Foreste e conservazione della biodiversità - Boschi vetusti

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Dipartimento di Scienze Ecologiche e Biologiche

VENERDI CULTURALI

Caspar David Friedrich

Venerdì 24/11/2023

Dalle ore 17:00 alle 19:00

Stato delle foreste in Italia

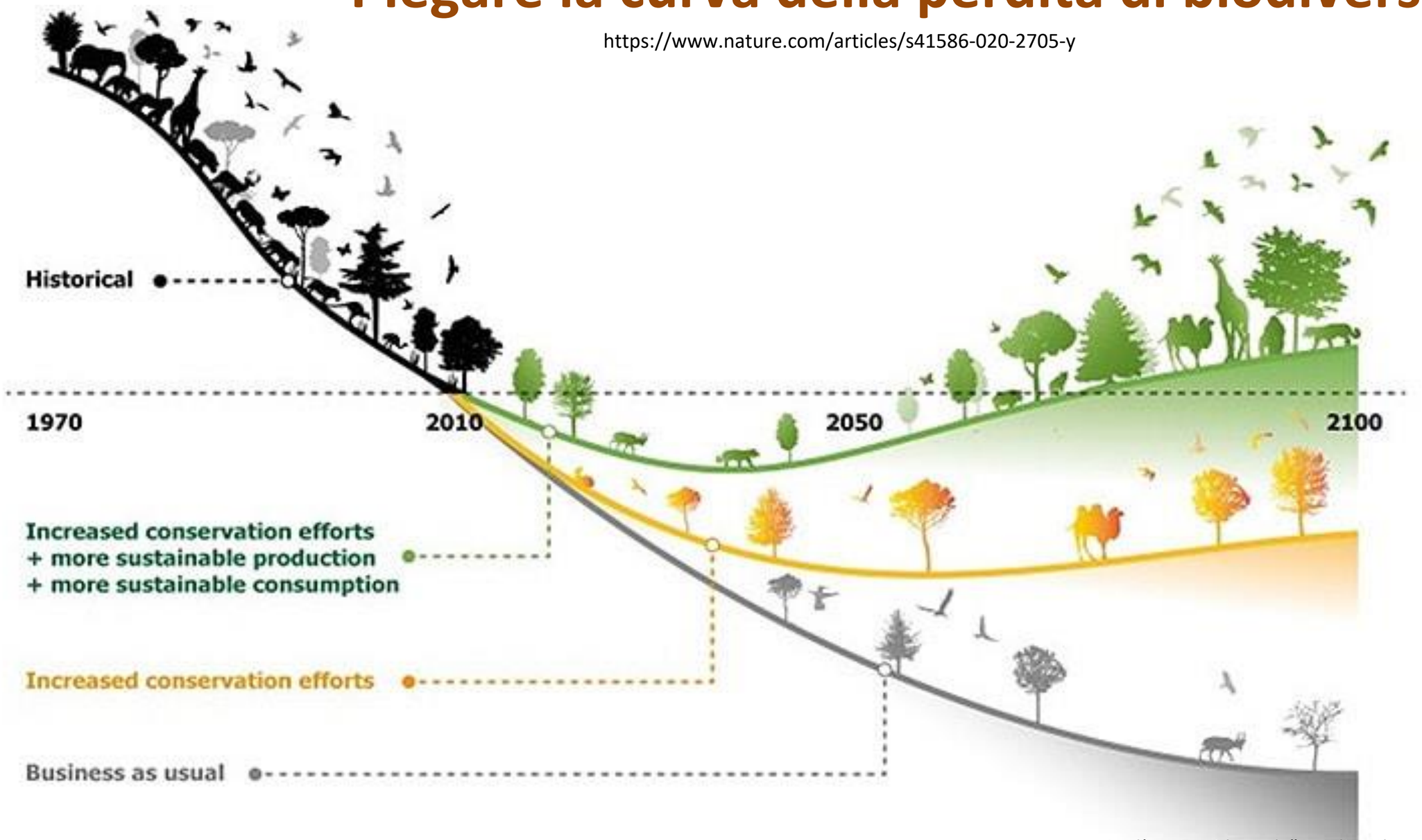
Relatori: Davide De Laurentis (CUFA), Piermaria Corona (CREA), Gianluca Piovesan (Università della Tuscia), Giancarlo Papitto (CUFA)

Moderatore: Andrea Sonnino (FIDAF)

UNIVERSITÀ DEGLI STUDI DELLA TUSCIA

Piegare la curva della perdita di biodiversità

https://www.nature.com/articles/s41586-020-2705-y



- Ecosistemi funzionali e conservazione della biodiversità: il caso delle foreste
- Le cause della perdita di biodiversità
- Le soluzioni internazionali: il ruolo chiave delle aree protette

Leclère, David, et al. "Bending the curve of terrestrial biodiversity needs an integrated strategy." *Nature* 585.7826 (2020): 551-556.

The new EU-wide Biodiversity Strategy will:

Establish protected areas for at least:

30%
of land in Europe

30%
of sea in Europe

With stricter protection of remaining EU primary and old-growth forests legally binding nature restoration targets in 2021.

ensuring at least 10% of EU land and sea areas are “strictly protected”.

Restore degraded ecosystems at land and sea across the whole of Europe by:

Increasing organic farming and biodiversity-rich landscape features on agricultural land

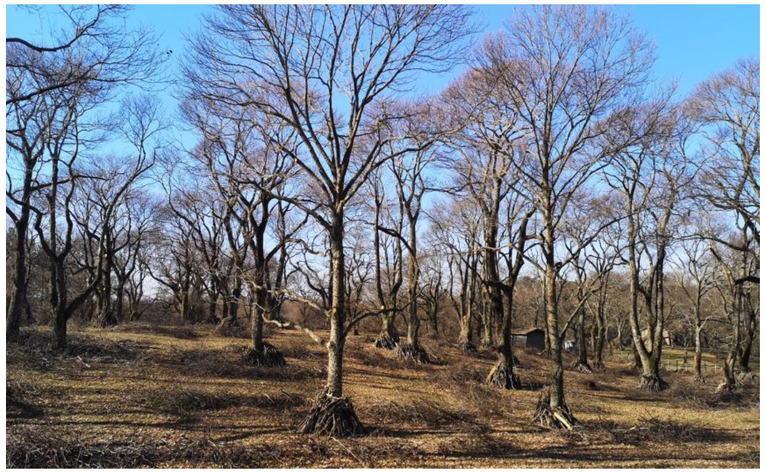
Halting and reversing the decline of pollinators

Restoring at least 25 000 km of EU rivers to a free-flowing state

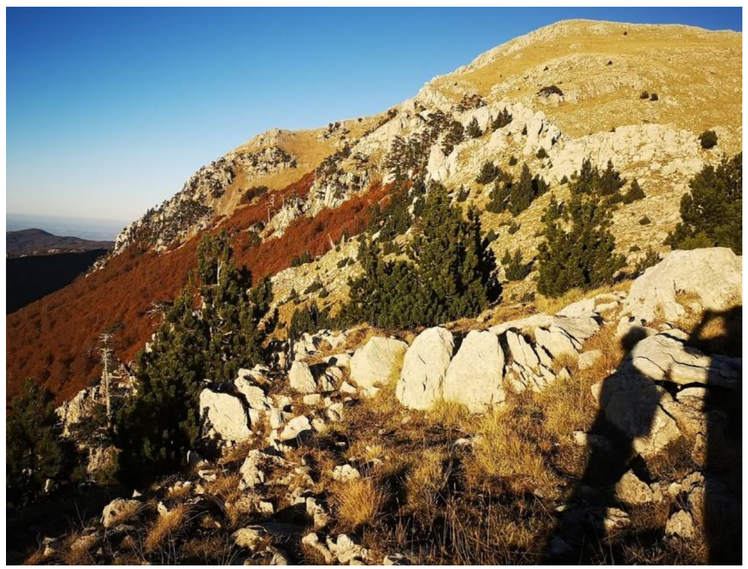
Reducing the use and risk of pesticides by 50% by 2030

Planting 3 billion trees by 2030

Arboriculture vs Silviculture



Cultural Landscapes



Natural Landscapes

Rewilding vs Old-growth forest

Foreste vetuste: Cenni storici

Michele Tenore
Napoli, 5 maggio 1780 – Napoli, 19 luglio 1861

S. VIII. P. 0

VIAGGIO

IN ALCUNI LUOGHI

DELLA BASILICATA

E DELLA

CALABRIA CITERIORE

EFFETTUATO NEL 1826.

CENNO

SULLA

GEOGRAFIA FISICA E BOTANICA

DEL

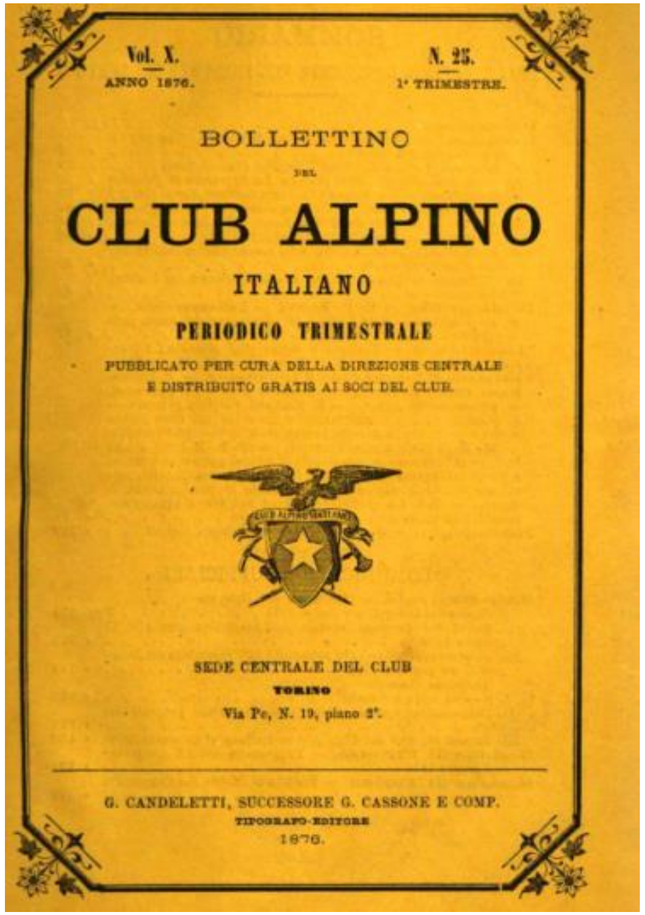
REGNO DI NAPOLI ;

DI M. TENORE.

L' abete nasce ne' boschi della regione anzidetta. Esso si mostra più frequente sulle falde orientali delle Sile ; ma sul Pollino , e precisamente sul bosco detto di Rubbia, sfoggia la sua maggiore bellezza. In questo bosco non è difficile trovare abeti di 130 a 150 piedi , le cui nere cime sembrano contendere alle nubi l' impero delle aeree regioni.

Dopo 3 ore di cammino, ci siam trovati nel centro di nera foresta, ove difficilmente umane orme s' imprimono. I faggi e gli abeti di mole piucchè colossale, si stringono per modo da non permettere l' adito che a qualche debole ed interrotto raggio di luce. Molti di questi grandi alberi, dalla violenza de' turbini schiantati, a barricarci la strada si frappongono. A volerne giudicare a colpo d' occhio, sembraci esservene di fino a 130 palmi di altezza, su di un diametro di circa tre piedi. Sparsi tra questi alberi trovansi tre diverse specie di aceri, cioè il *neapolitanum*, che qui chiamano *sfennero*, lo *pseudo-platanus* che distinguono col nome di *arcò*, ed il *Lobelii*, che chiamano *acero*. Quest' ultimo gareggia con i faggi per le sue non comuni dimensioni.

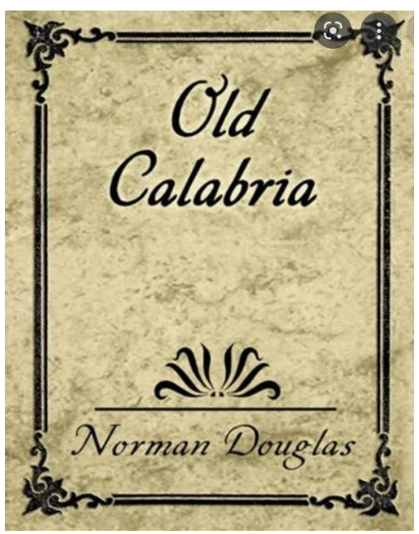
Prezioso per le costruzioni così navali che civili riescir potrebbe questa immensa quantità di legname se potesse facilitarsene il trasporto. Quì tutto è abbandonato alla natura, e solo di volta in volta sogliono i pastori impiegar qualche faggio per costruirne le loro capanne. Anche da Rotonda, una volta l'anno, gran parte della popolazione qui recasi per abbattere e trasportarsi uno de' più grossi abeti destinato a servir di *majo* in una delle loro pubbliche feste. Le nostre guide ci han detto puranco, che più di una volta si avrebbe voluto trar partito di quelle foreste; ma che la difficoltà de' trasporti ne ha fatto abbandonare il pensiero. Generalmente crediamo che il nostro paese sia povero di boschi, perchè sogliamo giudicarne da quelli che vediamo a portata de' luoghi accessibili, ma se vorremmo darci la pena di seguire il pedestre cammino de' pastori fin nell' interno de' nostri sterminati monti, oh come ci sarebbe facile disingannarci!



G.B Bruno

latticini locali, eccellenti oltre ogni dire. Facemmo onore a tutto bravamente, ed alle 3 pomeridiane, separatici dagli amici di Terranova, incominciammo la discesa della valle del Frido, sempre fra boschi di faggi ed abeti, con qualche raro acero. — Questi boschi sono in continua diminuzione per lo sfrenato taglio che loro si dà; non così quelli posti molto in alto, che invece sono rigogliosi, e dove la sola tempesta atterra gli alberi vetusti e marci.

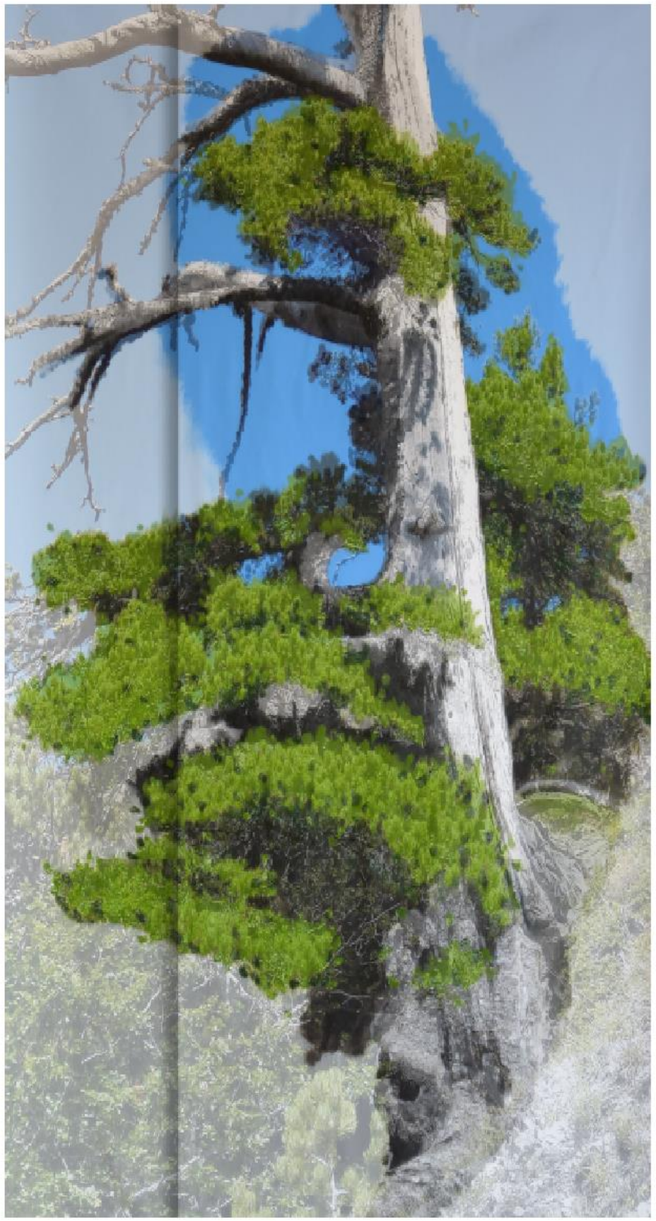
George Norman Douglas
(8 December 1868 – 7 February 1952)



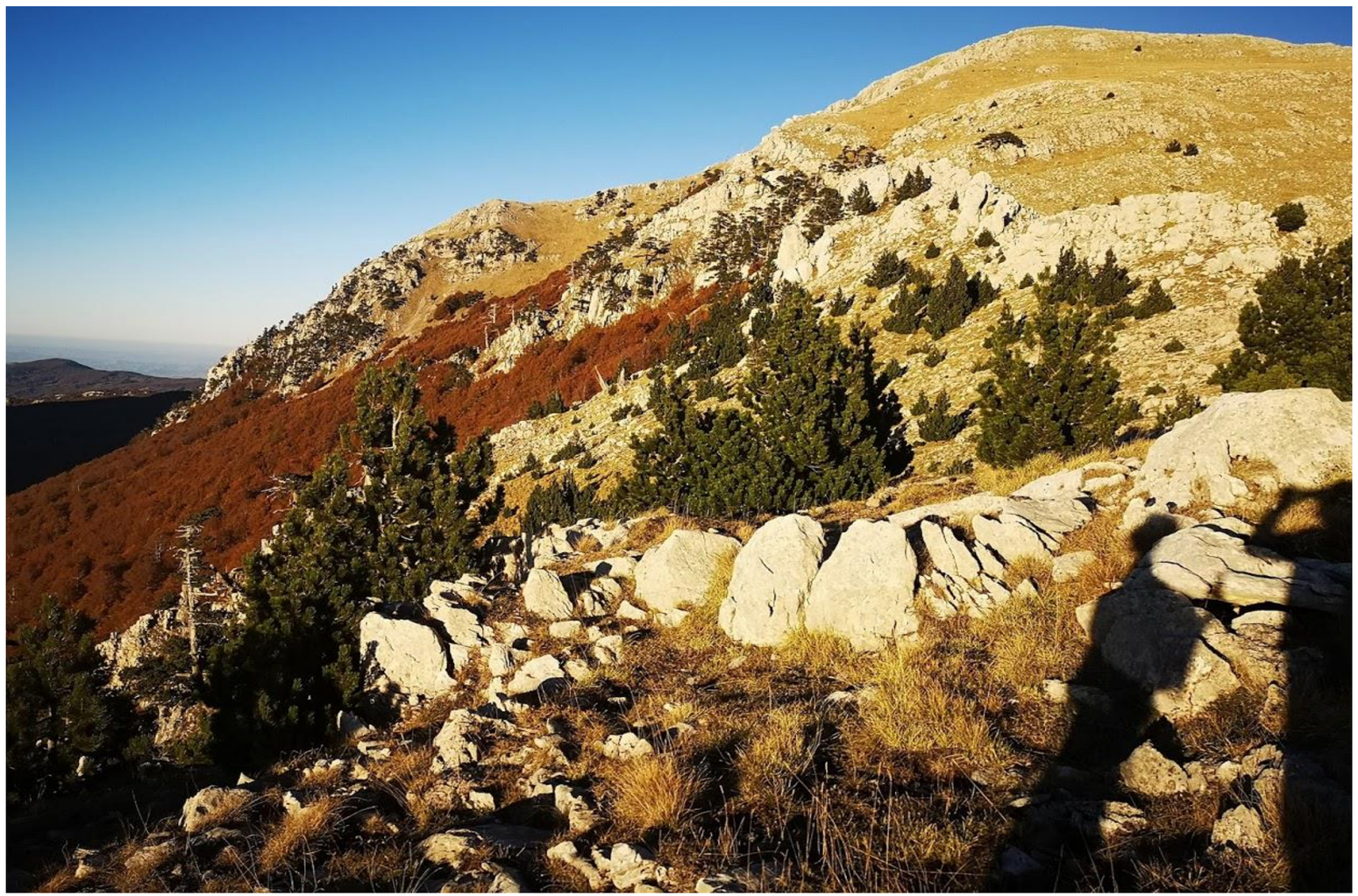
It is sad to think that in a few years' time nearly all these forests will have ceased to exist; another generation will hardly recognize the site of them. A society from Morbegno (Valtellina) has acquired rights over the timber, and is hewing down as fast as it can. They import their own workmen from north Italy, and have built at a cost of two million francs (say the newspapers) a special funicular railway, 23 kilometres long, to carry the trunks from the mountain to Francavilla at its foot, where they are sawn up and conveyed to the railway station of Cerchiara, near Sibari years-- they have now been at work for two, and **the results are already apparent in some almost bare slopes once clothed with these huge primeval trees**.

In olden days all this country was full of game; bears, stags and fallow-deer are mentioned. **Only wolves and a few roe-deer are now left**. **The forest is sombre, but not gloomy, and one would like to spend some time in these wooded regions, so rare in Italy, and to study their life and character--but how set about it?** The distances are great; there are no houses, not even a shepherd's hut or a cave; the cold at night is severe, and even in the height of midsummer one must be prepared for spells of mist and rain. I shall be tempted, on another occasion, to provide myself with a tent such as is supplied to military officers. They are light and handy, and perhaps camping out with a man-cook of the kind that one finds in the Abruzzi provinces would be altogether the best way of seeing the remoter parts of south and central Italy

Le foreste vetuste, gli ecosistemi naturali dove il tempo degli alberi è stato rispettato: loricati millenari e paesaggi del rewilding



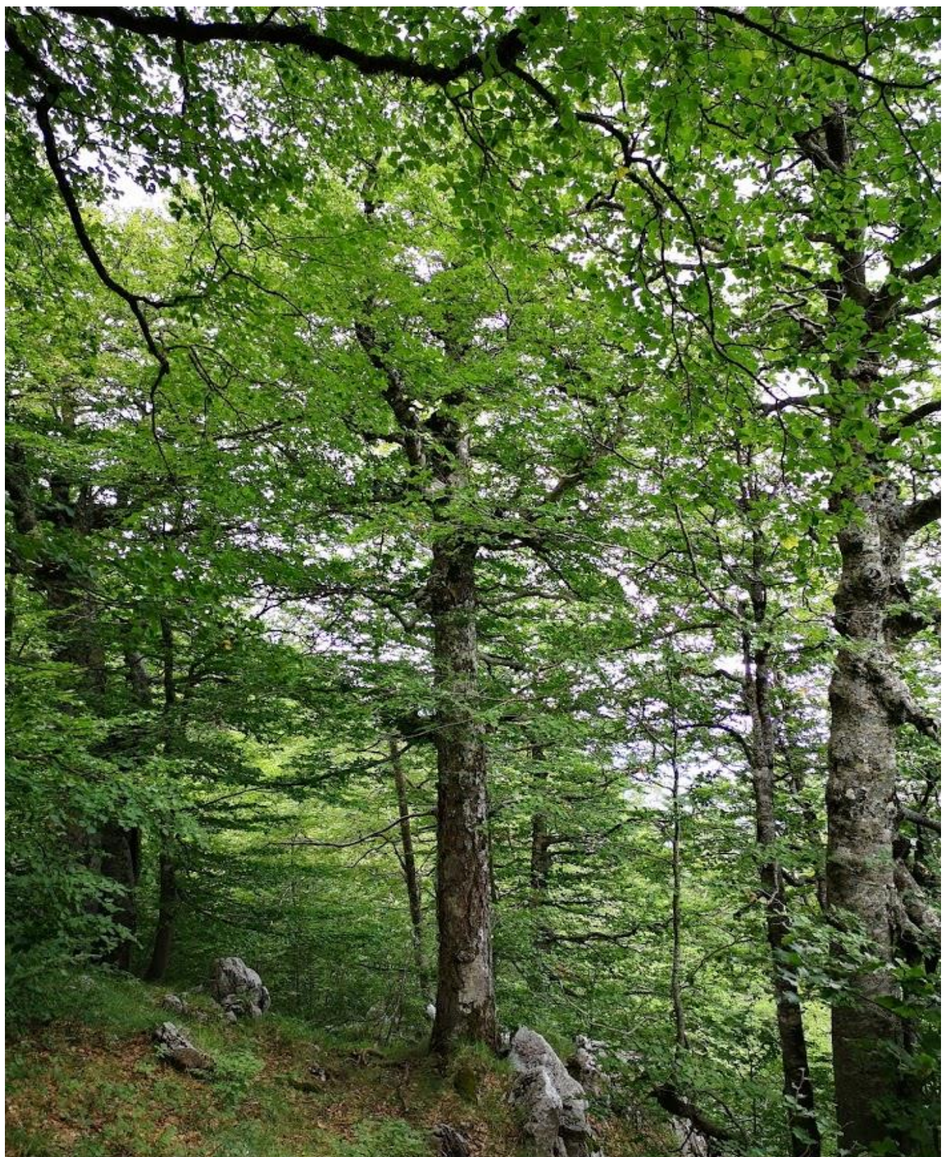
Mery Rigo, *Italus 1230*, 2019,
Elaborazione pittorica fotografica digitale FPF1, su carta patinata,
2 fogli, cm. 200x100 cadauno
(Contributo fotografico Gianluca Piovesan)
Collezione, BoCS Museum, Cosenza



I giganti della Calabria: campioni di longevità

Demetra, 930 anni

Michele, 622 anni



LA REGIONE DEGLI ORSI PESCASSEROLI

I boschi scendono sempre più frequenti dalle alture maestose, s'accostano sempre meglio al magro corso del fiume, s'indugiano più a lungo sui margini della strada levigata.

E' questa senza dubbio la valle d'Abruzzo meno spoglia di verde, meno depredata d'una ricchezza secolare che ammanta i dorsi più lontani e si perde nelle gole meno praticabili. Chi volesse penetrare in un bosco vergine di faggio, chi volesse sentire sotto il proprio passo le vibrazioni elastiche della terra soffice di foglie, chi volesse assistere all'alterna vicenda spontanea della vita e della morte, dell'arbusto che spunta e del tronco che si sfalda e torna terra, chi volesse ammirare il ritmo semplice e sicuro della Natura non turbato dalla violenza dell'uomo, chi volesse rincontrare le prime belve abbandonate alla loro libertà e al loro destino – non può che muovere dalla nostra strada e addentrarsi in quel viluppo di montagna che s'accavallano sull'orizzonte sconfinato.

La strada maestra non riuscì ad inseguire il bosco: essa scende col fiume, e a nulla valse il soccorso delle vie mulattiere che tentano il folto con audacia. La scarsezza di torrenti gonfi, l'assenza di ferrovie e la proprietà collettiva, hanno salvati milioni di tronchi dalla scure e dalla sega, hanno serbato gli orsi e i camosci al loro libero dominio.

