and human settlements have to become more inclusive, safe, resilient and sustainable. At the end of the course the student will know how to interpret the characteristics of the contemporary city in a changing climate. The student will know the main available tools and methods to understand, plan and design adaptive communities, taking into account the peculiarities of diverse context (urban, rural, island mountain). Greening and ecosystem services will be explored as strong driver of resilience and sustainability, while principle of environmental and climate justice will be integrated throughout the course.</p> <p>Obiettivi inglese: According with UN 2030 SDG n. 11, our cities and human settlements have to become more inclusive, safe, resilient and sustainable. At the end of the course the student will know how to interpret the characteristics of the contemporary city in a changing climate. The student will know the main available tools and methods to understand, plan and design adaptive communities, taking into account the peculiarities of diverse context (urban, rural, island mountain). Greening and ecosystem services will be explored as strong driver of resilience and sustainability, while principle of environmental and climate justice will be integrated throughout the course.</p>					

Secondo Anno di Corso

Gruppo: A) Compulsory Learning Activities

TAF: Ambito:

Cfu min: Cfu max:

Note:

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ. VER.
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9257 000 000 85201 - 0 - INTERNSHIP

6

0/0/150/0

No

Giudizio

Ambito: 1146 - Tirocini formativi e di orientamento

F

Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.

Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.

Gruppo: B) Free Choice Learning Activities - regolamento**TAF: D Ambito: 1008 - A scelta dello studente****Cfu min: 18 Cfu max: 18** Num. Esami: 1 Num. Idoneità: 0

La Scuola garantisce che, ai fini del rispetto del limite massimo di 12 esami/5 idoneità i CFU a scelta saranno acquisibili con 1 esami e 0 idoneità

Note: Free choice activities can be chosen during the first or the second year. Students can choose 18 ECTS among the following courses or among the ones not previously chosen in Groups 2-3-4-5-6 during the First Year.

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ. VER.
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Qualsiasi attività dell'Ateneo (010)

Ambito:

Qualsiasi attività della Presidenza della Scuola di Scienze sede di Bologna

Ambito:

Gruppo: C) Finale Examination and Thesis Preparation Activities (30 CFU)**TAF: Ambito:****Cfu min: 30 Cfu max: 30**

Note: Students must choose or the final examination (Group 1) or the final examination matched with one of the other activities listed in the respective groups (Group 2, 3, or 4).

Attività formativa	TIP	SSD	TAF	CFU	ORE F/E/L/N	FREQ. VER.
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GROUP 1

0-30

9257 000 000 86301 - 0 - FINAL EXAMINATION

30

0/0/0/0

No

Ambito: 1018 - Per la prova finale

E

Obiettivi: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor.

The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.

Obiettivi inglese: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor.

The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.

GROUP 2		0-30		
9257 000 000 60750 - 2 - FINAL EXAMINATION		6	0/0/0/0	No
Ambito: 1018 - Per la prova finale	E			
Obiettivi: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				
Obiettivi inglese: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				
9257 000 000 91232 - 0 - INTERNSHIP ABROAD FOR THE PREPARATION OF THE FINAL EXAMINATION		24	0/0/0/0	No Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 91228 - 0 - INTERNSHIP FOR THE PREPARATION OF THE FINAL EXAMINATION		24	0/0/0/0	No Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 90053 - 0 - PREPARATION FOR THE FINAL EXAMINATION ABROAD		24	0/0/0/0	No Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
GROUP 3		0-30		
9257 000 000 89774 - 0 - FINAL EXAMINATION (12 CFU)		12	0/0/0/0	No
Ambito: 1018 - Per la prova finale	E			
Obiettivi: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				
Obiettivi inglese: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				

9257 000 000 94535 - 0 - INTERNSHIP ABROAD FOR THE PREPARATION OF THE FINAL EXAMINATION (18 CFU)	18	0/0/450/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 94536 - 0 - INTERNSHIP FOR THE PREPARATION OF THE FINAL EXAMINATION (18 CFU)	18	0/0/450/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 94534 - 0 - PREPARATION FOR THE FINAL EXAMINATION ABROAD (18 CFU)	18	0/0/0/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
GROUP 4	0-30			
9257 000 000 94533 - 0 - FINAL EXAMINATION (18 CFU)	18	0/0/0/0	No	
Ambito: 1018 - Per la prova finale	E			
Obiettivi: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				
Obiettivi inglese: The final examination to graduate in the 2nd cycle degree programme consists in the production and public discussion of an original dissertation based on a topic that is consistent with the programme objectives, under the guidance of a supervising professor. The dissertation must demonstrate the students' command of the subject, critical skills, ability to work autonomously and strong communication skills.				
9257 000 000 94537 - 0 - INTERNSHIP ABROAD FOR THE PREPARATION OF THE FINAL EXAMINATION (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				

9257 000 000 94538 - 0 - INTERNSHIP FOR THE PREPARATION OF THE FINAL EXAMINATION (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the internship, which can be carried out in Italy or abroad, in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
9257 000 000 86266 - 0 - PREPARATION FOR THE FINAL EXAMINATION ABROAD (12 CFU)	12	0/0/300/0	No	Giudizio
Ambito: 1018 - Per la prova finale	E			
Obiettivi: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				
Obiettivi inglese: At the end of the preparation of the final examination, which can be carried out abroad in companies, public offices or laboratories, the student is able to analyze complex problems related to global change and to propose solutions for mitigation and adaptation with a multi-scale and multidisciplinary approach, applied to both natural and anthropized systems.				

Legenda:

CFU: crediti formativi universitari

TAF: tipologia attività formativa (A-di base; B-caratterizzanti; C-affini o integrative; F-ulteriori attività formative; D-a scelta autonoma dello studente; S- stages e tirocini presso imprese, enti pubblici o privati, ordini professionali; E-per la prova finale)

SSD: settore scientifico disciplinare

F/E/L/N: indica le ore Frontali/Esercitazioni/Laboratori/Ore di esercitazione e/o laboratorio tenute da non docenti

Freq.: segnala l'esistenza di un obbligo di frequenza

Ver.: indica la modalità di verifica del profitto finale

TIP.: indica la tipologia delle forme didattiche. Queste possono essere CON: convenzionali, E-L: in e-learning, MIX: miste, C/E: convenzionali e/o e-learning. Il corso di studio può definire annualmente una delle modalità.