VIAGGIO AGLI ALTIPIANI D'ABRUZZO AGLI INIZI DEL '900
GUIDA AI MONUMENTI STORICI ED ARTISTICI DI GIOIA, PESCASSEROLI, CASTEL DI SANGRO, ROCCARASO, SCANNO, PESCOCOSTANZO
Edizione a cura di Sara De Giorgi Edizioni digitali del CISVA 2010

VEDUTA DAL BALZO DELLA STREGA – IN FONDO ALLA VALLE PESCASSEROLI CAPOLUOGO DEL PARCO.

VALICO TRA PESCASSEROLI E VILLAVALLELONGA.

ZANGHERI P. - Una gemma naturale dell'Appennino da salvare. La Foresta Casentinese di Campigna (1968)

Il lavoro incrociato di due giganti nella protezione della natura

Fu opera di grande saggezza e coronamento d'una tenacia mai troppo lodata, l'avere ottenuto, sotto gli auspici dell'Università di Pavia, per particolare impegno del Prof. Pavan e dell'Amministrazione forestale (3) la creazione d'una piccola riserva integrale in una porzione del complesso boschivo sotto Poggio Scali, il « gran giogo » scrisse Dante (Purg. V.) dal quale, aggiunse l'Ariosto (c. IV) si « sco-

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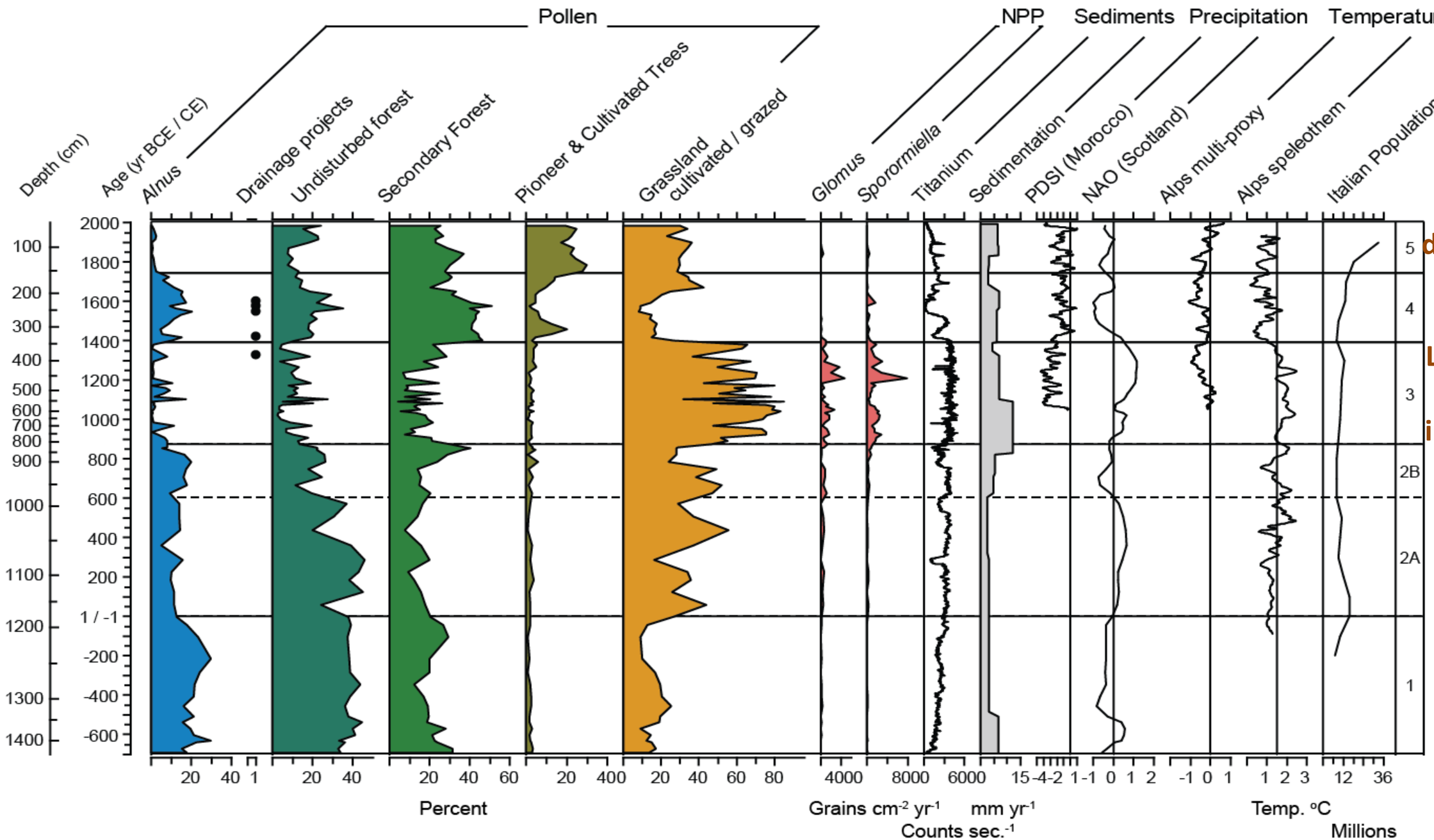
(3) M. PAVAN - *La riserva naturale integrale di Sasso Fratino nelle foreste demaniali casentinesi.* « Notiziario forestale e montano », 5 (73) (1960).

Fabio Clauser: Il decano dei Forestali che conosce il linguaggio degli alberi

L’uomo che ha portato nelle istituzioni l’amore per le foreste (tratto dal sito Non Sprecare di Antonio Galdo)

IL CENTENARIO CUSTODE DELLE FORESTE

Proprio quest’ultima impresa merita una menzione speciale. L’idea di questo sapiente amministratore è mutuata dal modello europeo di riserva integrale. La vera innovazione sta nel fatto, però, che Clauser l’ha cominciata a proporre in anni, i Cinquanta, nei quali la sensibilità nei confronti dell’ambiente non era particolarmente diffusa. Ma la sua tenacia e convinzione gli anno permesso, nei decenni successivi, di riuscire a far arrivare decreti ministeriali ad hoc. **In questo modo i tesori di Sasso Fratino, debitamente conservati e tutelati, hanno acquisito un interesse estetico e paesaggistico internazionale** in grado di attrarre studiosi di scienze forestali, botanici e faunisti da tuto il mondo, disposti a fare migliaia di chilometri per visitare uno dei pochi ecosistemi praticamente intatti in Europa.



Summary diagram with select data from Lago Lungo (Rieti) and independent climatic proxies

Received: 5 August 2021 | Revised: 28 June 2022 | Accepted: 18 July 2022
DOI: 10.1002/eap.2758

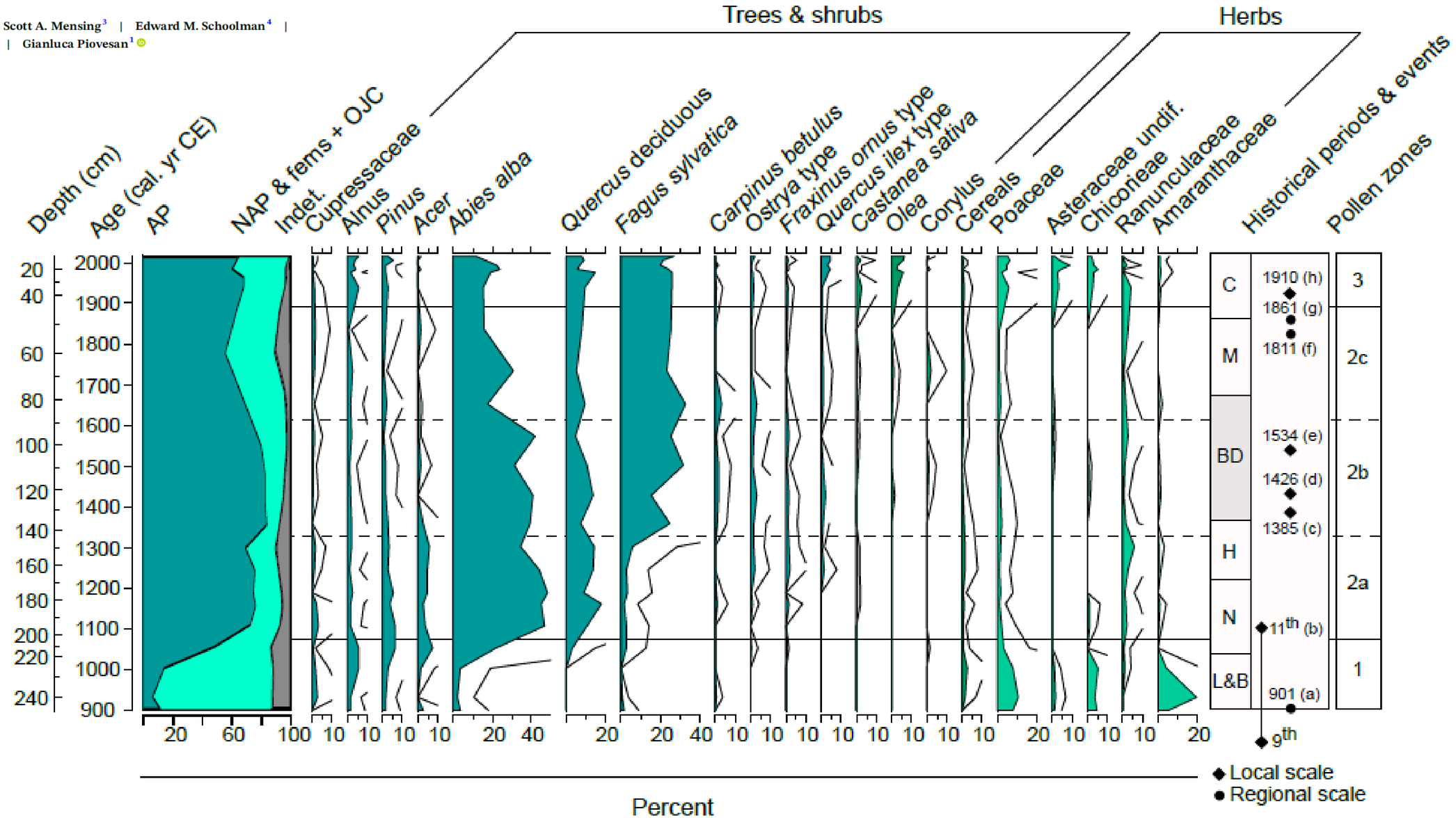
ARTICLE

ECOLOGICAL APPLICATIONS

Il Lago del Pesce (Parco Nazionale del Pollino)

Historical ecology identifies long-term rewilding strategy for conserving Mediterranean mountain forests in south Italy

Jordan Palli[1,2] | Scott A. Mensing[3] | Edward M. Schoolman[4] | Francesco Solano[1,2] | Gianluca Piovesan[1]



La foresta vetusta

The US Forest Service developed a generic definition for old-growth and specific sets of criteria and indicators for a wide range of forest types. The generic definition states: "**Old-growth forests are ecosystems distinguished by old trees and related structural attributes. Old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function**" (USDA, 1989; White & Lloyd, 1994).

In the working document by CBD (2006), old-growth is described as follows: '**Old-growth forest stands are stands in primary or secondary forests that have developed the structures and species normally associated with old primary forest of that type and have sufficiently accumulated to act as a forest ecosystem distinct from any younger age class**.'

L'ecosistema foresta

(tratto da Marco Paci. Ecologia forestale. Edagricole)

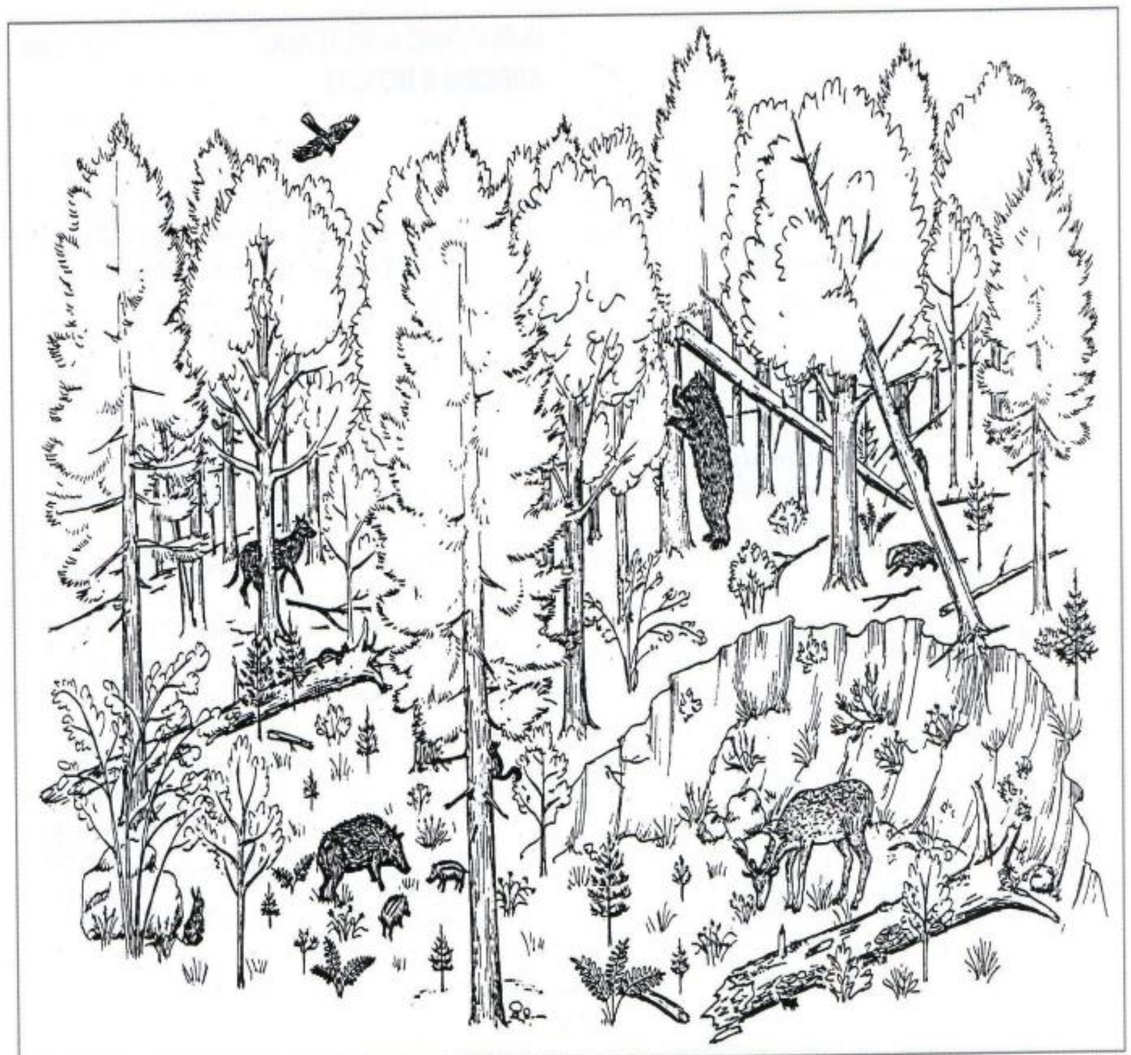
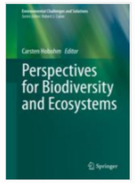


Fig. 1.3 - L'ecosistema foresta (*da Arrigoni, 1994*). Per le spiegazioni si rimanda al testo.

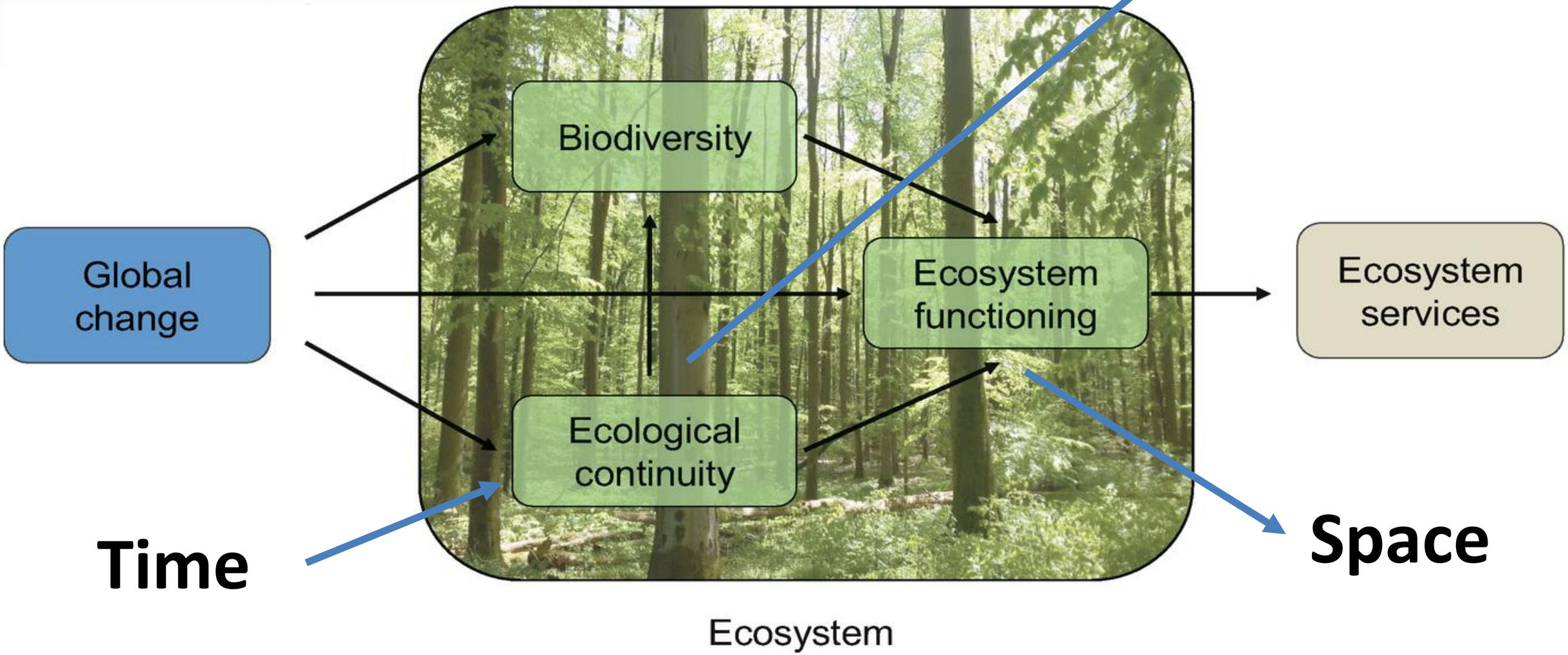


Perspectives for Biodiversity and Ecosystems pp 383-405 | Cite as

Forest Ecosystems: A Functional and Biodiversity Perspective

Authors | Authors and affiliations

Andreas Fichtner, Werner Härdtle



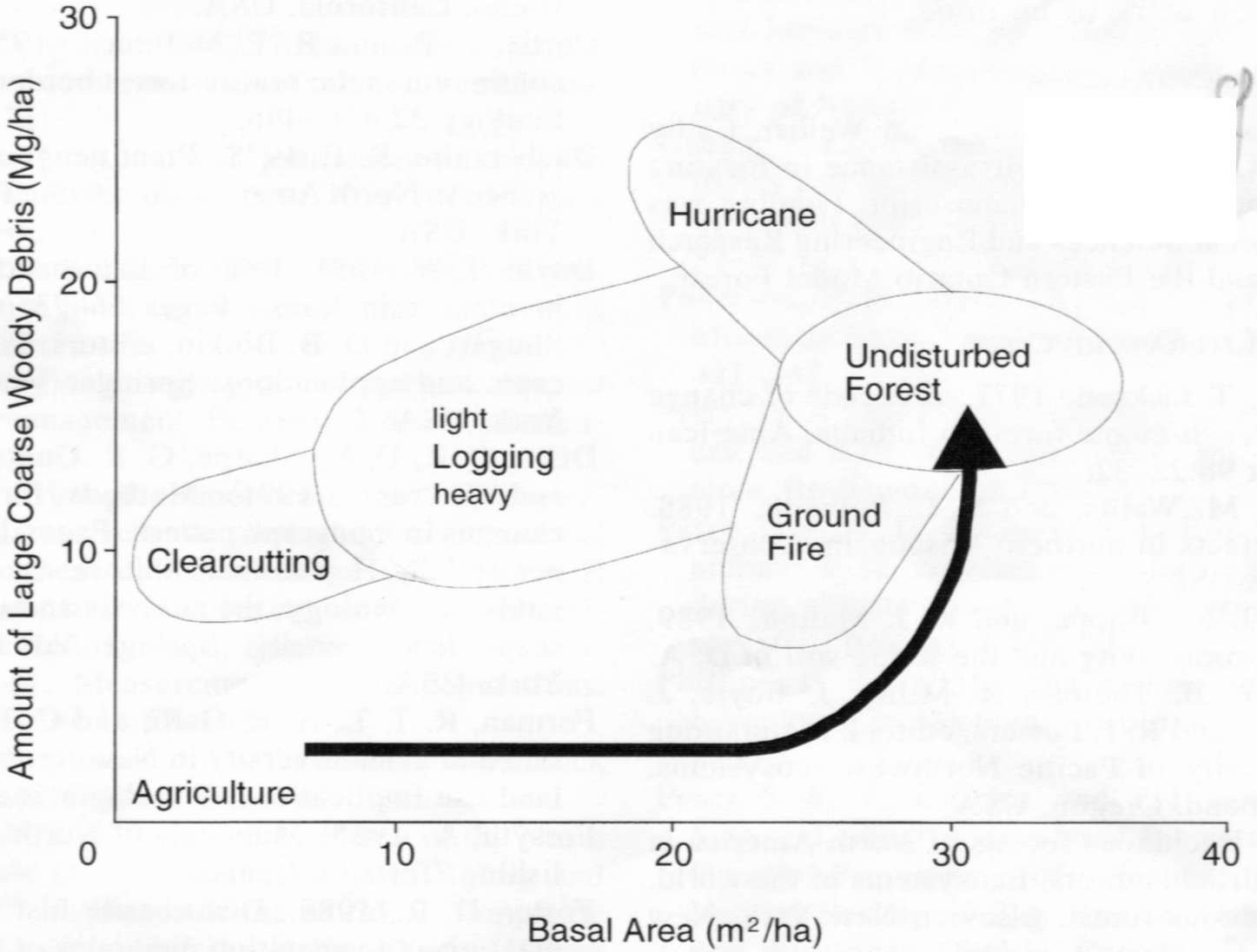


FIG. 3. Suggested changes in two properties of deciduous forests, coarse woody debris and basal area per hectare, with different processes. The arrow indicates a probable time course for the two properties during ecosystem recovery. During recovery/restoration, there is a delay in accumulation of large CWD because it is necessary for biomass to recover in order to create the raw material for CWD.

TABLE 13. Preliminary list of properties and the suggested levels for them.

Property	Measurement	Category values		
		Control	Intermediate	Low
Stand indicators				
1. Tree size	basal area (m^2) per hectare	>29	20–29	<20
2. Canopy composition	proportion of shade-tolerant tree species (American beech, sugar maple, basswood hemlock)	>70%	30–70%	<30%
3. Coarse woody debris	megagrams per hectare	>20	10–20	<10
	presence of large decaying logs (≥8 logs per hectare)	both firm and crumbling	either firm or crumbling	no large logs present
4. Herbaceous layer	number of ephemeral species (see list in Table 5)	≥6	2–5	<2
5. Corticulous bryophytes	number of bryophyte species (not restricted to list in Table 6)	≥7	2–6	<2
6. Wildlife trees	number of snags per 10 ha (>50.8 cm dbh)	≥4	1–3	<1
7. Fungi	no information			
Landscape indicators				
8. Avian community	number of forest interior species	>5	2–4	<2
9. Large carnivores	number of species present	≥6	3–5	<3
10. Forest area	hectares	$>10^5$	10^2–10^5	$<10^2$

Keddy, P.A. e Drummond, C.G. (1996) Ecological properties for the evaluation, management, and restoration of temperate deciduous forest ecosystems. *Ecological Applications,* ***6,*** *748*-762.

I paesaggi forestali intatti

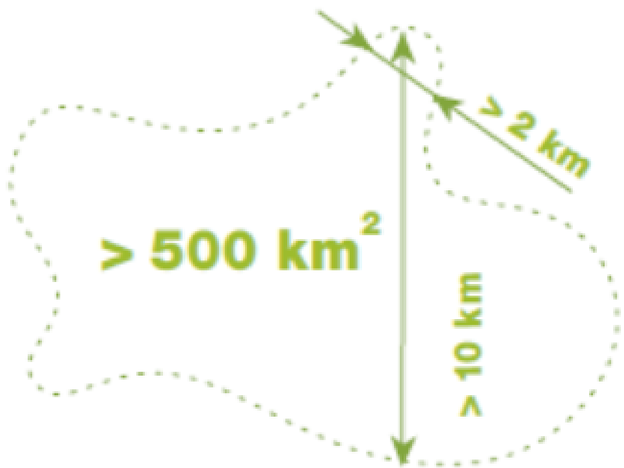
https://intactforests.org/concept.html

Definition

COMPONENTS OF FOREST LANDSCAPE

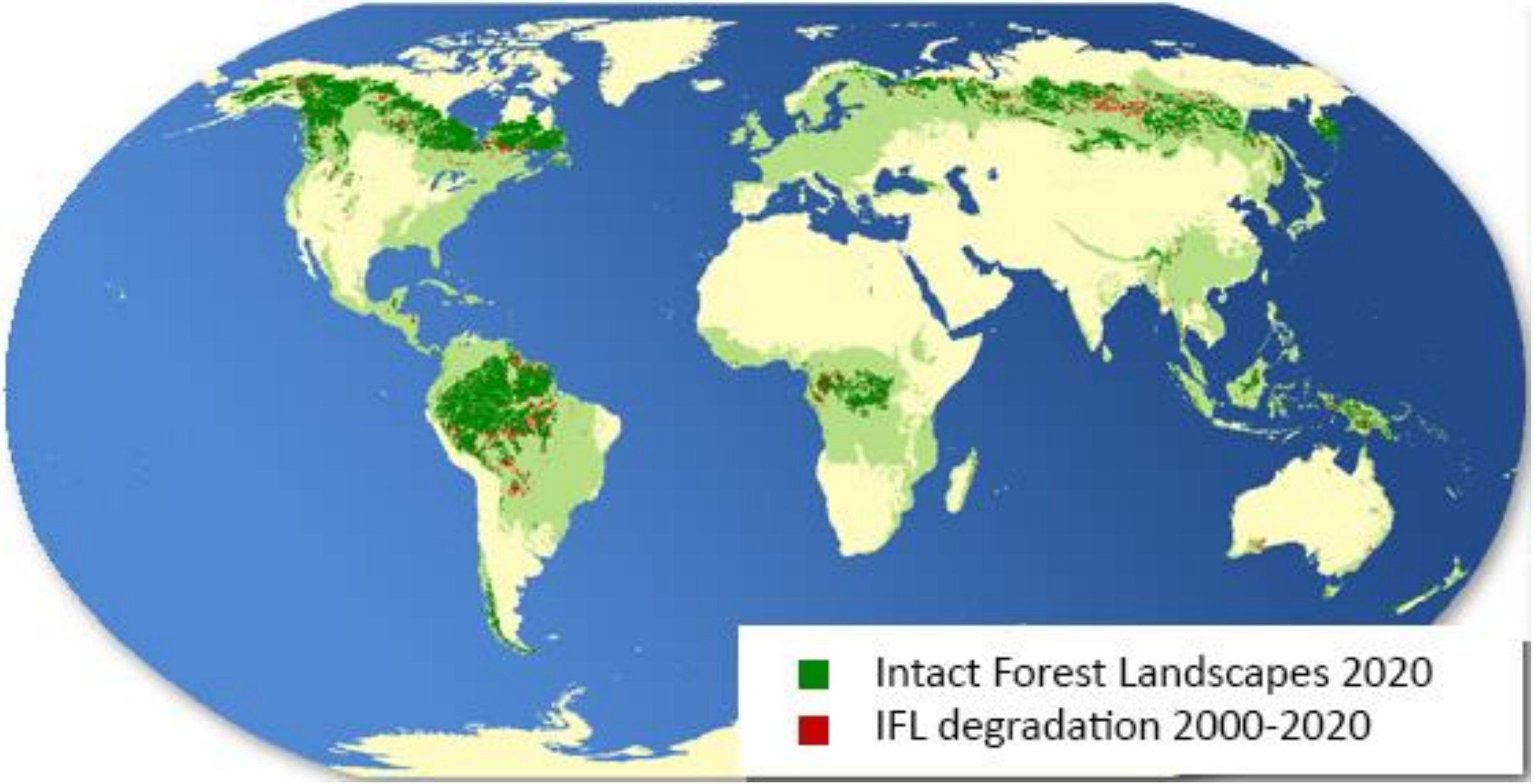
We define an **Intact Forest Landscape (IFL)** as an unbroken expanse of natural ecosystems within the zone of current forest extent, showing no signs of significant human activity and large enough that all native biodiversity, including viable populations of wide-ranging species, could be maintained. Although all IFL are within the forest zone, some may contain extensive naturally tree-less areas, including grasslands, wetlands, lakes, alpine areas, and ice. This definition builds on the definition of Frontier Forest that was developed by WRI (Bryant et al., 1997).

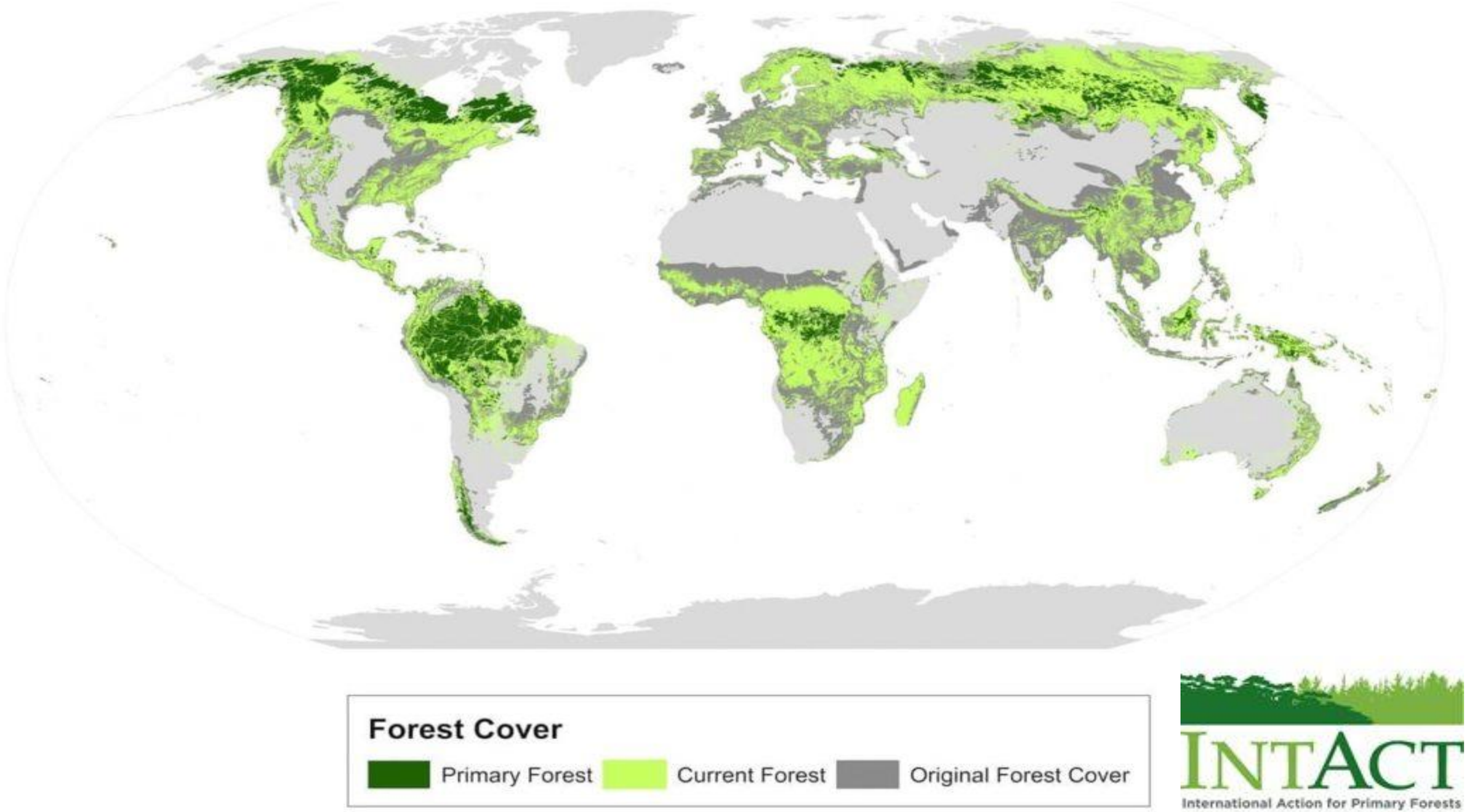
Technically, an **Intact Forest Landscape (IFL)** is defined as a territory within today's global extent of forest cover which contains forest and non-forest ecosystems minimally influenced by human economic activity, with an area of at least 500 km^2 (50,000 ha) and a minimal width of 10 km (measured as the diameter of a circle that is entirely inscribed within the boundaries of the territory).



1 LARGER THAN 500 KM^2
2 AT LEAST 10 KM WIDE AT THE BROADEST PLACE
3 AT LEAST 2 KM WIDE IN CORRIDORS OR APPENDAGES

Areas with evidence of certain types of human influence are considered disturbed and consequently not eligible for inclusion in an IFL:


Intact Forest Landscapes 2020
IFL degradation 2000-2020



INTACT
International Action for Primary Forests

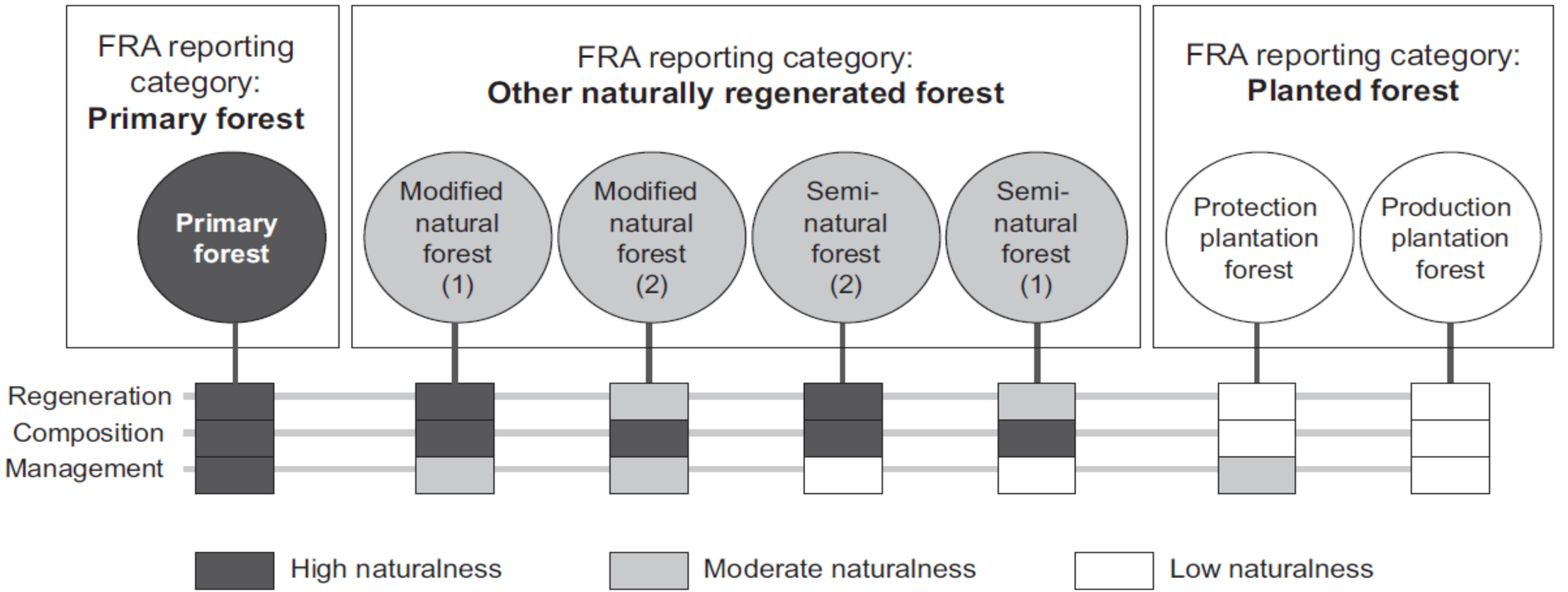
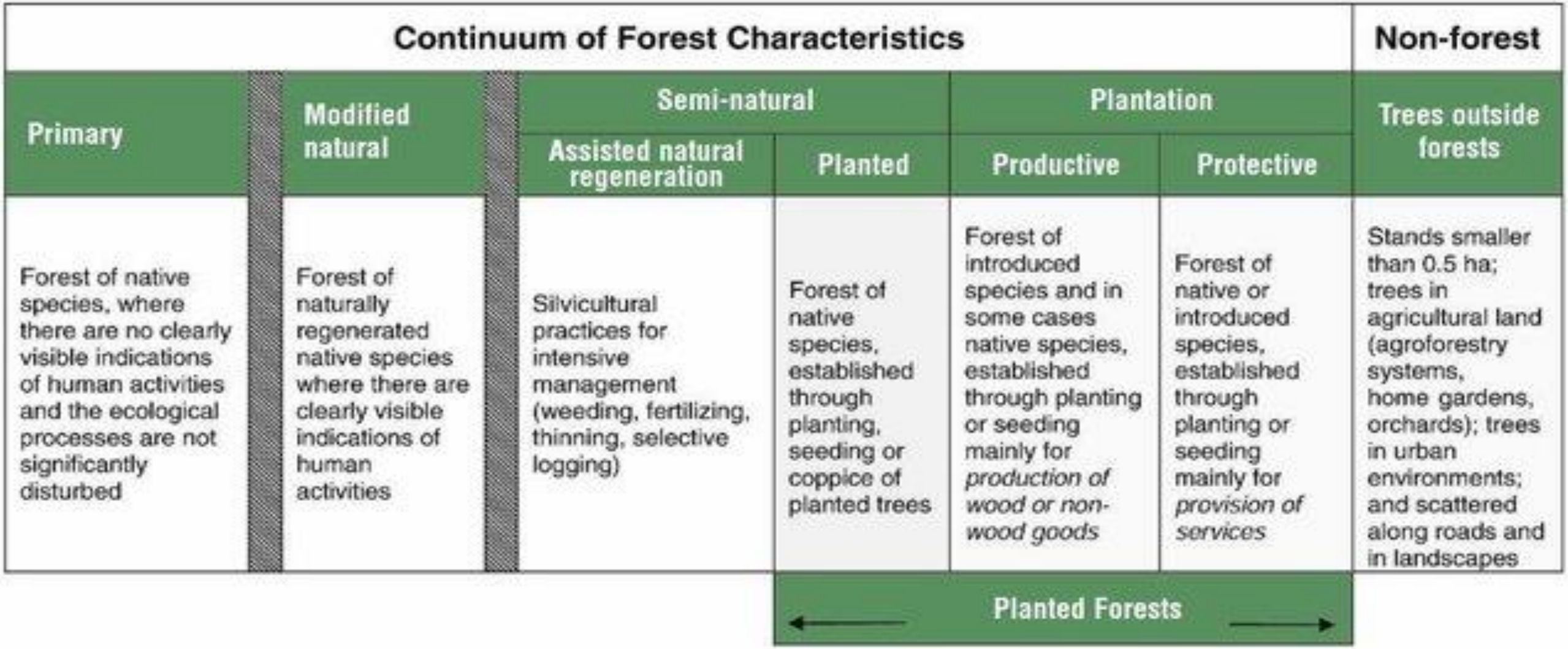


FIG. 3. Categories of forest naturalness from Carle and Holmgren (2003) (seven circles) and FRA (FAO 2012) (three boxes). The high-to-low naturalness gradient represents regeneration of the forest from natural to gap filling through assisted regeneration to fully artificial, composition of the forest from local to indigenous to exotic tree species, management of the forest from none to extensive to intensive. Moderate naturalness may be seen as moderate in a given location or as a result of a mix of intensity over a landscape.


Continuum of Forest Characteristics
Non-forest
Primary
Modified natural
Semi-natural
Assisted natural regeneration
Planted
Plantation
Productive
Protective
Trees outside forests
Forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed
Forest of naturally regenerated native species where there are clearly visible indications of human activities
Silvicultural practices for intensive management (weeding, fertilizing, thinning, selective logging)
Forest of native species, established through planting, seeding or coppice of planted trees
Forest of introduced species and in some cases native species, established through planting or seeding mainly for production of wood or non-wood goods
Forest of native or introduced species, established through planting or seeding mainly for provision of services
Stands smaller than 0.5 ha; trees in agricultural land (agroforestry systems, home gardens, orchards); trees in urban environments; and scattered along roads and in landscapes
Planted Forests

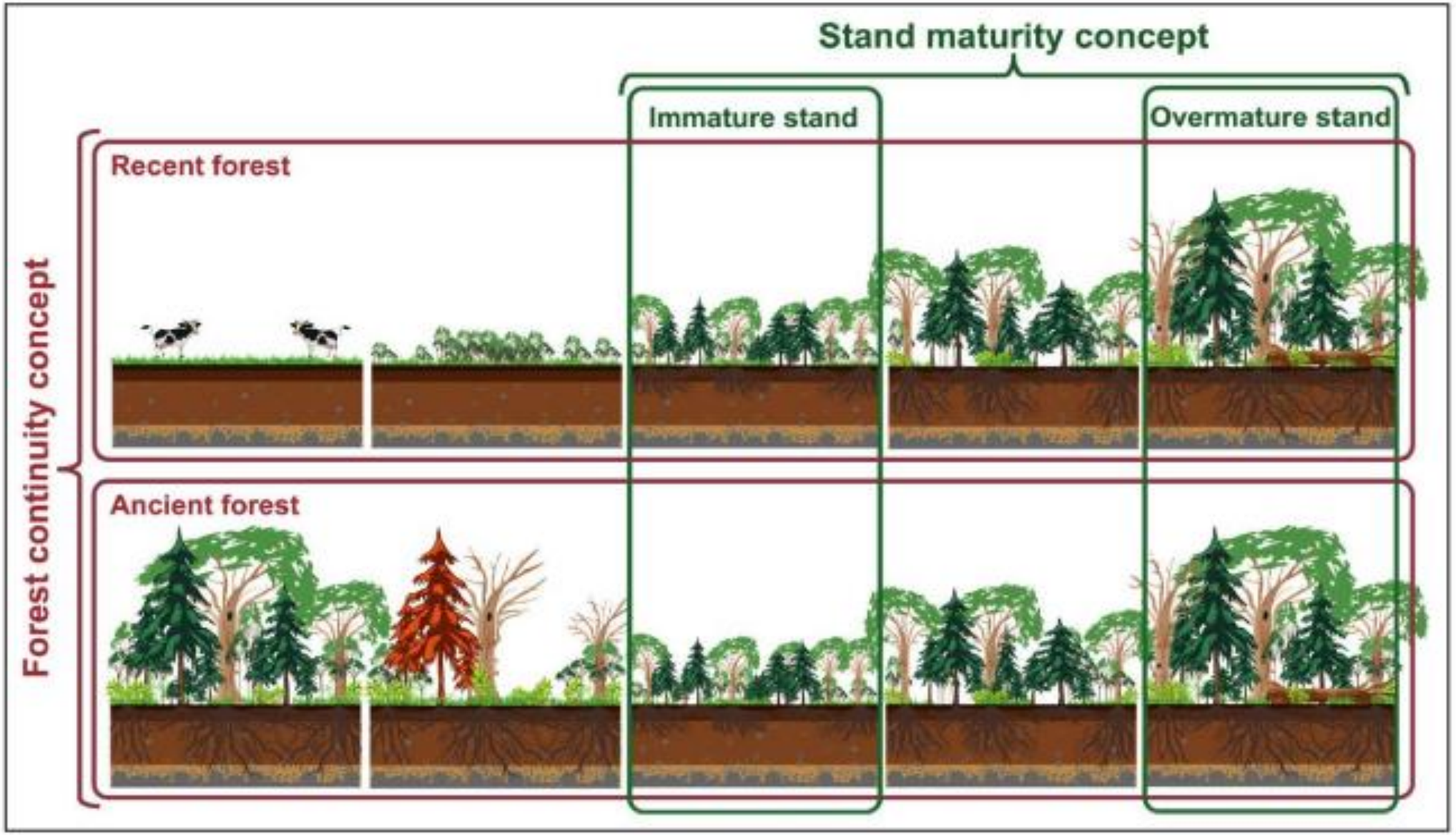


Fig.1. Depiction of the difference between forest continuity and stand maturity (related to the old-growth concept) from Janssen et al (2019). Please note that Ancient forests may also consist solely of young and immature stands, or even plantations on ancient woodland sites.

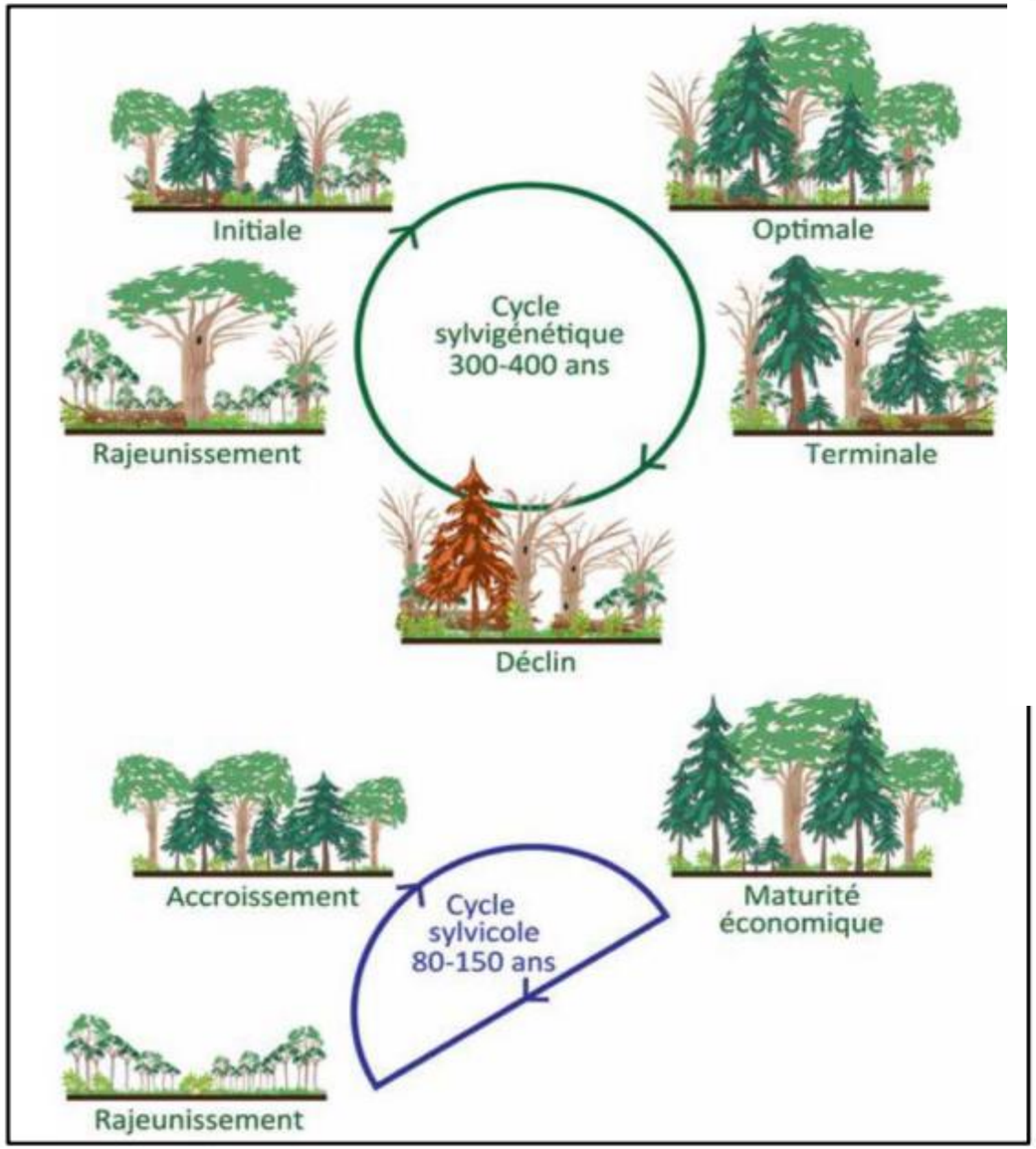


Fig.6 illustrates how the rejuvenation phase (Rajeunissement) after an old-growth late-seral (Terminale) and decay phase (Déclin), e.g. due to stand-replacing disturbance clearly differs from the rejuvenation phase after harvest in a managed forest. (from Bouget et al. 2021) .

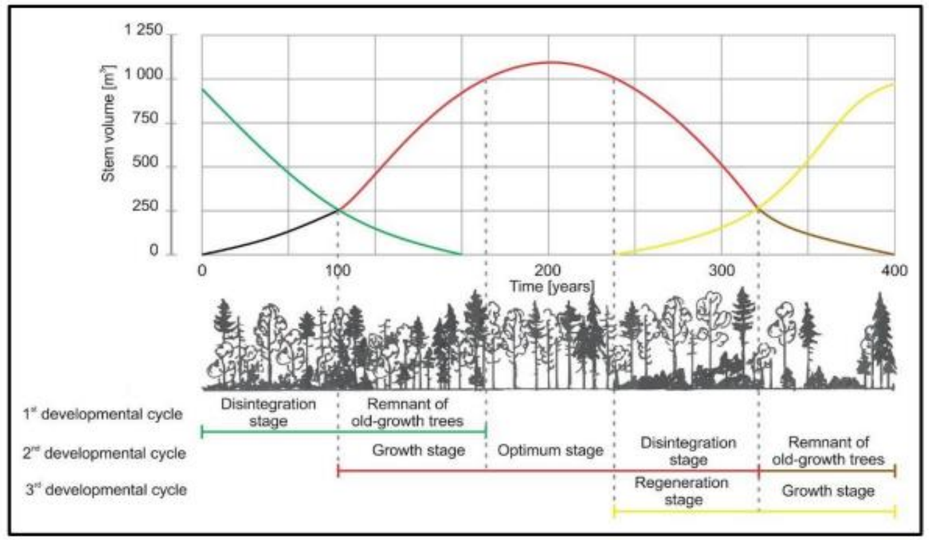


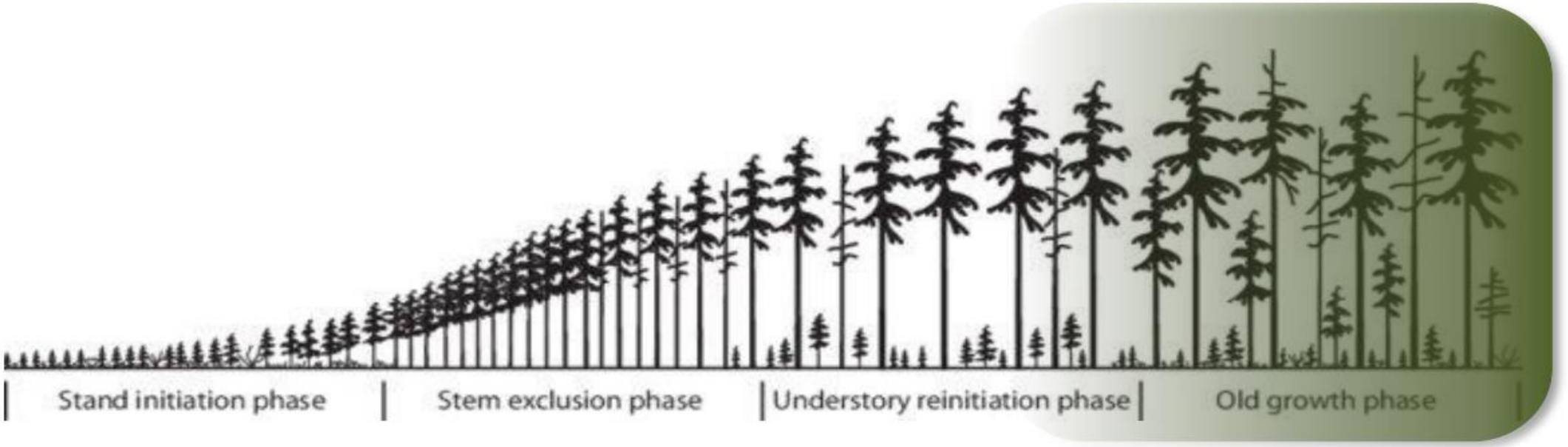
Fig.5 Illustrates that the different developmental phases not only develop gradually, but also overlap over different generations of tree cohorts. During the ageing and disintegration phase of the first developmental cycle, the regeneration and growth phase of the second cycle already takes off. During this phase, important remnants of old-growth features may still be present. Figure from Machar et al (2017) based on Korpel (1995)

LIFE-PROGNOSES -Work Package 1.11

Old-growth criteria and indicators for beech forests (*Fageta*).

Vandekerkhove K., Meyer P., Kirchmeir H., Piovesan G., Hirschmugl M., Larrieu L., Kozák D., Mikoláš M., Nagel T., Schmitt C. & Blumröder J.

Final version – March 2022



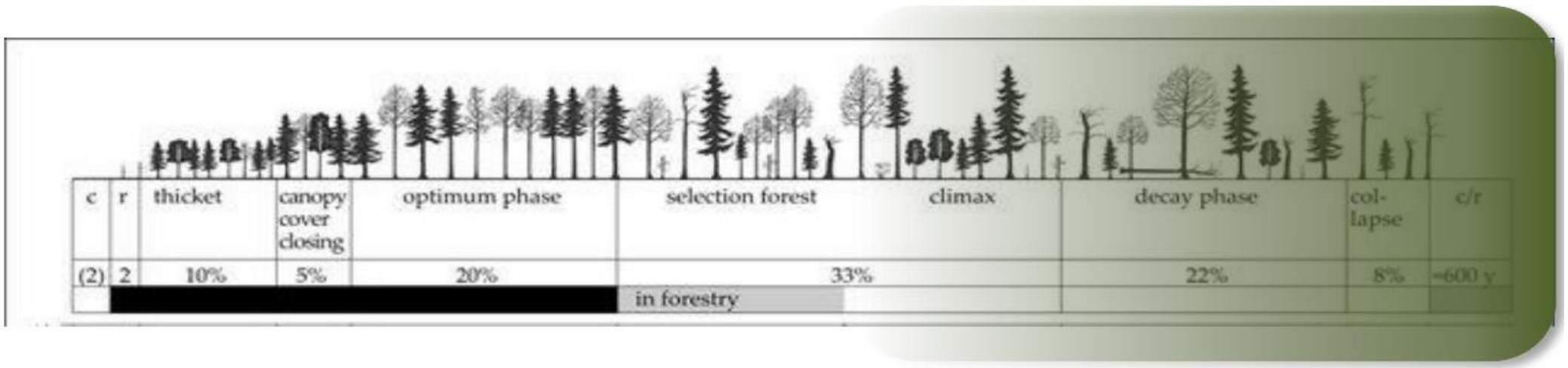
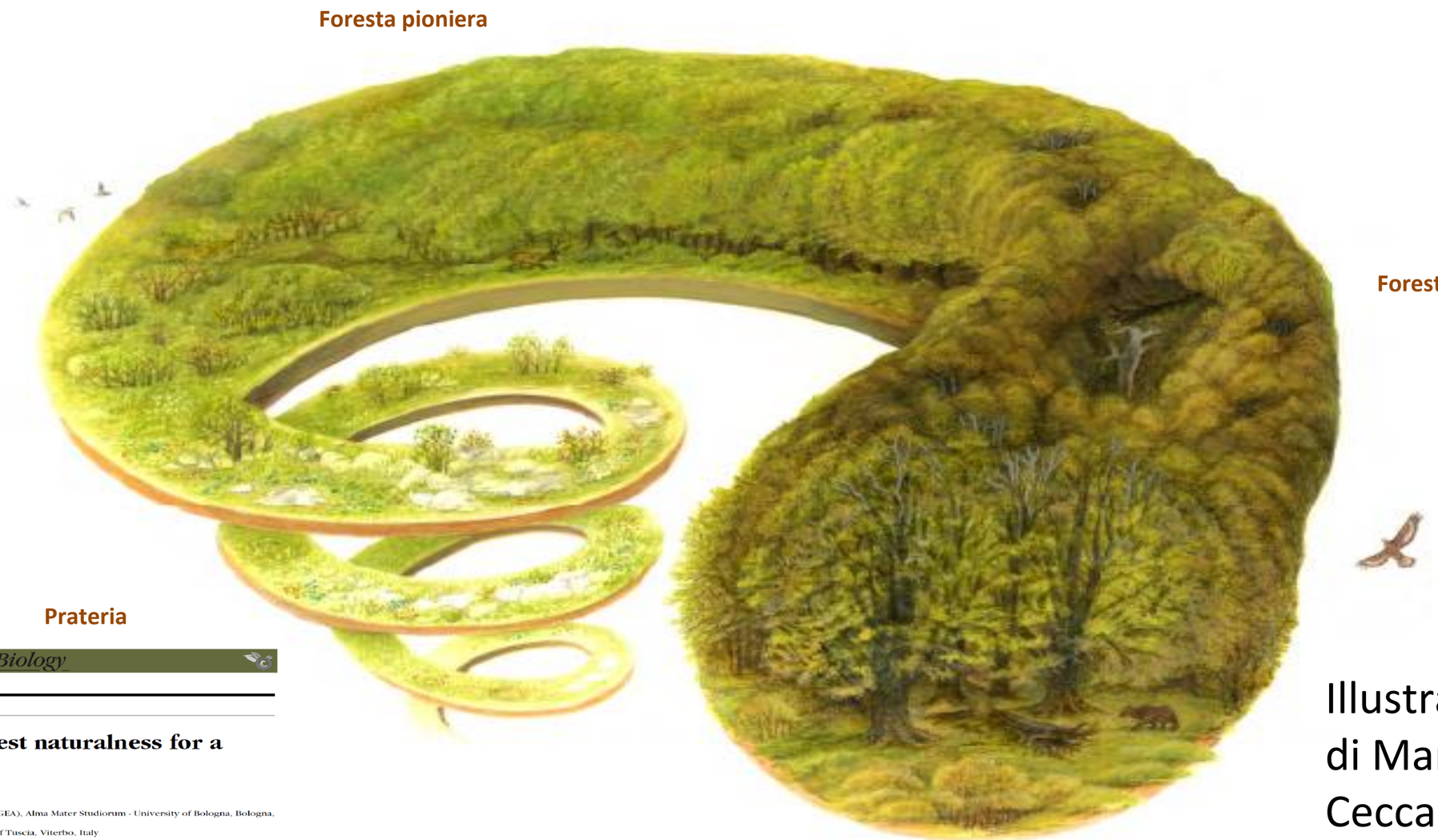


Fig.4 Gradual development of old-growth-characteristics in a (simplified) linear life-cycle development (based on Kimmins, 2003 and Scherzinger, 1997). Both authors provide arbitrary 'border lines' to delineate the different phases, while the development towards 'old-growthness' is a gradual and complex process.

Le dinamiche naturali degli ecosistemi forestali: le successioni



Conservation Biology

Essay

Need for a global map of forest naturalness for a sustainable future

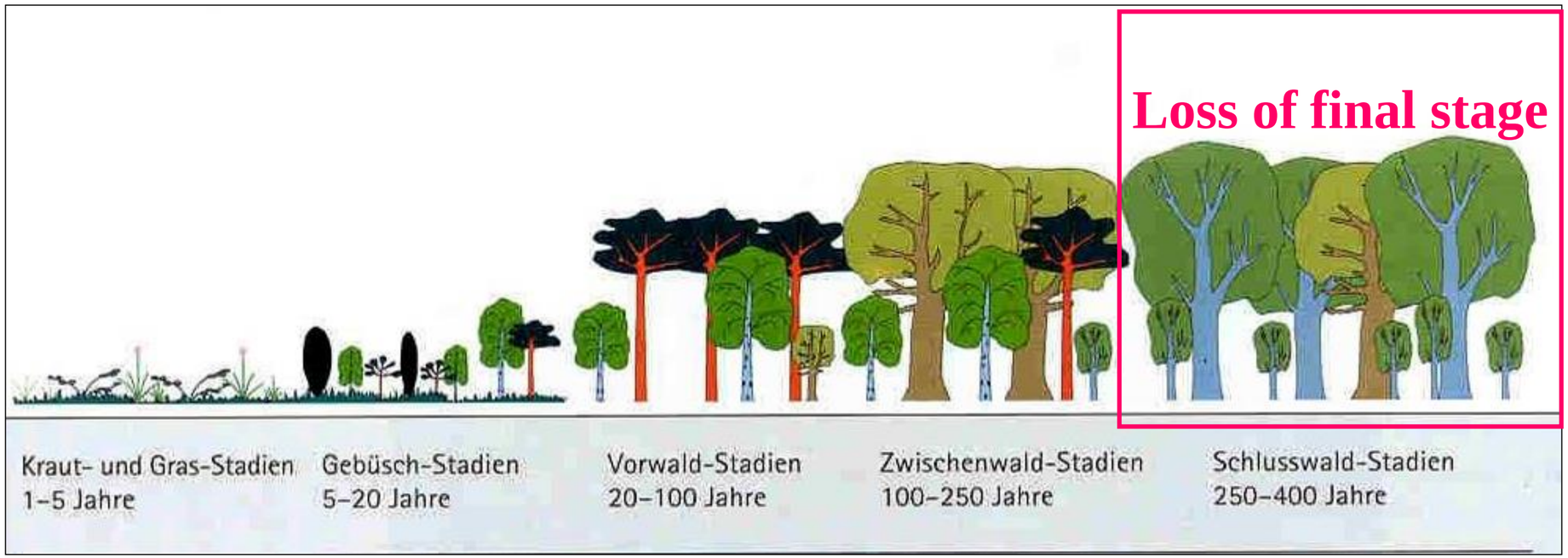
Alessandro Chiarucci [1] and Gianluca Piovesan [2]

[1]Department of Biological, Geological and Environmental Sciences (BIGEA), Alma Mater Studiorum - University of Bologna, Bologna, Italy, email alessandro.chiarucci@unibo.it

[2]Department of Agriculture and Forest Sciences (DAFNE), University of Tuscia, Viterbo, Italy

Illustrazioni a cura di Marisa Ceccarelli

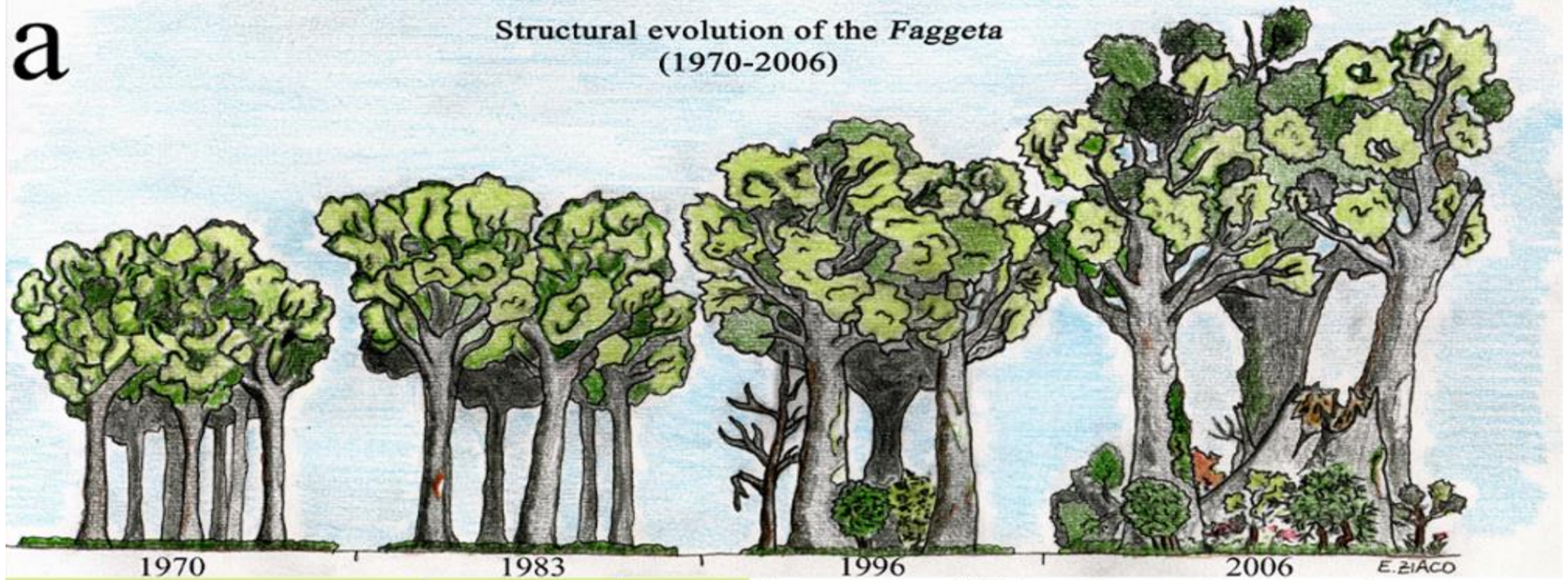
Forest development stages (from Jeschke)

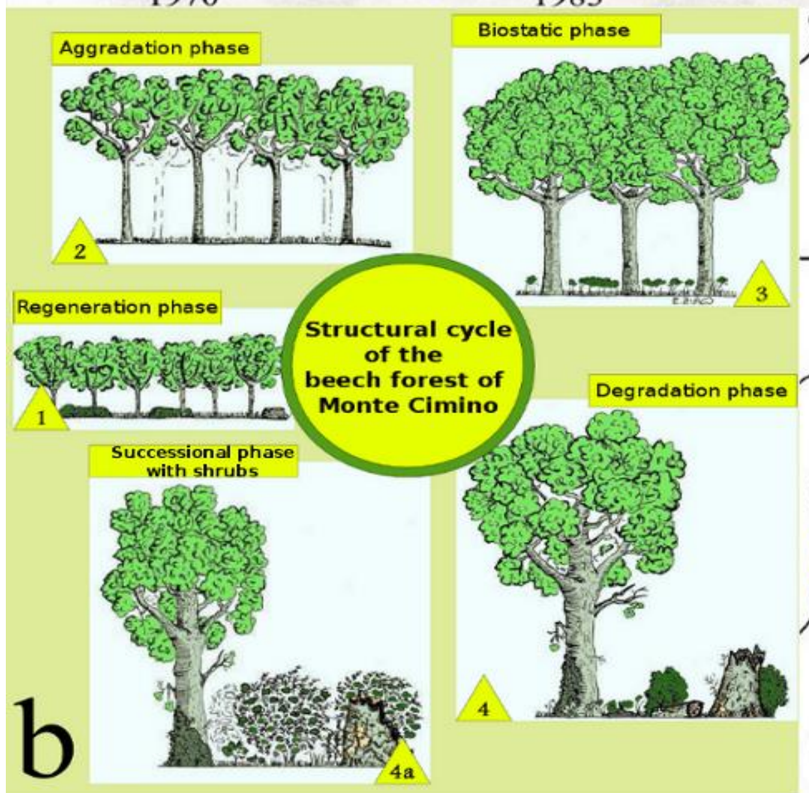


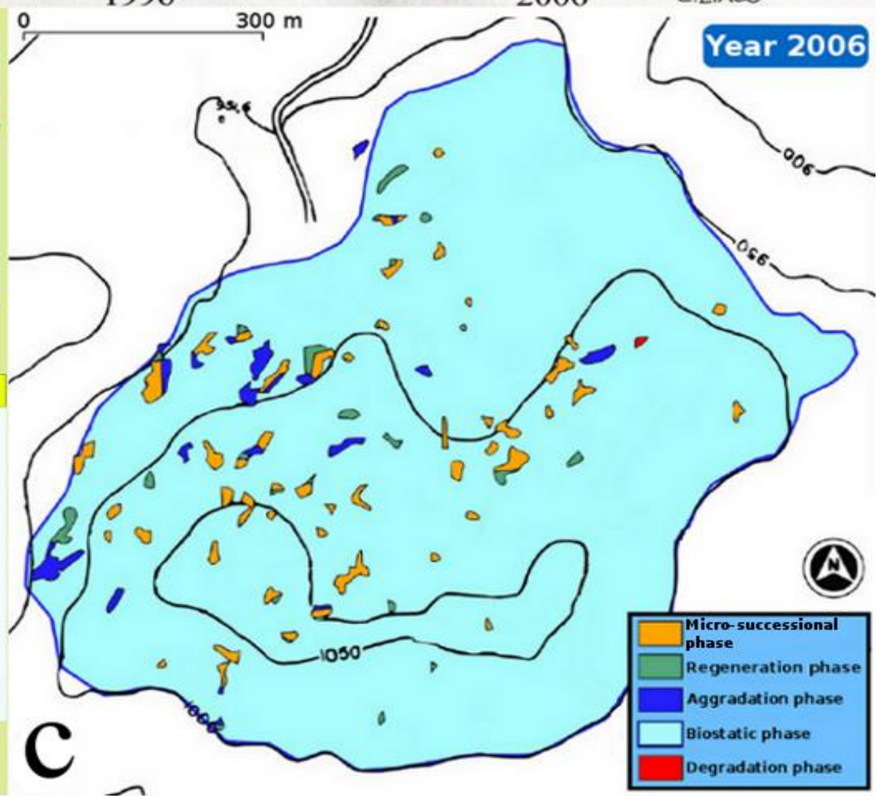
Birch-oak forests, Oak-hornbeam forests, Pine-oak forests, Oak-beech forests

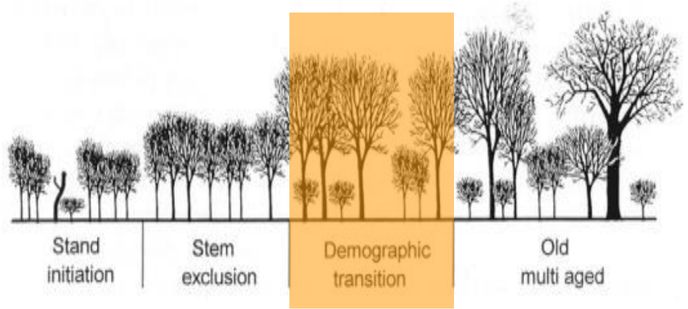
Most forest associations in Central Europe, described by phyto-sociology are degraded stages, or pioneer / intermediate stages of forest development.

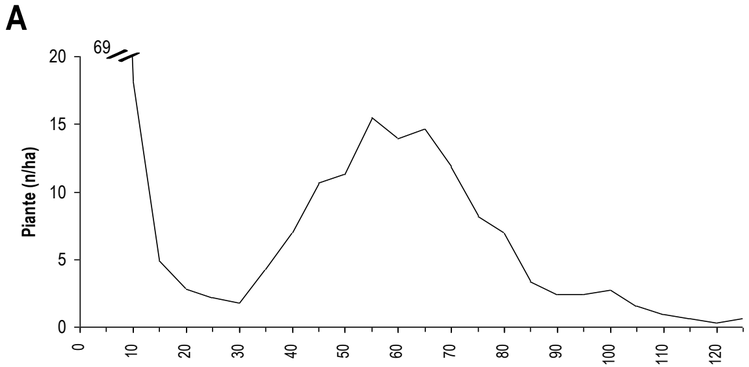
In functional restoration programs studying of historical landscape dynamics and old-growth (OG) stands is key to describing the reference conditions associated with natural forest ecosystems. This approach can provide a benchmark to measure the impact of forest management or evaluate the effectiveness of ecological restoration.

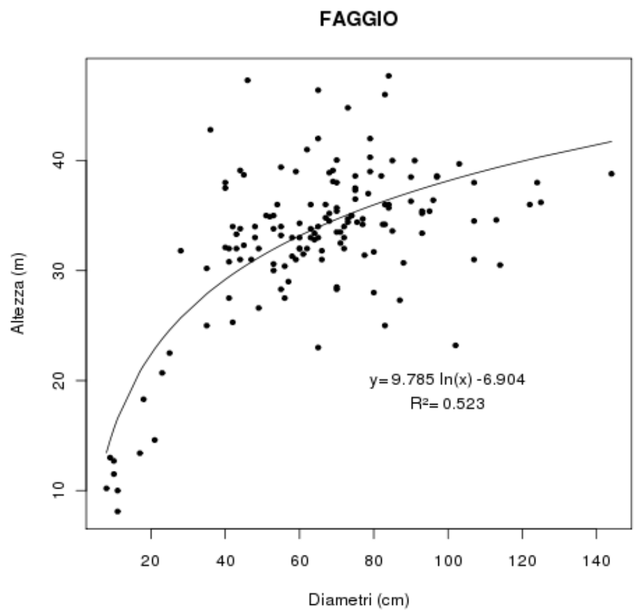

a
Structural evolution of the *Faggeta*
(1970-2006)
1970
1983
1996
2006
E.ZIACO


Aggradation phase
2
Biostatic phase
3
Regeneration phase
1
Structural cycle of the beech forest of Monte Cimino
Degradation phase
Successional phase with shrubs
4a
4
b


0
300 m
Year 2006
Micro-successional phase
Regeneration phase
Aggradation phase
Biostatic phase
Degradation phase
c


Stand initiation
Stem exclusion
Demographic transition
Old multi aged


A
69
Piante (n/ha)
0
5
10
15
20
0
10
20
30
40
50
60
70
80
90
100
110
120


FAGGIO
Altezza (m)
10
20
30
40
y=9.785 ln(x) -6.904
R²= 0.523
20
40
60
80
100
120
140
Diametri (cm)

Unveiling the complex canopy spatial structure of a Mediterranean old-growth beech (Fagus sylvatica L.) forest from UAV observations : the case of primary old-growth stands

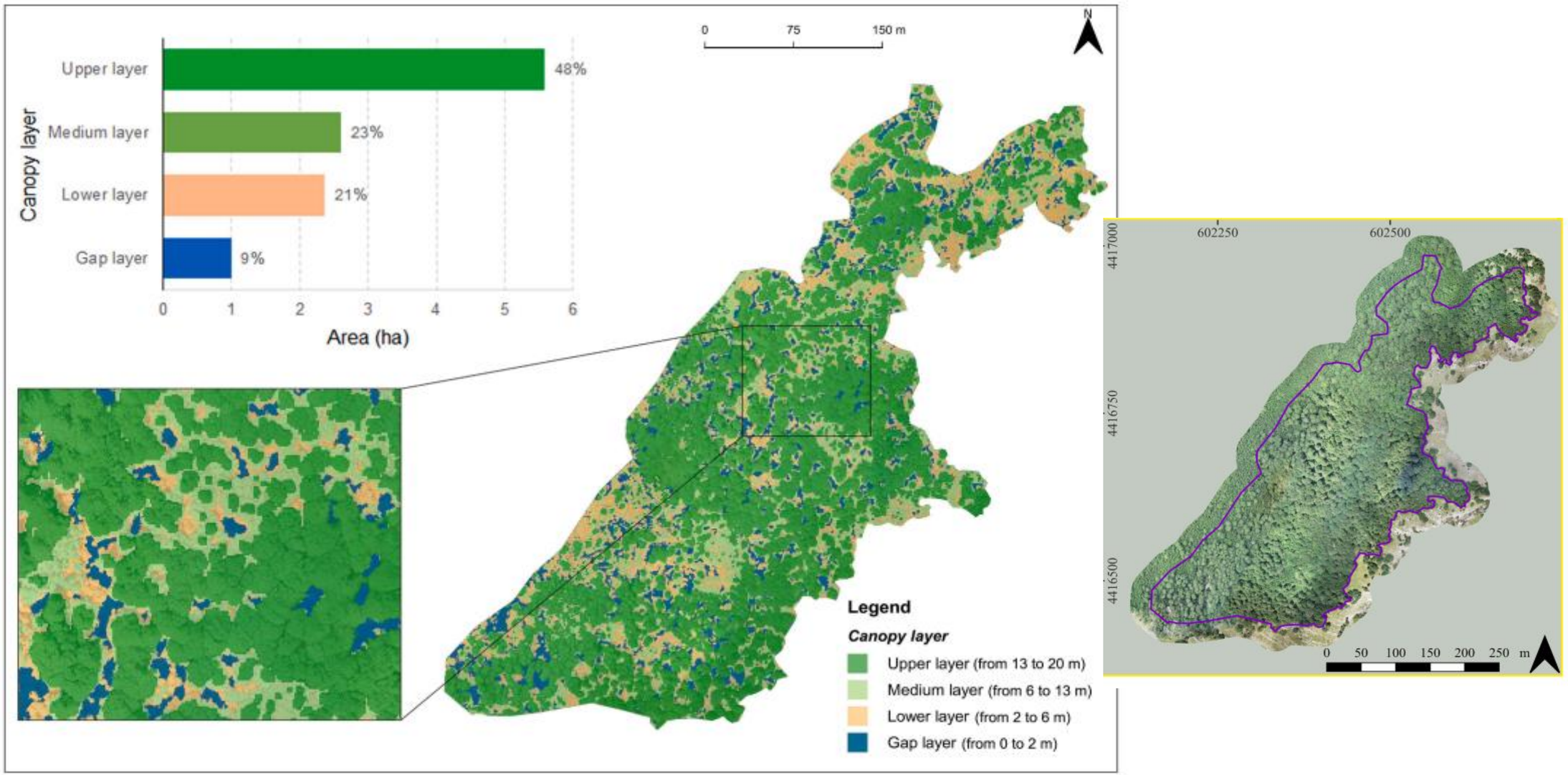
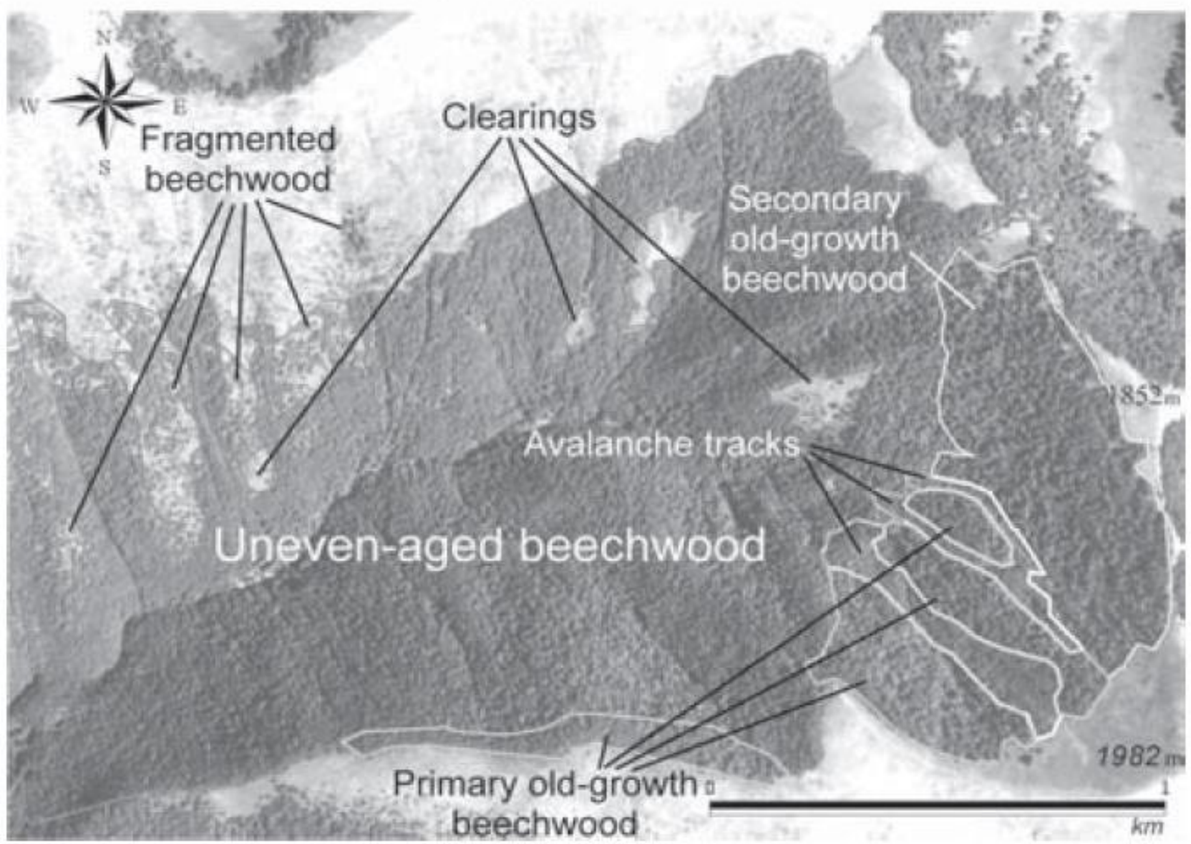


Fig. 6. Vertical layer distribution map Mount Pollinello's old-growth forest according to the canopy height classification scheme, estimated from $CHM_{0.5}$.

Valle Cervara is a primary old-growth stands that escaped logging in the 50s thanks to a joint work of a botanist Loreto Grande and the forest service



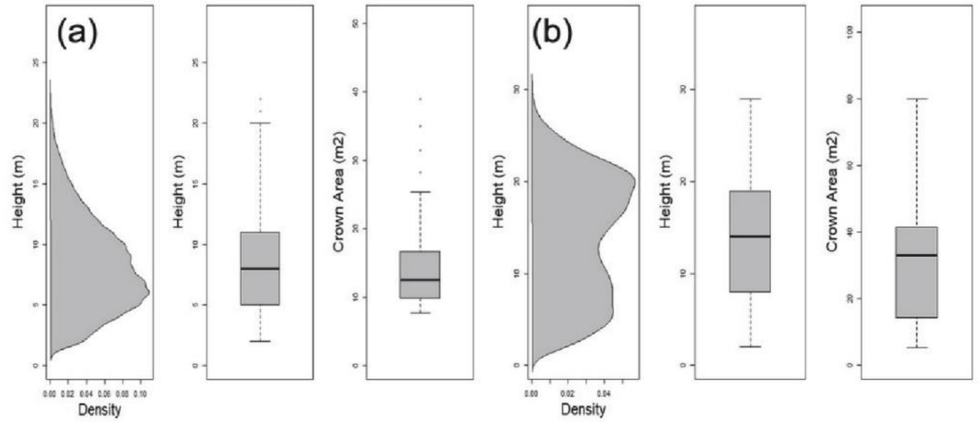


Fig. 4. Canopy height density profile, tree height density distribution and crown area density distribution from LiDAR-derived Canopy height model (CHM) for plot 1 (a) and plot 2 (b) of the old-growth forest of Val Cervara.

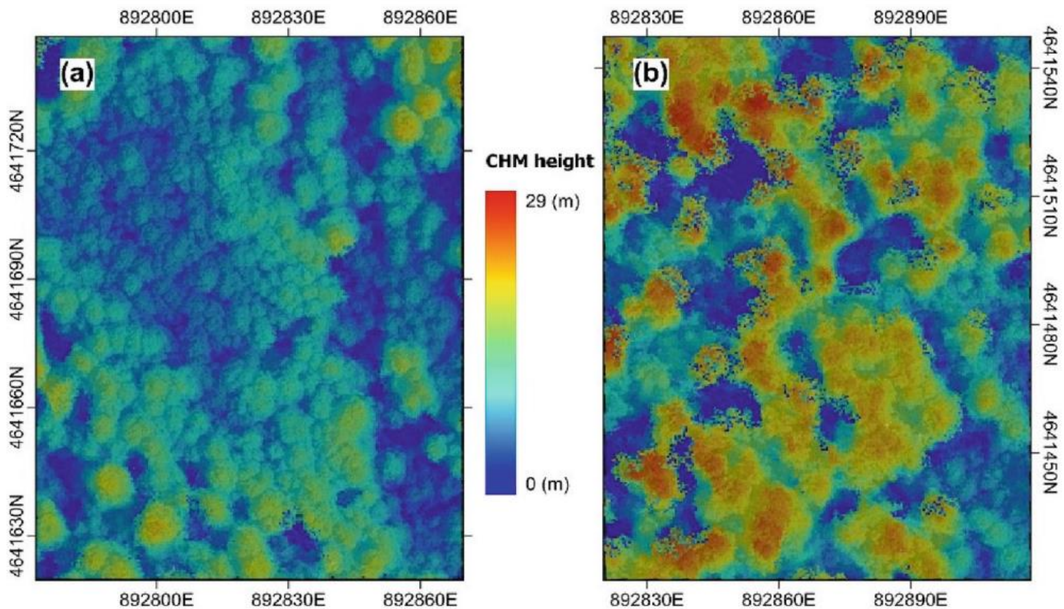
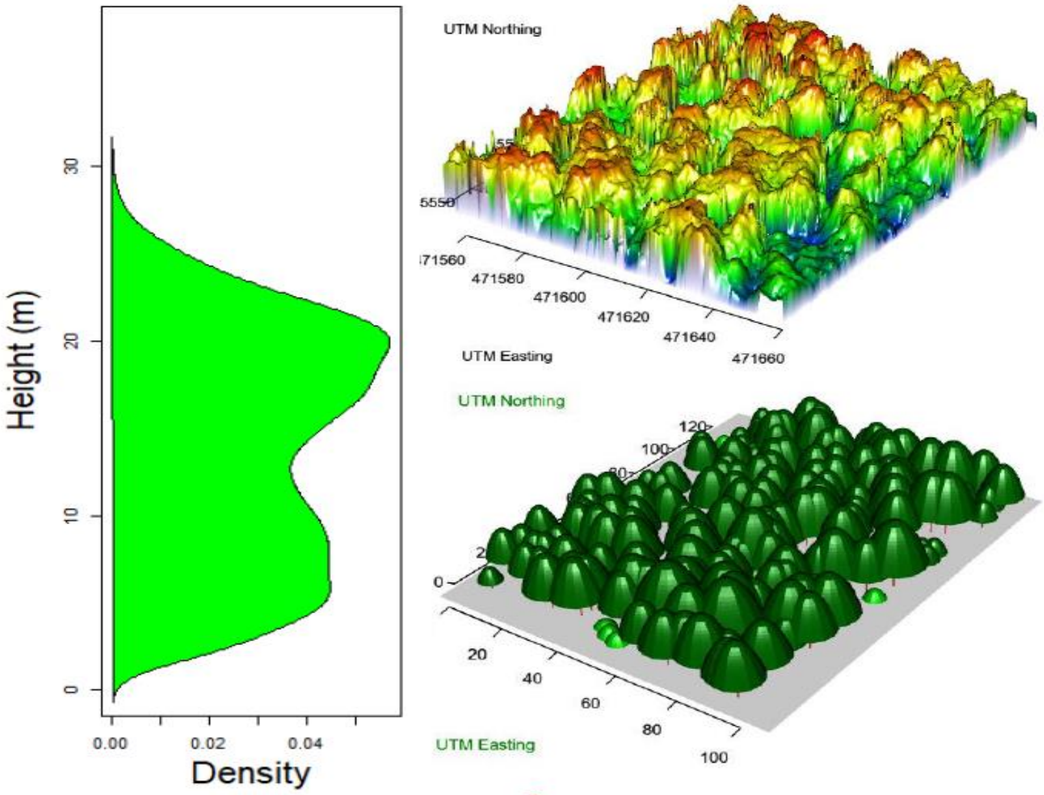


Fig. 3. LiDAR-derived Canopy height model (CHM) for plot 1 (a) and plot 2 (b) of the old-growth beech forest of Val Cervara (EPSG 32633 coordinate system).



Praticò, Salvatore, et al. "An Unpiloted Aerial System (UAV) Light Detection and Ranging (LiDAR) Based Approach to Detect Canopy Forest Structure Parameters in Old-Growth Beech Forests: Preliminary Results." *International Conference on Computational Science and Its Applications*. Cham: Springer Nature Switzerland, 2023.

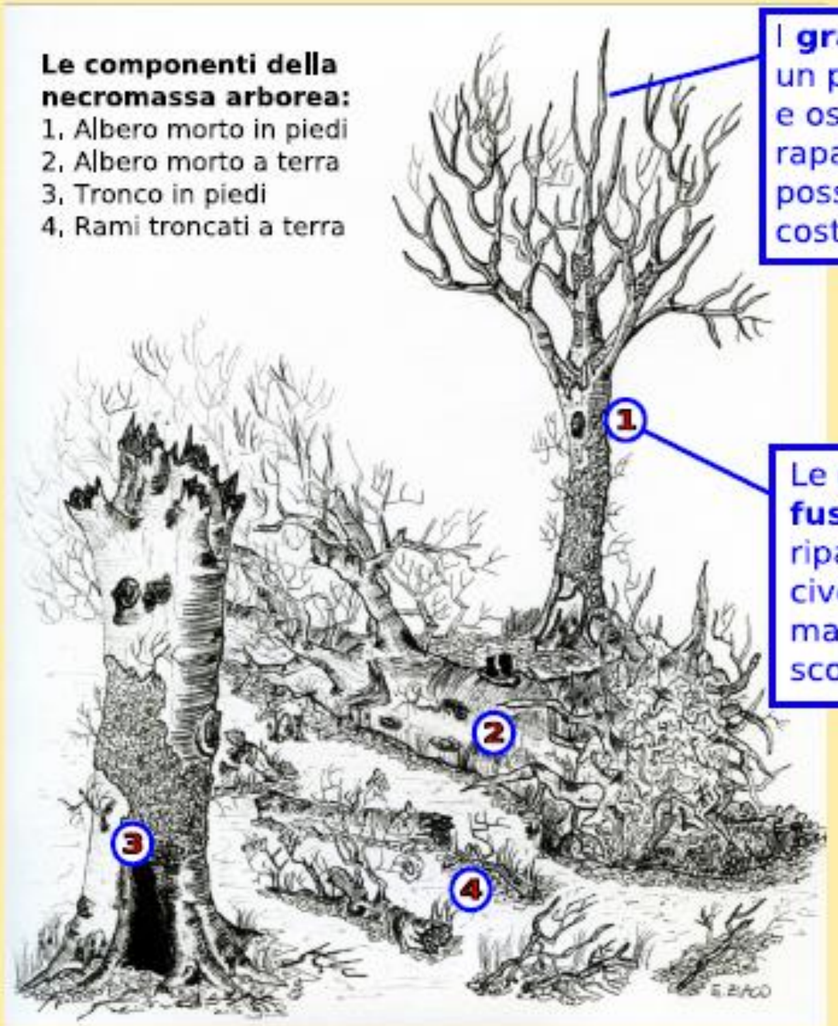
Il legno morto quale indicatore di naturalità degli ecosistemi forestali

I **pipistrelli** si rifugiano sotto la corteccia che si distacca dal fusto

Il **picchio** scava il legno in decomposizione alla ricerca degli insetti di cui si nutre

Le **cavità alla base** dell'albero possono ospitare mammiferi, come il gatto selvatico o il **tasso**

Batteri, funghi e artropodi saproxilici (p.e. ***Rosalia alpina***) vivono sull'albero moribondo o morto, decomponendo il legno



I **grandi rami** sono un punto d'appoggio e osservazione per i rapaci che vi possono anche costruire il nido

Le **cavità lungo il fusto** offrono riparo a gufi e civette o a piccoli mammiferi come scoiattoli e ghiri

Ogni parte dell'albero habitat è importante per il mantenimento della biodiversità e il funzionamento dell'ecosistema.

Utilizzazione forestale

Taglio

1-semplificazione strutturale

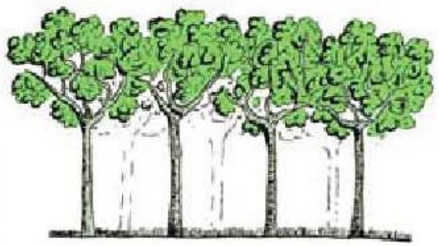
2-minore necromassa

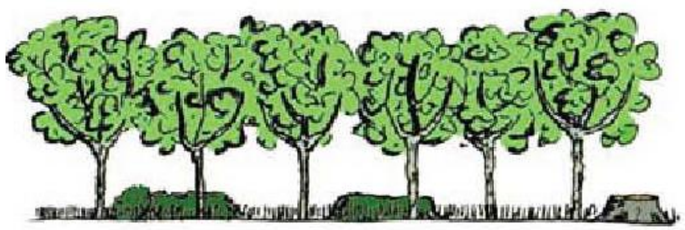
3-assenza di alberi habitat

4-perdita di biodiversità

5-minore fertilità

6-aumento di erosione





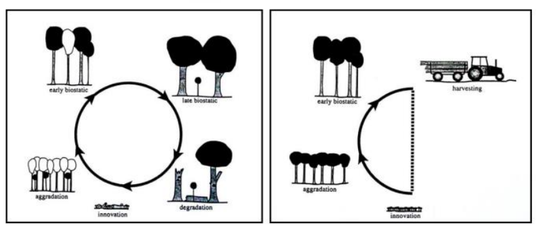
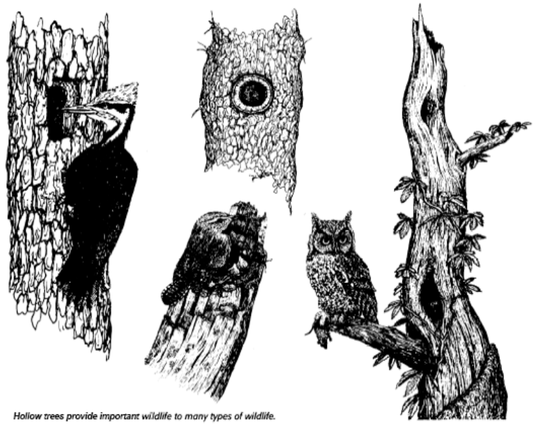
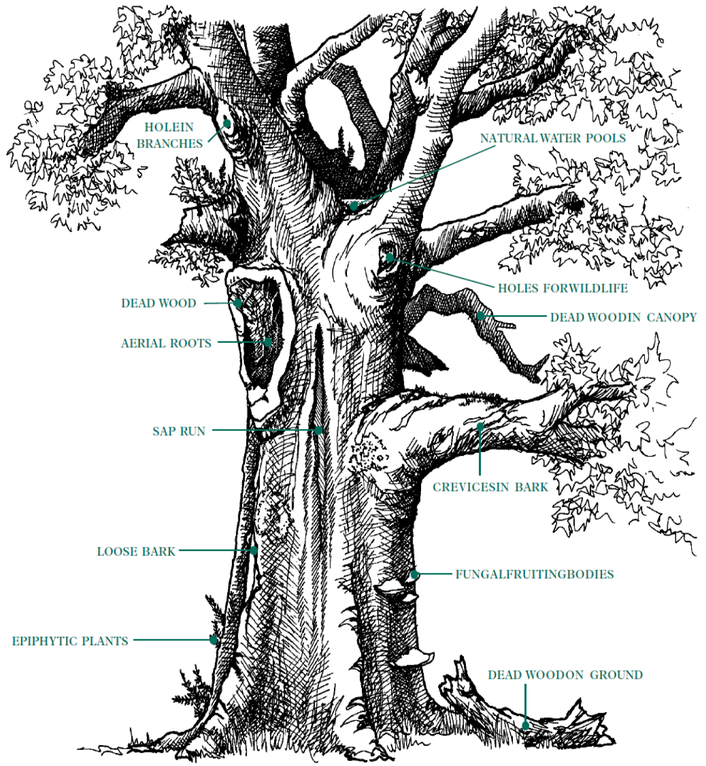


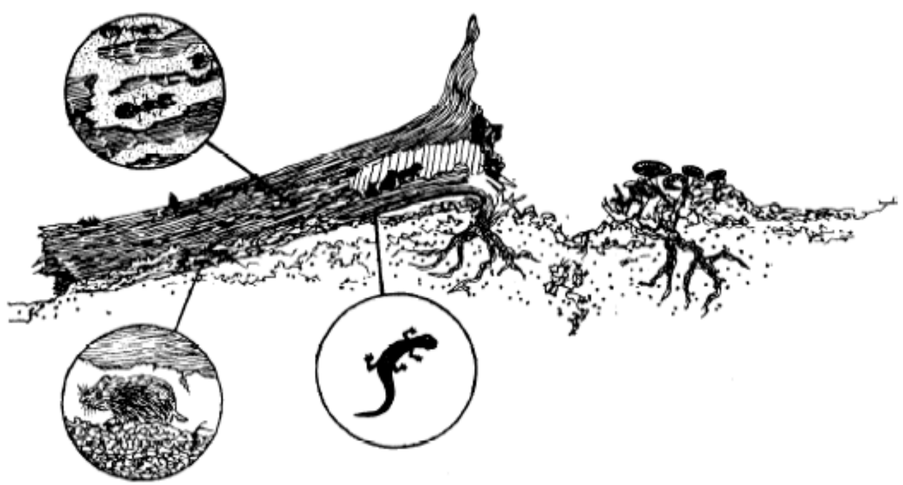
Fig 2. The 'management shortcut', eliminating the late-seral (late biostatic) and generation-transition phases (degradation phase) of the forest (Emborg & Christensen, 1990).



Hollow trees provide important wildlife to many types of wildlife.

Figure 3*. *Diagram to show the features characteristic of a veteran tree.*





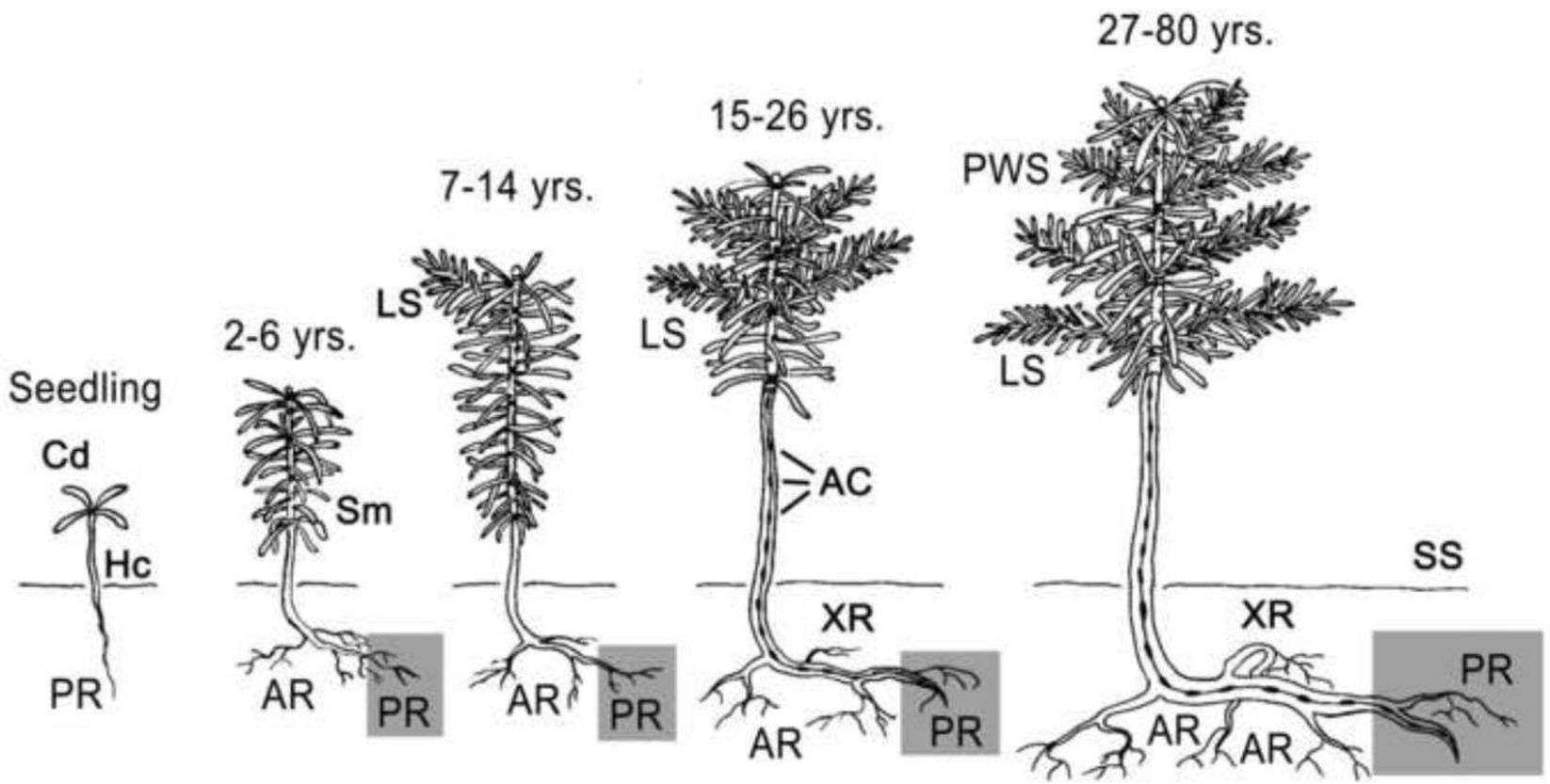
- **Ecological Integrity**
- **Key structural process**

Figure 12. *The stages in the life of a tree.*

VETERAN TREES INITIATIVE

	A	B	C	D	E	F	G
STAGES						*IDEAL NATURAL STATE: OPTIMUM GROWTH*	
FORMATIVE	A - B	INFANCY PRE-SEXUAL MATURITY:			YOUNG TREE, HIGH VITALITY GROWTH ENHANCED BY MYCORRHIZAL ROOT ASSOCIATES	GERMINATION	
	B - C	JUVENILE TO EARLY MATURITY:			CONTINUED FAST GROWTH NET INCREASE IN ANNUAL INCREMENT LOW VOLUME OF DYSFUNCTIONAL TISSUE	LOW HABITAT CONTRIBUTION	HIGH VITALITY
FULL TO LATE MATURITY	C - D	FULL TO LATE MATURITY:			GROWTH TO PEAK CROWN SIZE COLONISATION BY SAPROXYLIC (DEADWOOD) INVERTEBRATES MAXIMUM POLLINATION AND SEED CAPACITY ONSET OF NATURAL LIMB LOSS INCREASE OF DYSFUNCTIONAL TISSUE ACCELERATED FUNGAL COLONISATION AND ACTIVITY		
ANCIENT	D - E	EARLY ANCIENT STAGE:			RETRENCHMENT OF CROWN: REDUCTION IN NET ANNUAL INCREMENT CONTRACTION OF LIVE CROWN INCREASED VEGETATIVE VITALITY IN LOWER CROWN INCREASED FUNGAL ACTIVITY AND WOOD DECAY INCREASED COLONISATION BY FLORA AND SAPROXYLIC FAUNA		
	E - F	LATE ANCIENT STAGE:			ADVANCED RETRENCHMENT DECLINE IN CROWN SIZE AND ANNUAL INCREMENT EXTENSIVE HOLLOWING CROWN COLLAPSE DECLINING VITALITY ADVANCED HEARTWOOD DECAY AND HOLLOWING ADVANCED ACTIVITY BY FAUNA AND FLORA	INCREASING NUTRIENT STATUS OF TREE FOR COLONISERS INCREASING HABITAT	GRADUAL DECLINE IN VITALITY
	F - G	SENESCENT:			TERMINAL DECLINE: TREE DEATH CONTINUING FUNGAL ACTIVITY PEAK OF SAPROXYLIC ACTIVITY NUTRIENT RECYCLING		DEATH

Growth suppression (old-growth environment) during the first stage of ontogeny enhances longevity in closed forests



Hc – hypocotyl, Cd – cotyledon, Sm – stem, LS – lateral shoot, PWS – pseudo-whorl shoot, AC – air cavities (pith nodes), PR – primary root, AR – adventitious roots, XR – xylorhizome, SS – soil surface.

Zaitsev, G. A., Kulagin, A. Y., & Davydychev, A. N. (2018). The particularities of the growth of Siberian fir (*Abies sibirica* Ledeb.) in the first stages of ontogeny in conifer forests (Ufa plateau, Pre-Ural). *Trees*, *32*(2), 511-518.

Saplings of fir and beech of 1 m height can be older than 100 years!
Up to 150 years in old-growth forests - strict reserves (Sasso Fratino!!)

Old, senescent trees

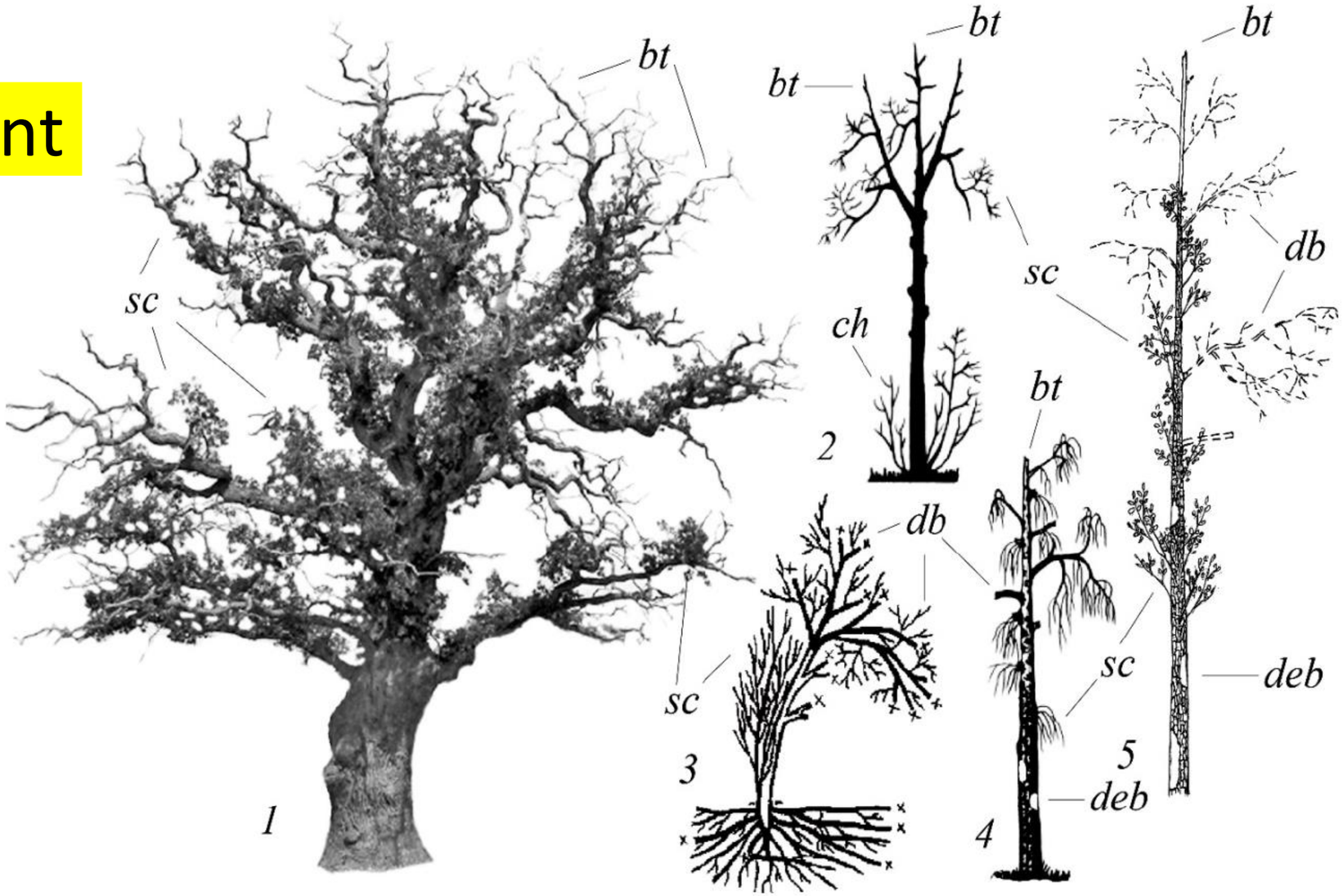


Fig. 14. Senile plants:
1 – *Quercus robur* with normal vitality grown in meadow (height – 20 m); *2* – *Tilia cordata* with normal vitality grown in forest (19 m); *3* – *Salix caprea* with normal vitality grown at forest edge (10 m); *4* – *Betula pendula* with normal vitality grown in open area (19 m); *5* – *Alnus glutinosa* with low vitality grown in forest (18 m). Designations: *bt* – broken top, *deb* – delamination of bark. Other designations: see Fig. 11, 13. Sources and the authors of figures: *1* – O. I. Evstigneev; *2*, *4* – A. I. Shirikov; *3* – [32]; *5* – A. V. Korotkova

Evstigneev OI, Korotkov VN (2016) Ontogenetic stages of trees: an overview. Russ J Ecosyst Ecol 1(2):1–31

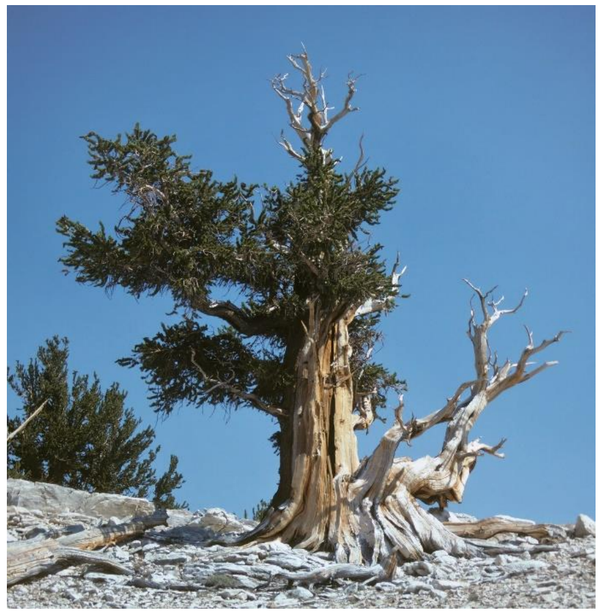
Tree longevity

Species

Long-lived trees are mainly conifers

Maximum ages of conifer species are typically an order of magnitude greater than crossdated angiosperm species (5000 years vs 500 years)

http://www.rmtrr.org/oldlist.htm



Environment

Slow growth enhance longevity. Site fertility and growth suppressions:

Oldest trees are not the biggest, they are generally found in harsh environment close to the species limit of tolerance (rocky sites, arid regions, cold environment).

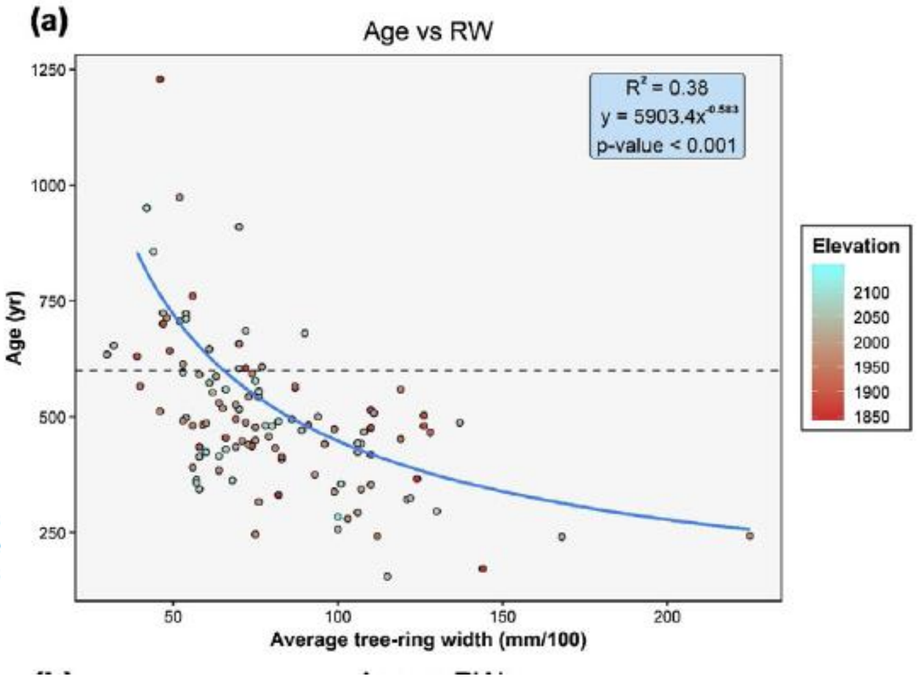


Fig. 8. Tree age plotted against average tree-ring width (dbh > 50 cm). Symbol color was used to represent (a) elevation and (b) sampled site (see legend). A horizontal dotted line shows the 600-year threshold. A power law function (blue line) with confidence intervals (grey shading) was overlaid to indicate a potentially non-linear relationship.

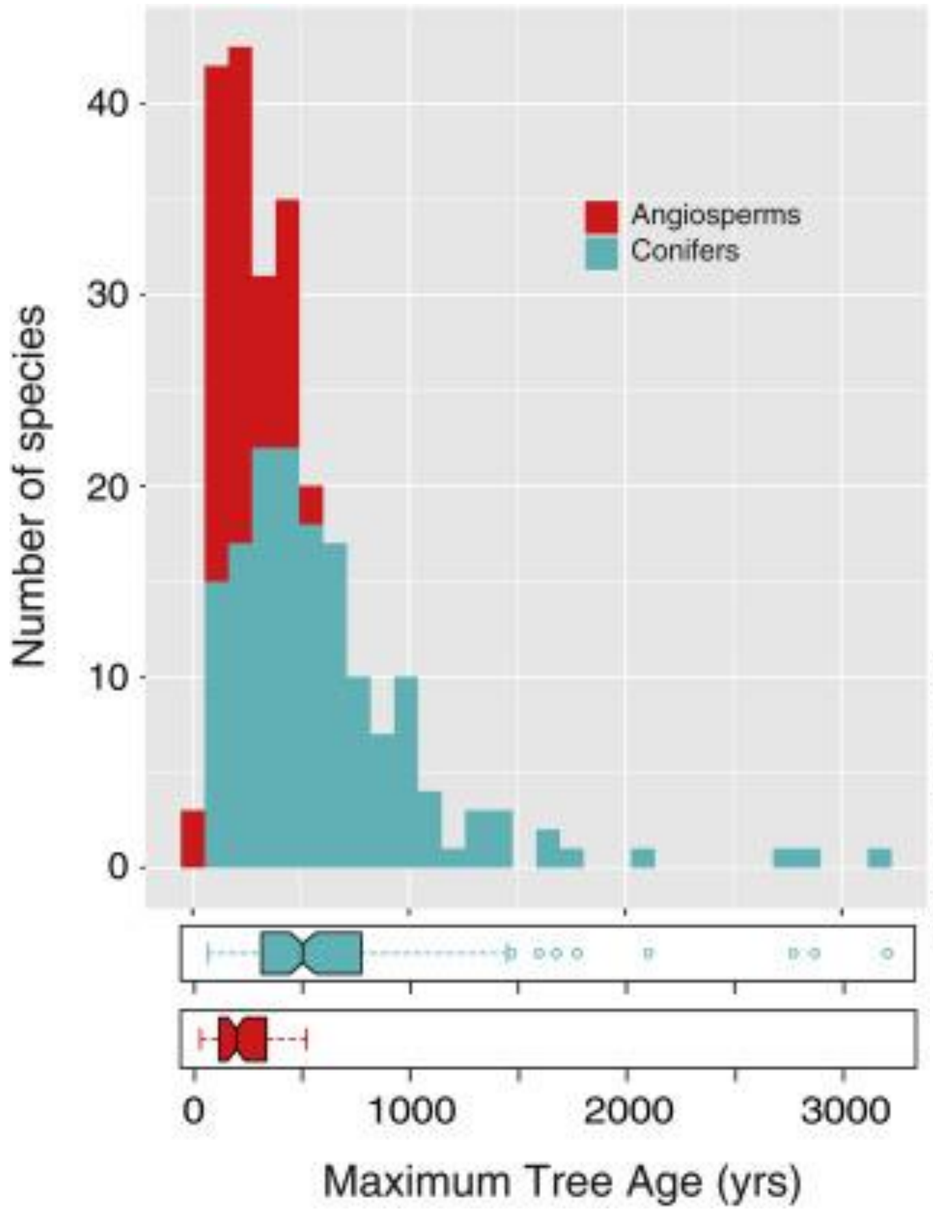
iScience

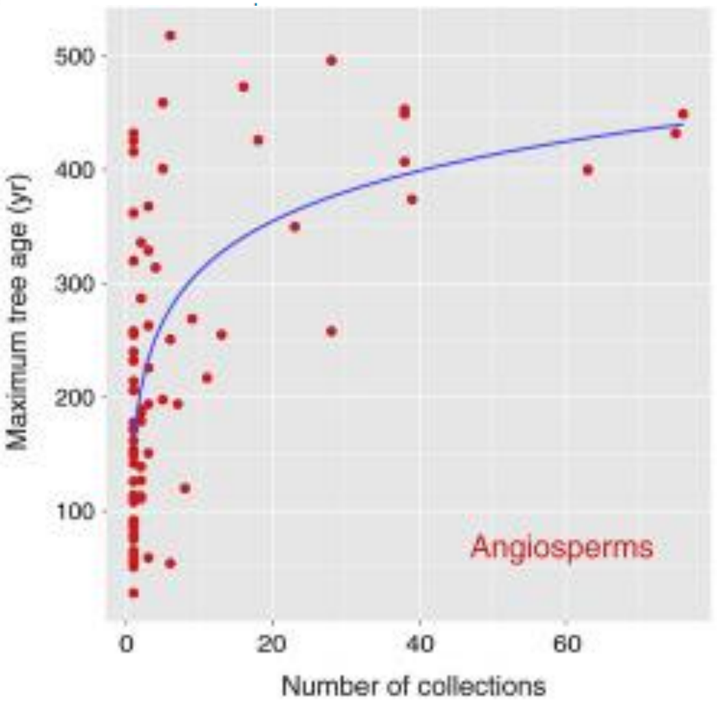
Volume 26, Issue 3, 17 March 2023, 106138

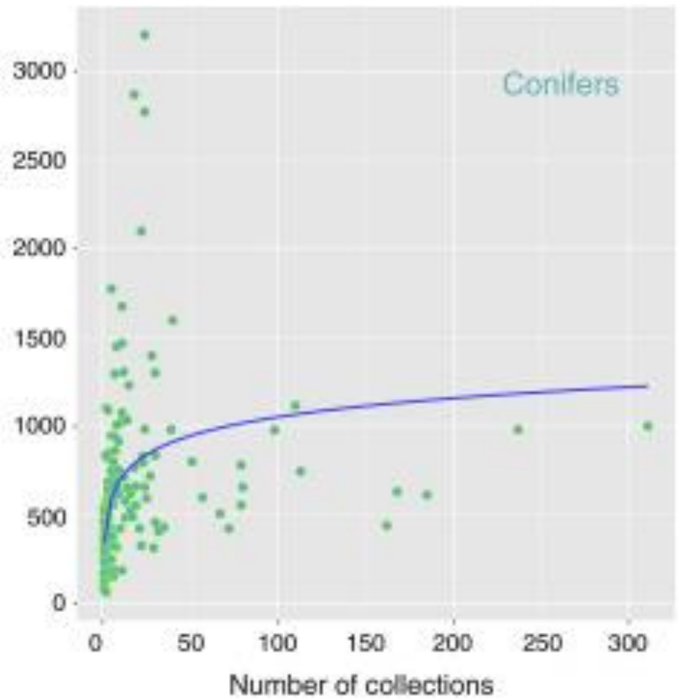
Article

Maximum tree lifespans derived from public-domain dendrochronological data

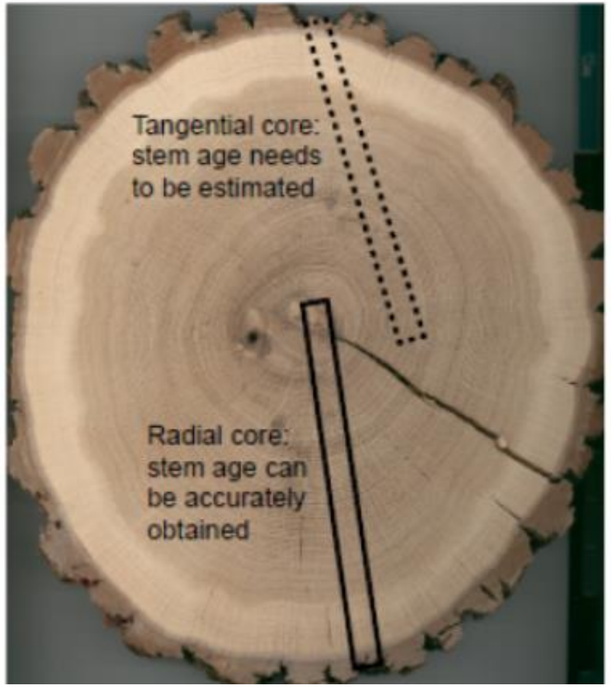
Franco Biondi [1 4], David M. Meko [2], Gianluca Piovesan [3]

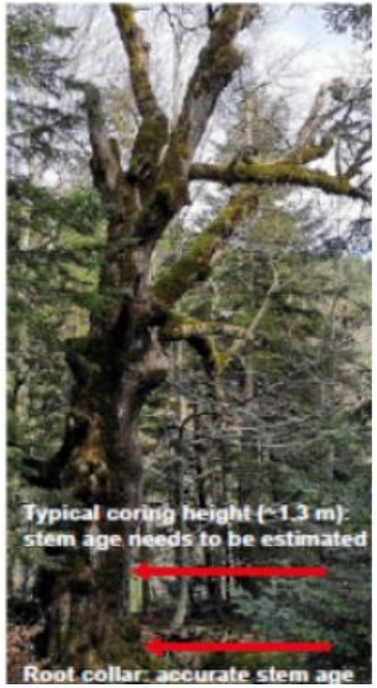




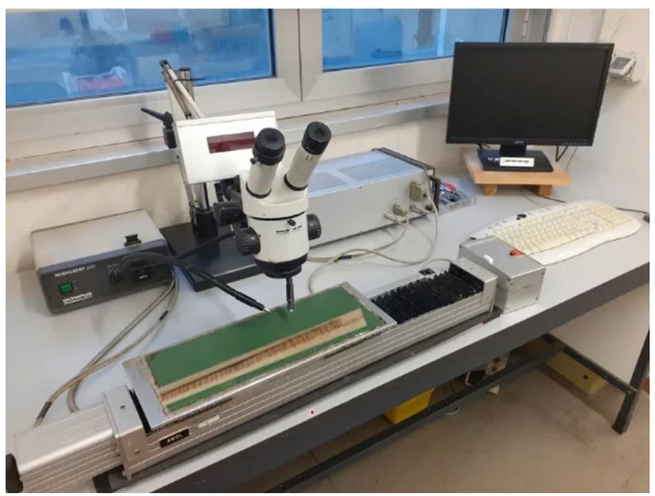


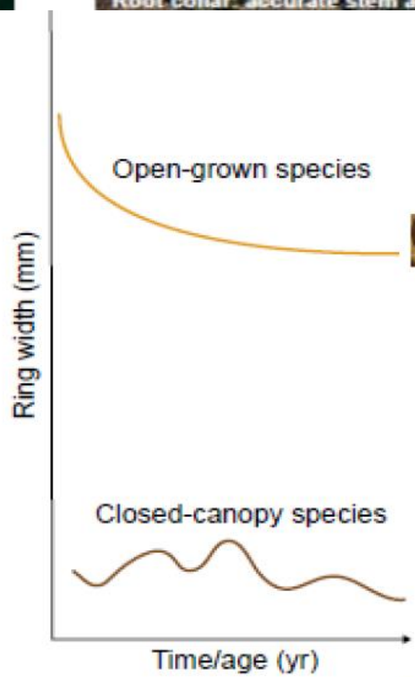
Tree Dating

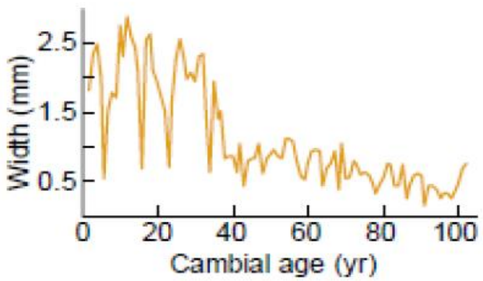


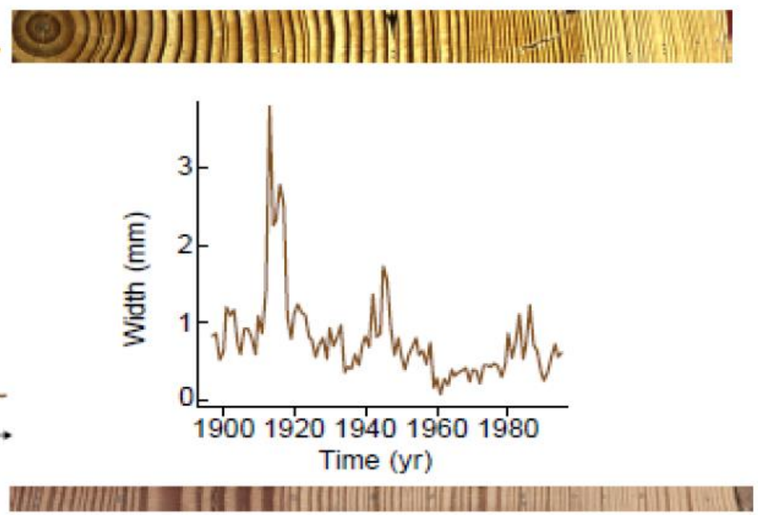


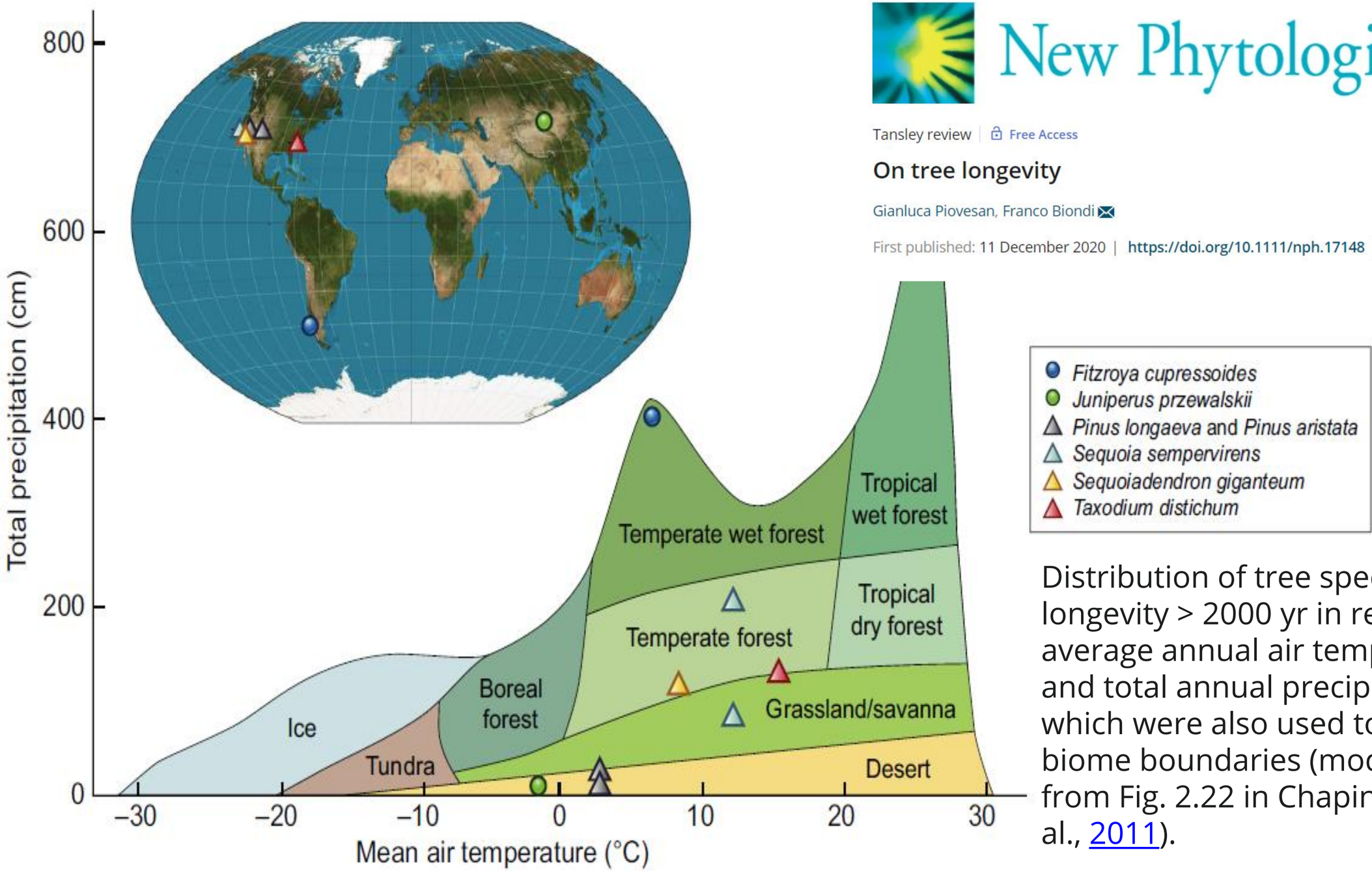
Dendrochronological analysis: complete cores are needed











New Phytologist

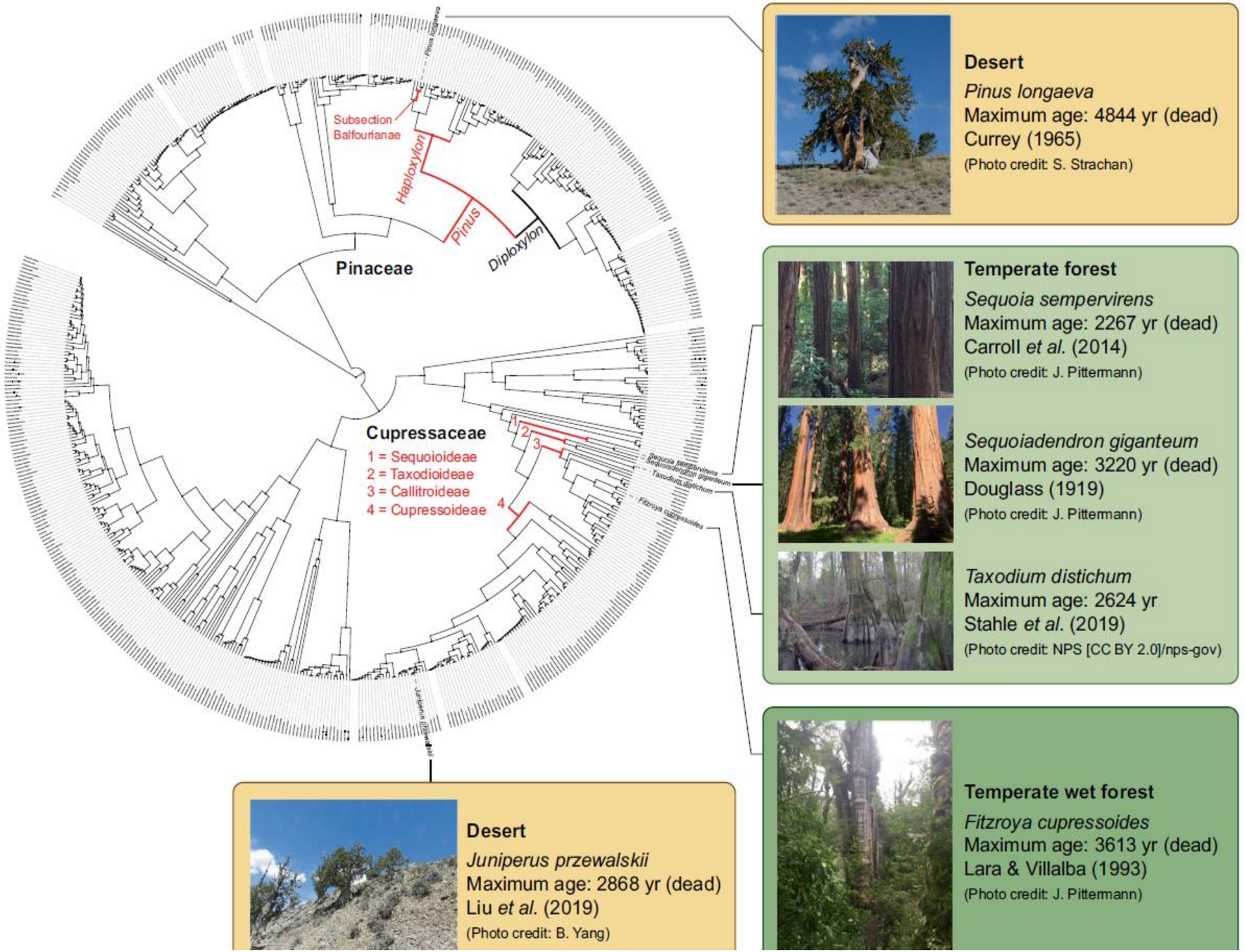
Tansley review | Free Access

On tree longevity

Gianluca Piovesan, Franco Biondi

First published: 11 December 2020 | https://doi.org/10.1111/nph.17148 | Citations: 11

Distribution of tree species with longevity > 2000 yr in relation to average annual air temperature and total annual precipitation, which were also used to draw biome boundaries (modified from Fig. 2.22 in Chapin III et al., 2011).



Desert

Pinus longaeva
Maximum age: 4844 yr (dead)
Currey (1965)
(Photo credit: S. Strachan)

Temperate forest

Sequoia sempervirens
Maximum age: 2267 yr (dead)
Carroll *et al.* (2014)
(Photo credit: J. Pittermann)

Sequoiadendron giganteum
Maximum age: 3220 yr (dead)
Douglass (1919)
(Photo credit: J. Pittermann)

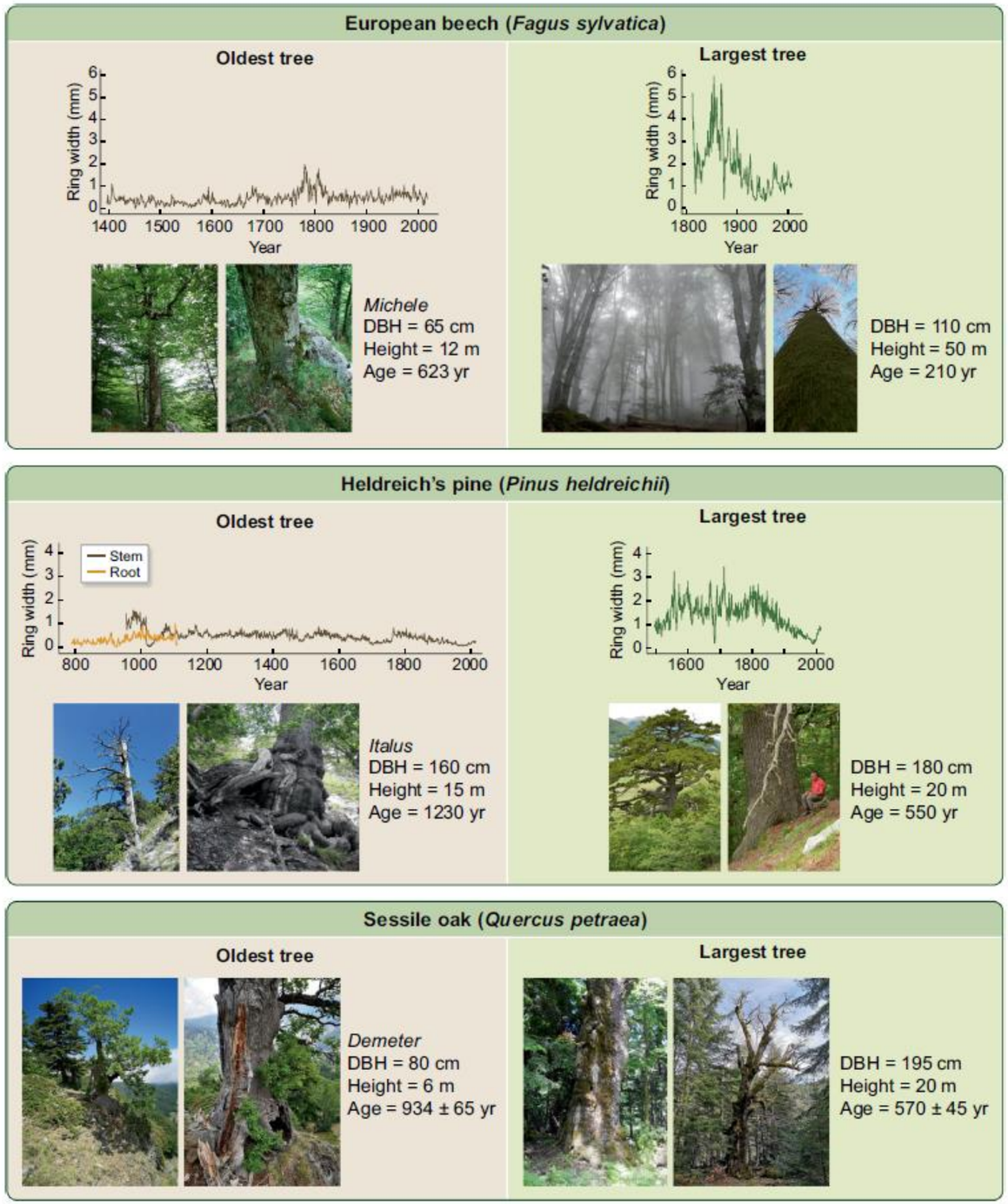
Taxodium distichum
Maximum age: 2624 yr
Stahle *et al.* (2019)
(Photo credit: NPS [CC BY 2.0]/nps-gov)

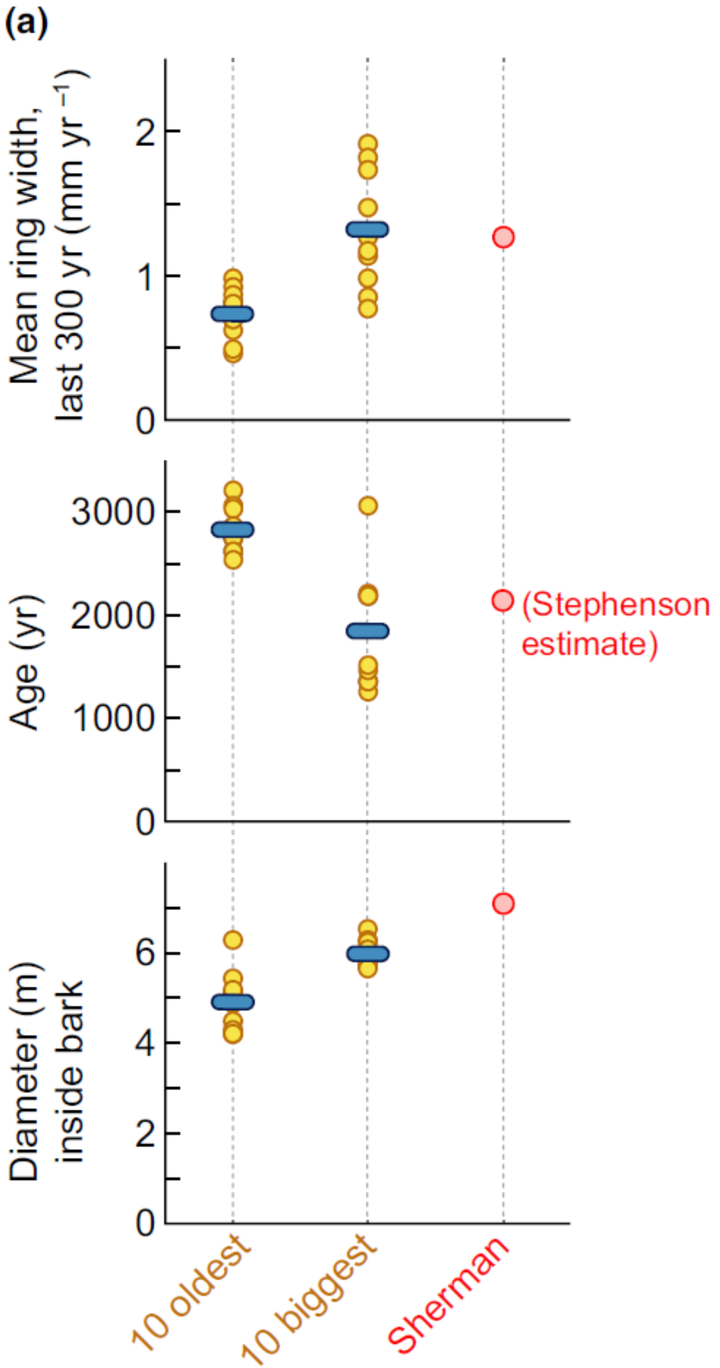
Temperate wet forest

Fitzroya cupressoides
Maximum age: 3613 yr (dead)
Lara & Villalba (1993)
(Photo credit: J. Pittermann)

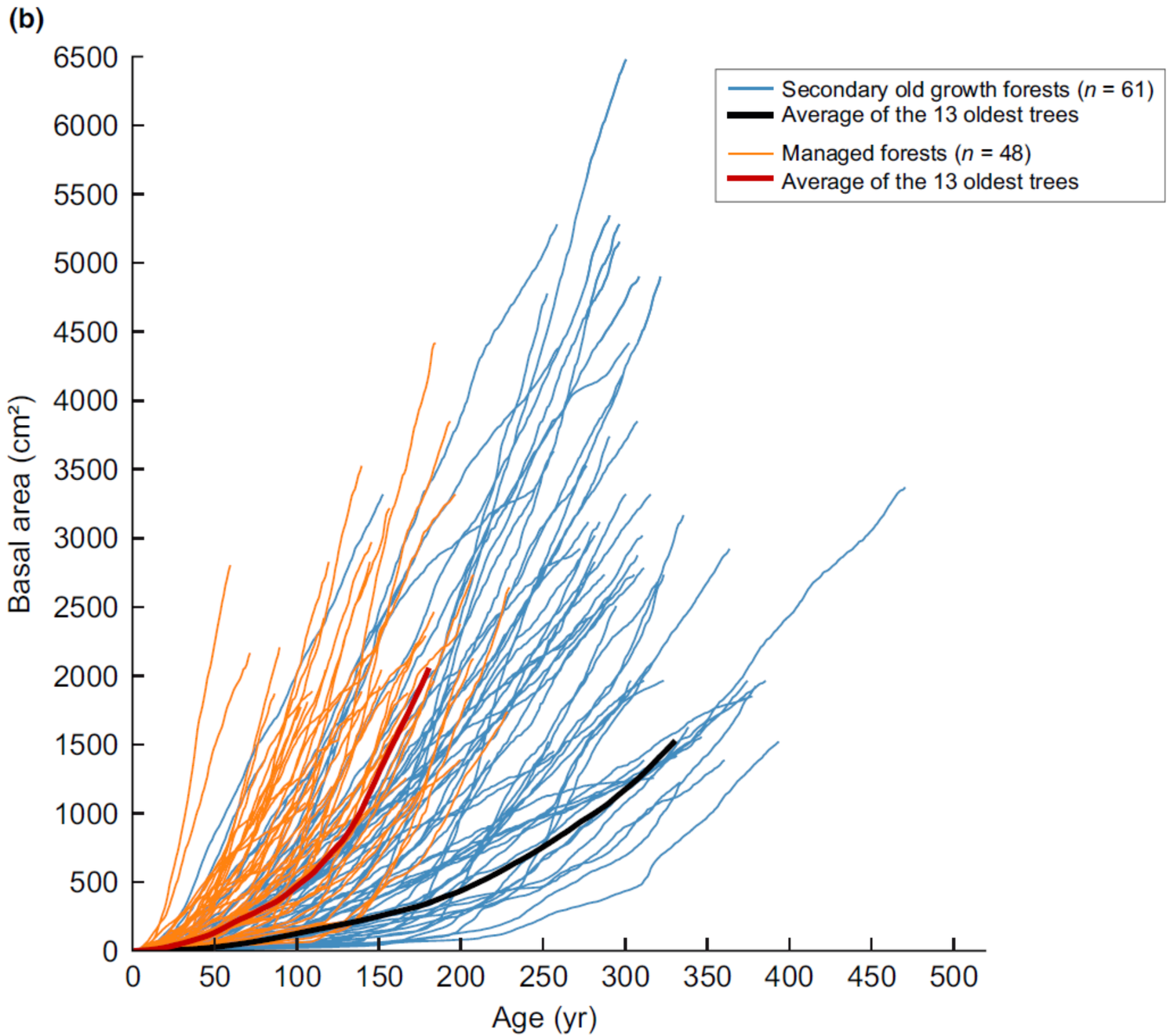
Desert

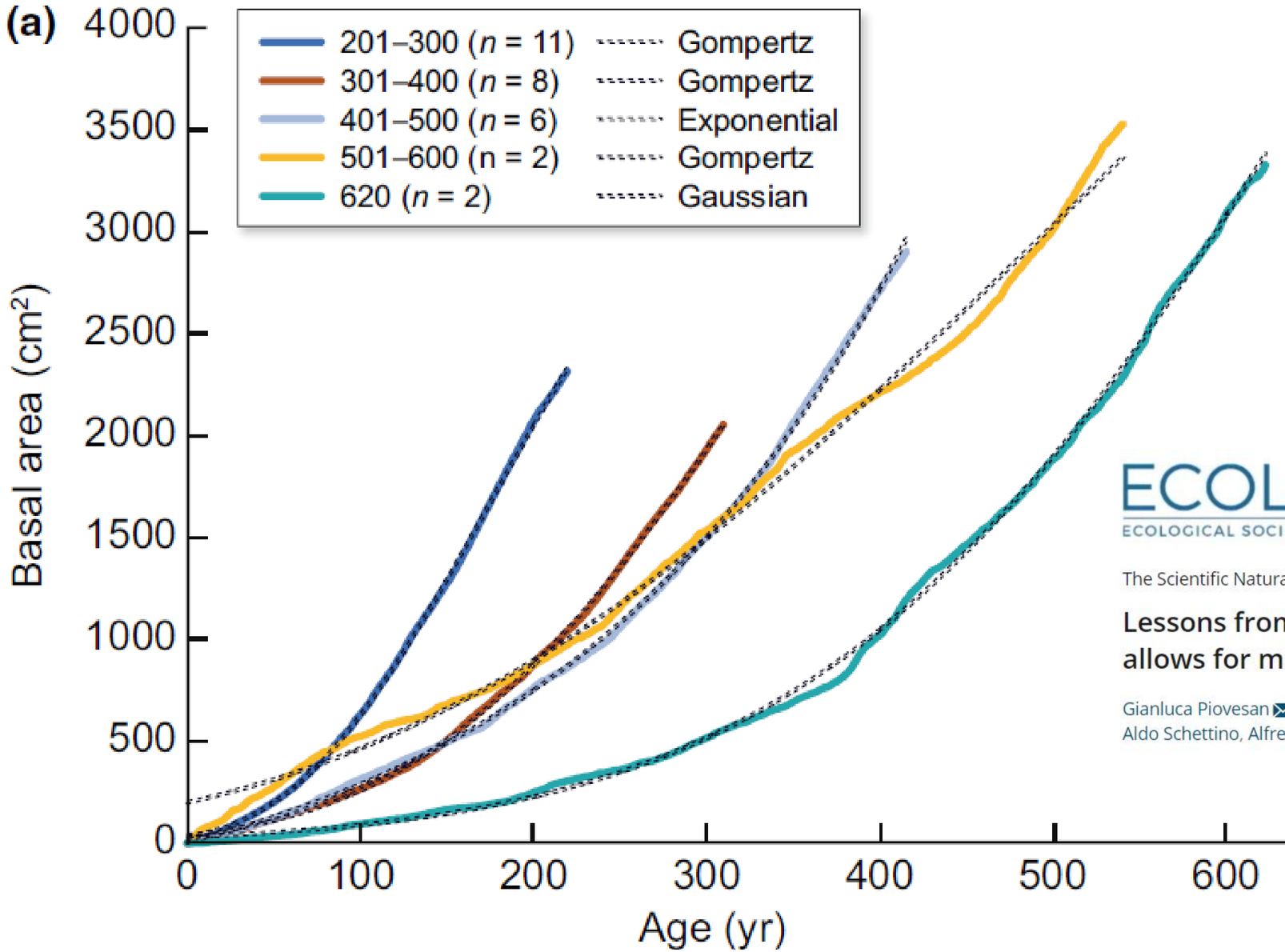
Juniperus przewalskii
Maximum age: 2868 yr (dead)
Liu *et al.* (2019)
(Photo credit: B. Yang)


European beech (Fagus sylvatica)
Oldest tree
Ring width (mm)
Year
Michele
DBH = 65 cm
Height = 12 m
Age = 623 yr
Largest tree
DBH = 110 cm
Height = 50 m
Age = 210 yr
Heldreich's pine (Pinus heldreichii)
Oldest tree
Stem
Root
Italus
DBH = 160 cm
Height = 15 m
Age = 1230 yr
Largest tree
DBH = 180 cm
Height = 20 m
Age = 550 yr
Sessile oak (Quercus petraea)
Oldest tree
Demeter
DBH = 80 cm
Height = 6 m
Age = 934 ± 65 yr
Largest tree
DBH = 195 cm
Height = 20 m
Age = 570 ± 45 yr


(a)
Mean ring width, last 300 yr (mm yr⁻¹)
Age (yr)
Diameter (m) inside bark
(Stephenson estimate)
10 oldest
10 biggest
Sherman


cm 1 2 3 4 5 6 7
cm 1 2 3 4 5 6 7


(b)
Secondary old growth forests (n = 61)
Average of the 13 oldest trees
Managed forests (n = 48)
Average of the 13 oldest trees
Basal area (cm²)
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
400
450
500
Age (yr)



ECOLOGY
ECOLOGICAL SOCIETY OF AMERICA

The Scientific Naturalist

Lessons from the wild: slow but increasing long-term growth allows for maximum longevity in European beech

Gianluca Piovesan ✉, Franco Biondi, Michele Baliva, Giuseppe De Vivo, Vittoria Marchianò, Aldo Schettino, Alfredo Di Filippo

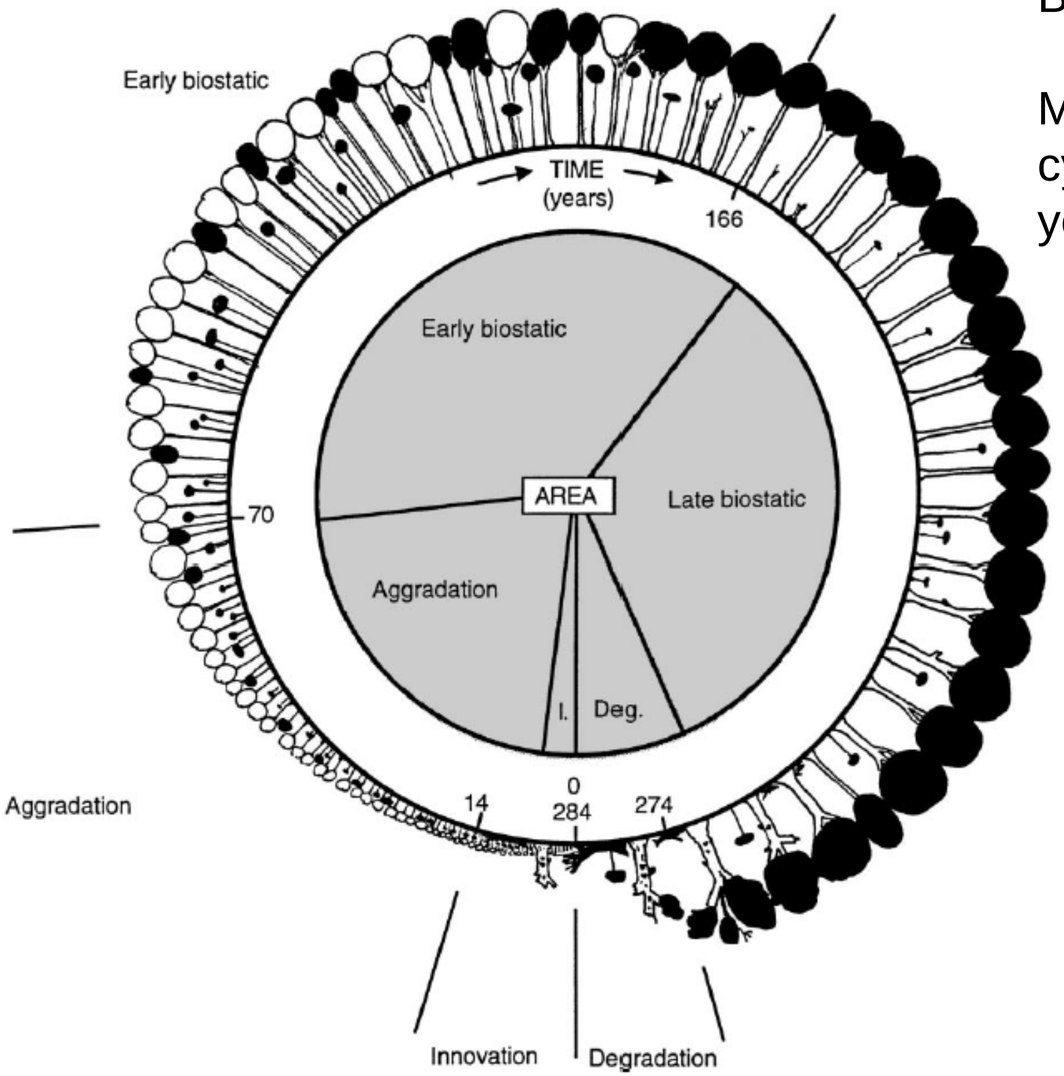
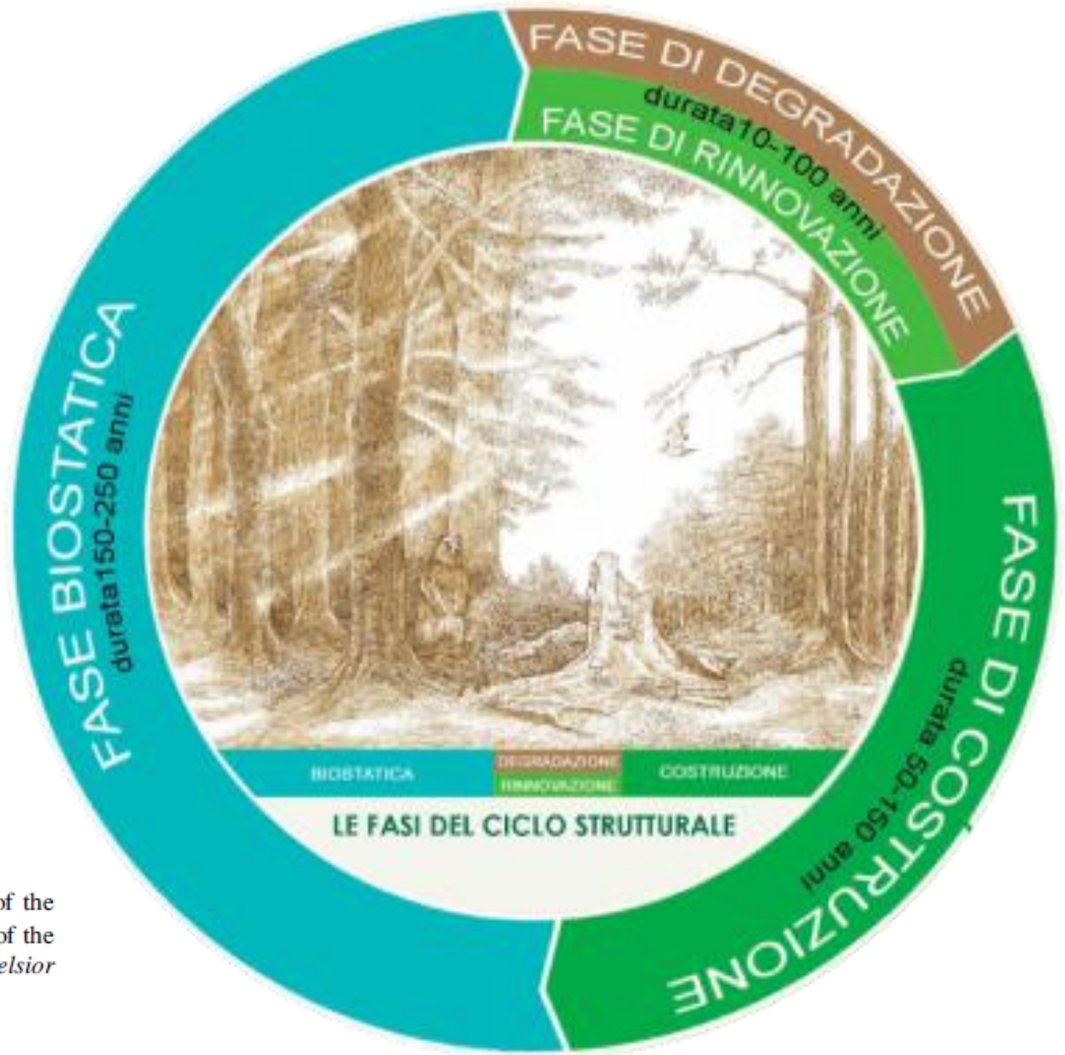


Fig. 5. The mosaic cycle in time and space, Suserup Skov, 1992. The pie in the middle shows the accumulated area of each phase of the shifting mosaic. The outer circle indicates the calculated duration of each phase of the forest cycle, numbers indicate years from start of the cycle. The typical structure of the forest throughout the forest cycle is illustrated. Note the climax microsuccession from *Fraxinus excelsior* (white) to *Fagus sylvatica* (shaded) during the innovation, the aggradation and the early biostatic phases.

The altitudinal gradient:
Bioclimate control tree growth and longevity.

Moving from low elevation to high mountain beech stands forest cycle (turnorver) pass from **200** years to more than **400** hundred years.



nature plants

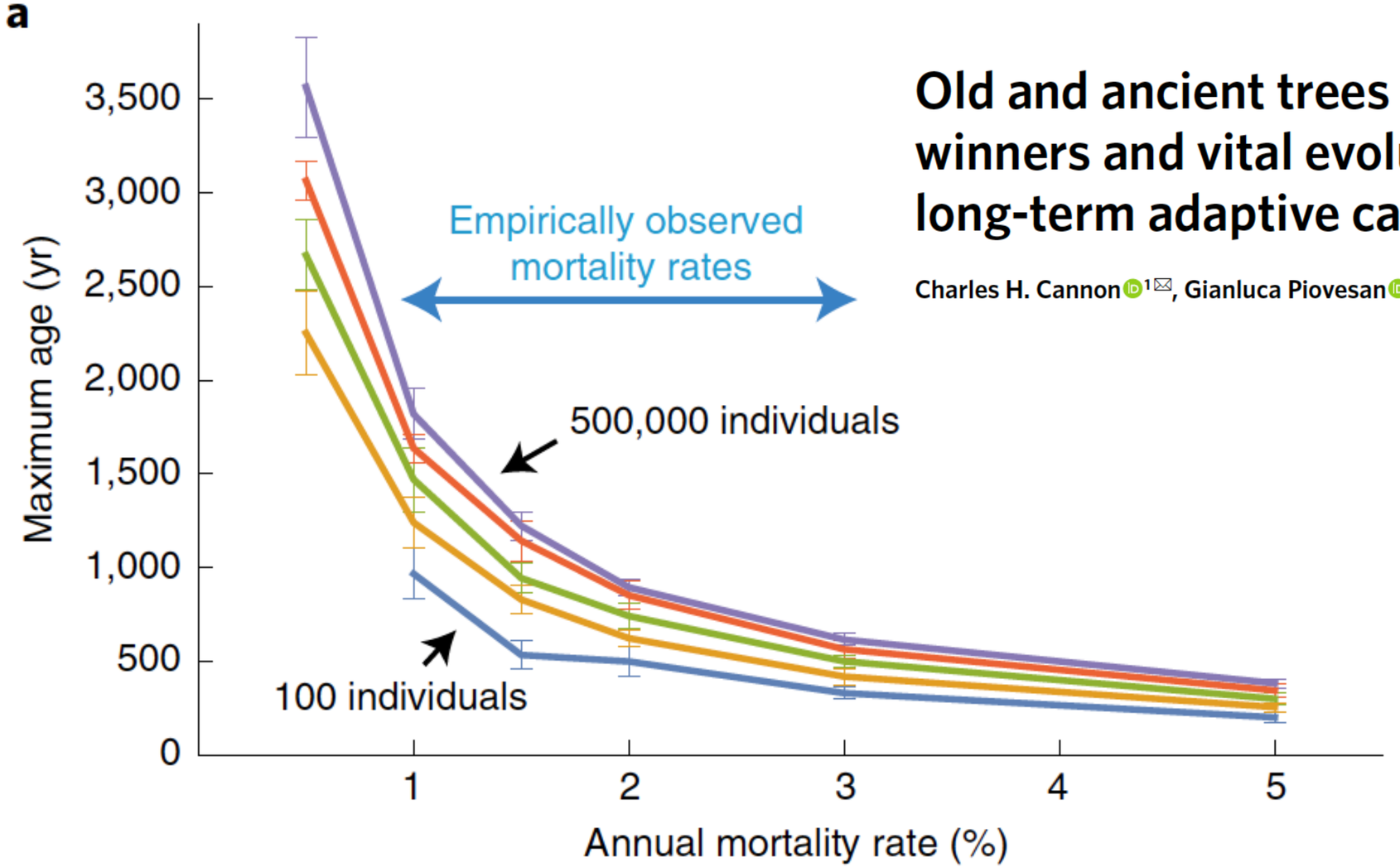
ARTICLES

https://doi.org/10.1038/s41477-021-01088-5

Check for updates

Old and ancient trees are life history lottery winners and vital evolutionary resources for long-term adaptive capacity

Charles H. Cannon[1]✉, Gianluca Piovesan[2] and Sergi Munné-Bosch[3,4]



The Morton Arboretum

Trends in
Ecology & Evoluti

Science & Society

Ancient trees: irreplaceable conservation resource for ecosystem restoration

Gianluca Piovesan [1,@], Charles H. Cannon [2,6,*,@], Jiajia Liu [3] and Sergi Munné-Bosch [4,5]

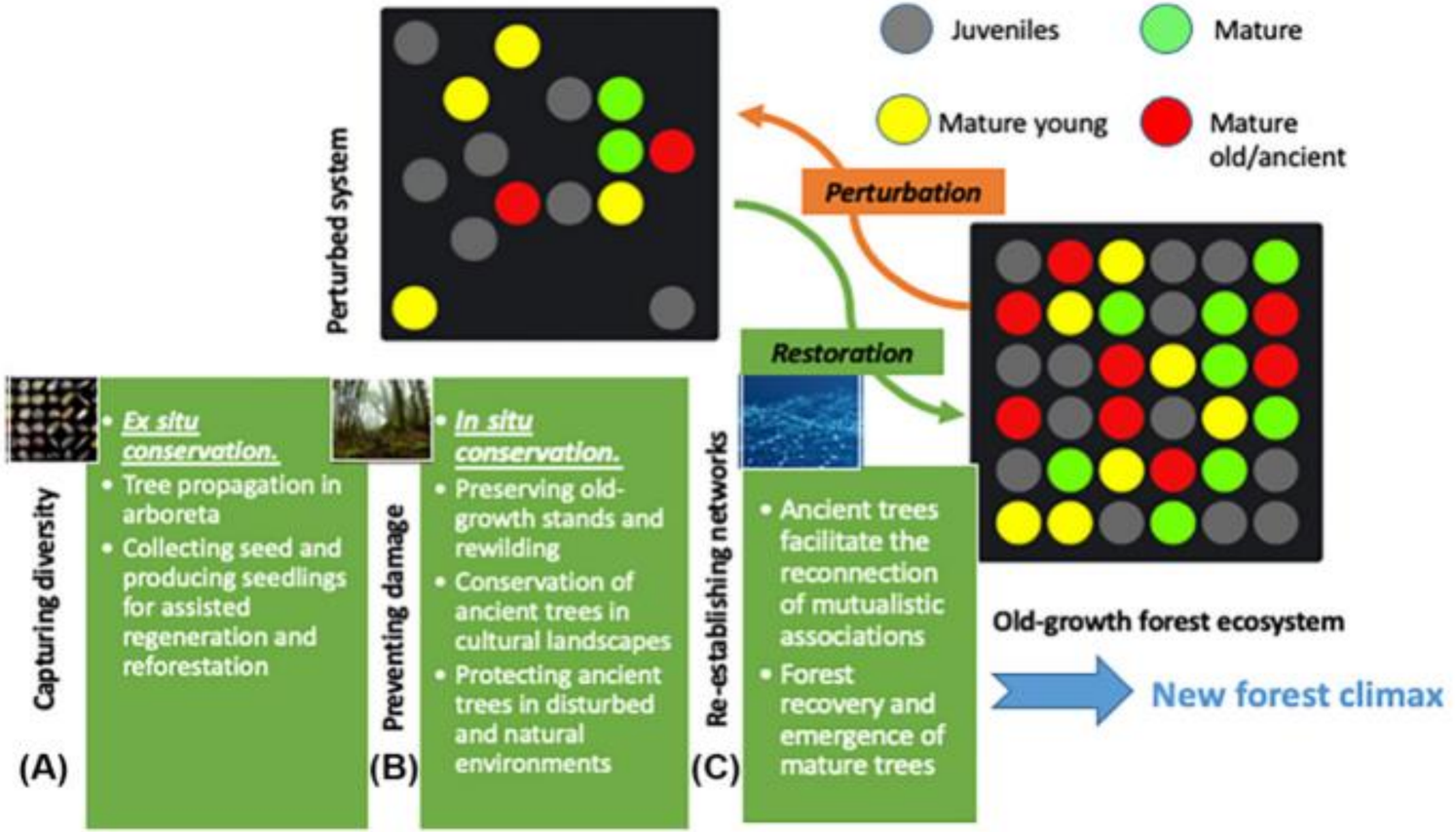
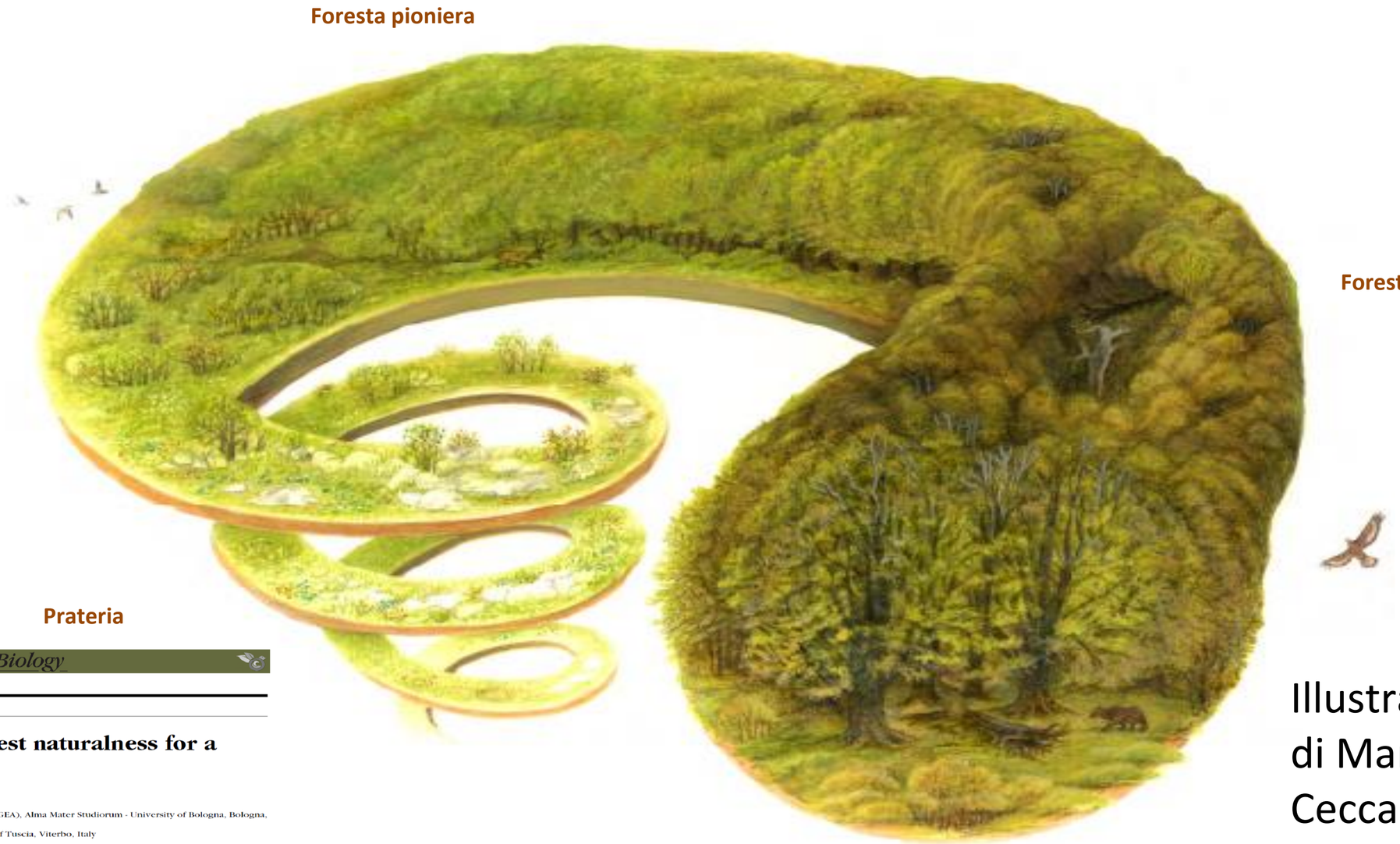


Figure 1. Role of ancient trees in re-establishing functional networks for resilient forest ecosystems and cultural landscapes. (A) Seed collection and propagation of ancient trees can capture their germplasm diversity for active forest restoration projects. (B) Ancient tree protection in old-growth and rewilding landscapes will guarantee ecosystem functionality and biodiversity conservation while maintaining ancient trees in disturbed landscapes contributes to forest regeneration. The interaction networks and great regenerative capacity of ancient trees can accelerate the restoration of perturbed ecosystems towards a functional old-growth forest such as in the case of forest rewilding (C).

Le dinamiche naturali degli ecosistemi forestali: le successioni



Illustrazioni a cura di Marisa Ceccarelli

Conservation Biology

Essay

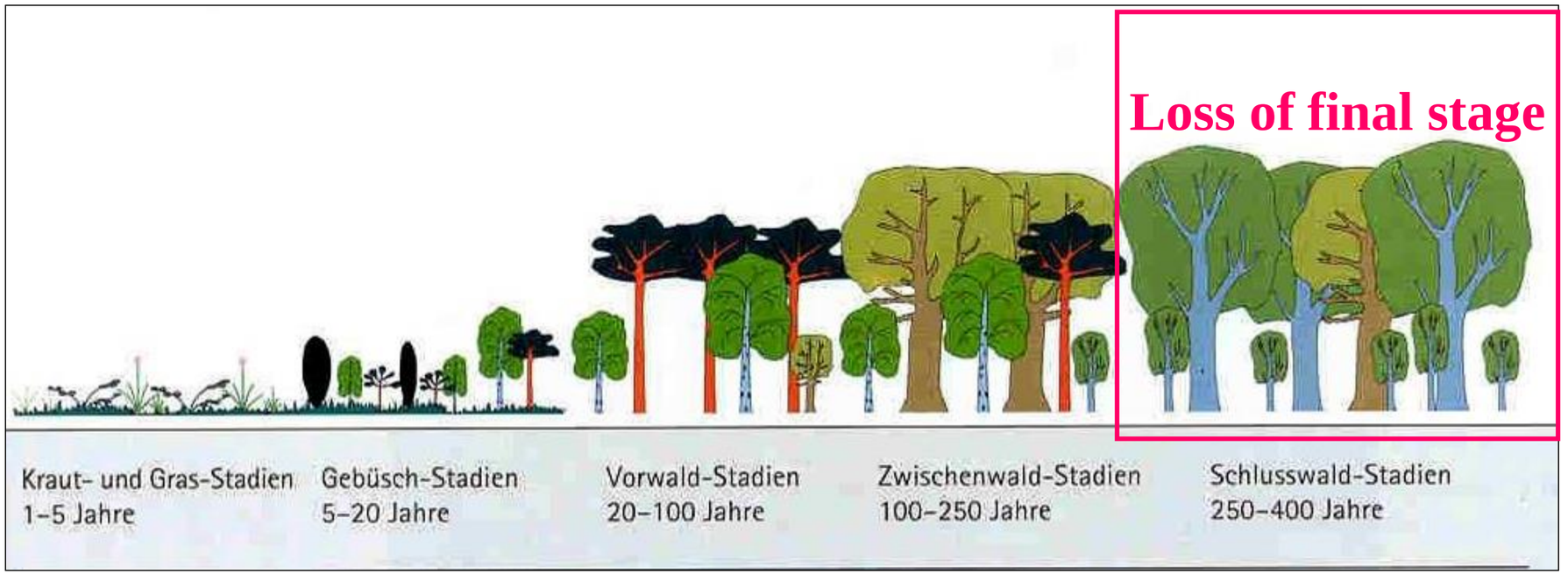
Need for a global map of forest naturalness for a sustainable future

Alessandro Chiarucci [1] and Gianluca Piovesan [2]

[1]Department of Biological, Geological and Environmental Sciences (BIGEA), Alma Mater Studiorum - University of Bologna, Bologna, Italy, email alessandro.chiarucci@unibo.it

[2]Department of Agriculture and Forest Sciences (DAFNE), University of Tuscia, Viterbo, Italy

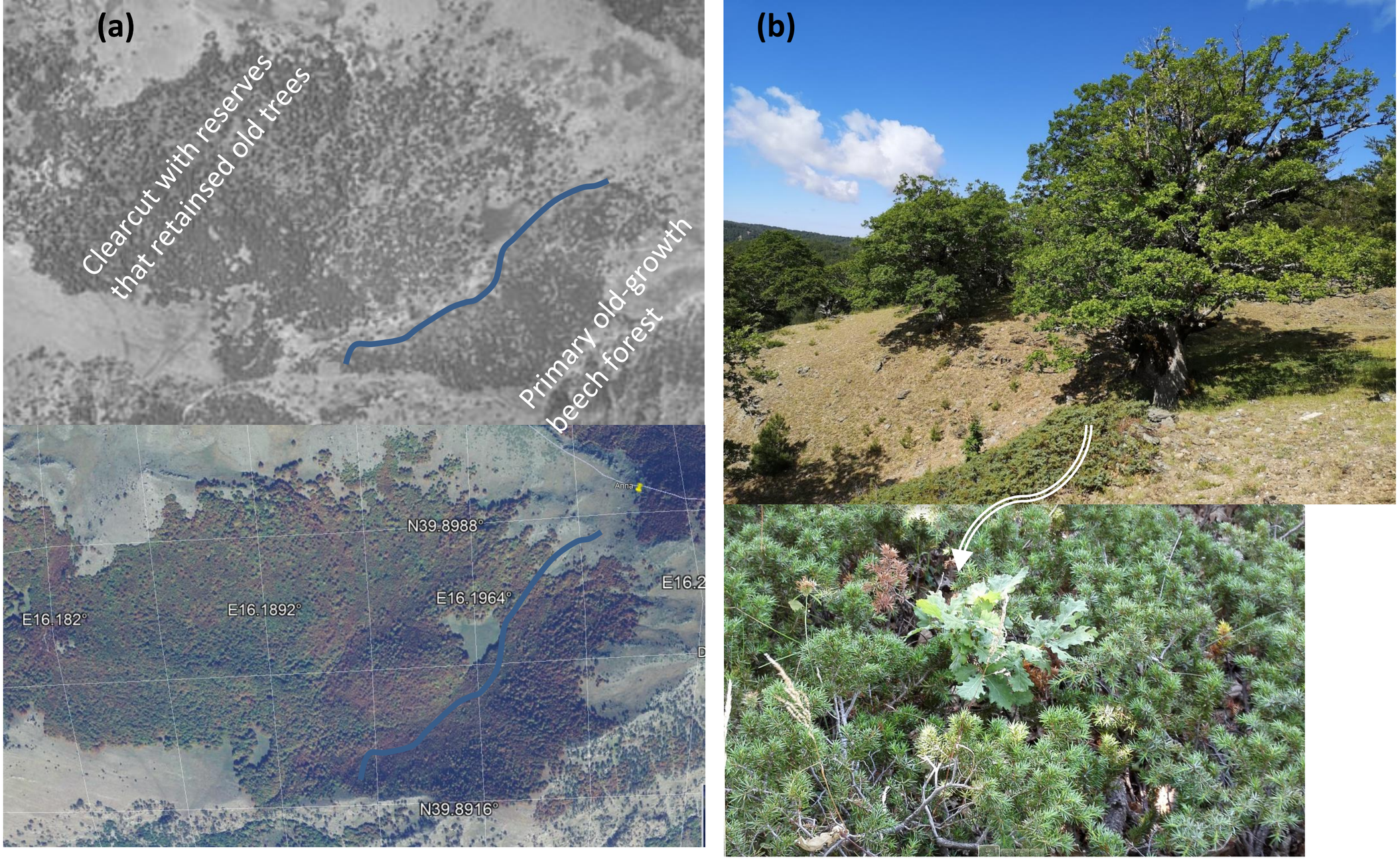
Forest development stages (from Jeschke)



Birch-oak forests, Oak-hornbeam forests, Pine-oak forests, Oak-beech forests

Most forest associations in Central Europe, described by phyto-sociology are degraded stages, or pioneer / intermediate stages of forest development.

In functional restoration programs studying of historical landscape dynamics and old-growth (OG) stands is key to describing the reference conditions associated with natural forest ecosystems. This approach can provide a benchmark to measure the impact of forest management or evaluate the effectiveness of ecological restoration.


(a)
Clearcut with reserves that retainsed old trees
Primary old-growth beech forest
N39.8988°
E16.182°
E16.1892°
E16.1964°
E16.2
N39.8916°
(b)

Wilderness

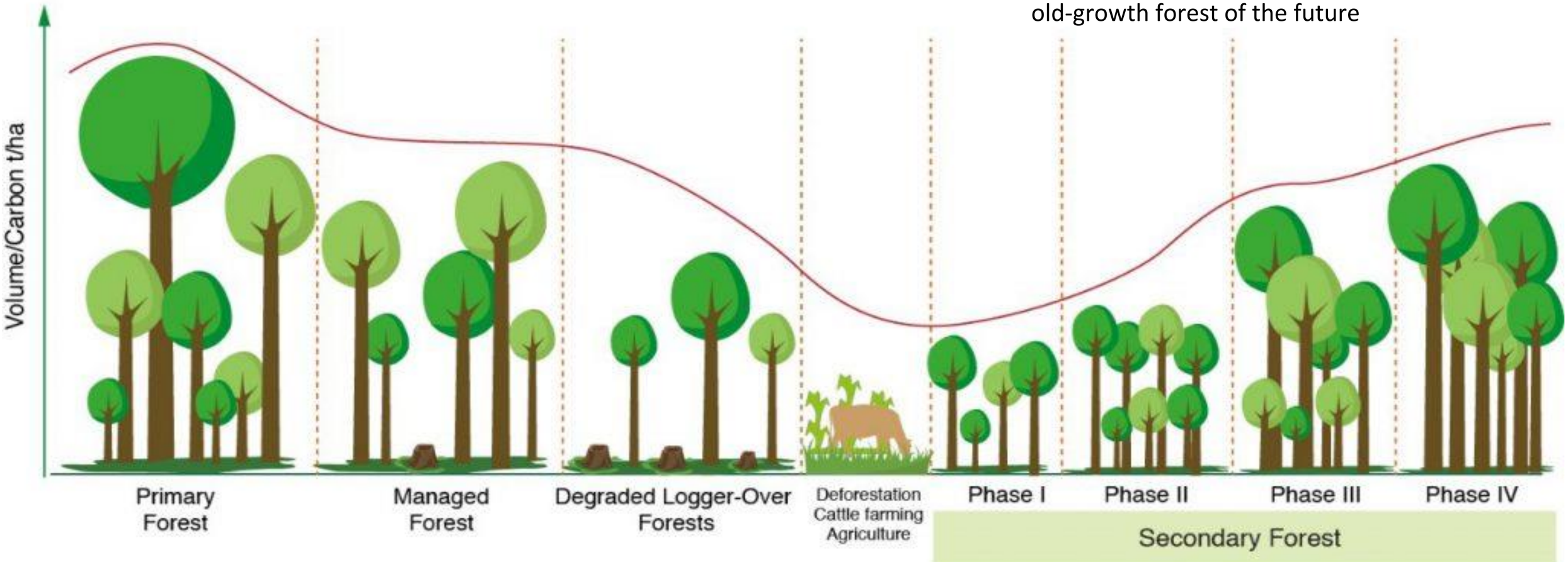
Half earth: Protect the last remnants of old-growth forests

The Forest Transition Curve

From Primary Forests to Secondary Forest

Forestry and Climate Change Fund

Half earth: **Rewilding** landscapes and the old-growth forest of the future



https://www.forestryandclimate.com/impact/the-potential-of-secondary-forests/

The old-growth status

Ecosystems characterized by old trees and the related structural attributes

(USFS, 1989)

[...]Old-growth encompasses the later stages of stand development

(Spies, *Journal of Forestry*, 2004)

Reduced/absent

human impact

Age

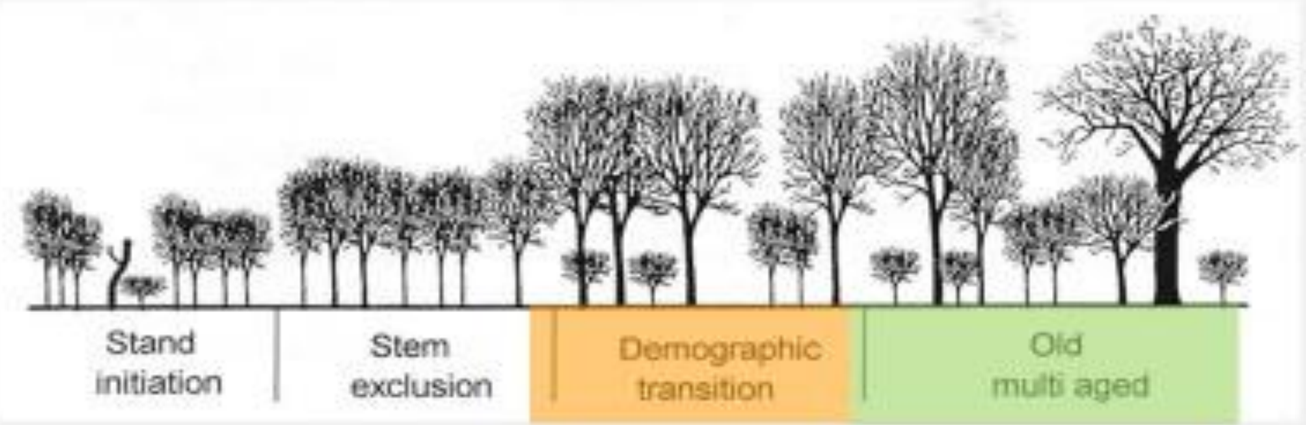
Dimensions

Senescence and Death

Dead Biomass

Increased Natural Heritage

Natural mortality of canopy trees



The 4 stages of structural development of a tree community (Frelich 2002)

OG Attributes → **Old-growthness degree**

Ecological Applications, 27(2), 2017, pp. 349–354

Moving beyond the concept of "primary forest" as a metric of forest environment quality

P. Y. Bernier,[1,6] D. Paré,[1] G. Stinson,[2] S. R. J. Bridge,[3] B. E. Kishchuk,[3] T. C. Lemprière,[4] E. Thiffault,[5] B. D. Titus,[2] and W. Vasbinder[3]

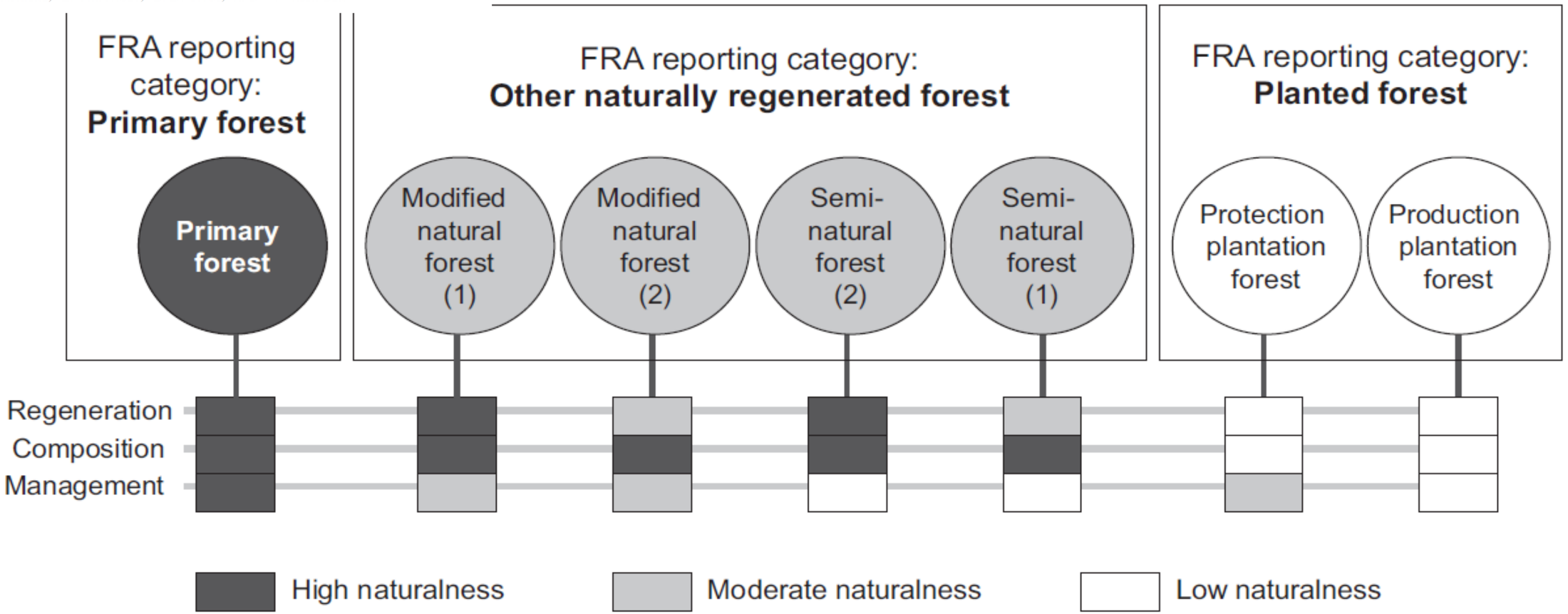
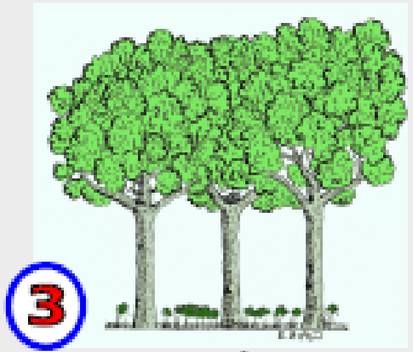


FIG. 3. Categories of forest naturalness from Carle and Holmgren (2003) (seven circles) and FRA (FAO 2012) (three boxes). The high-to-low naturalness gradient represents regeneration of the forest from natural to gap filling through assisted regeneration to fully artificial, composition of the forest from local to indigenous to exotic tree species, management of the forest from none to extensive to intensive. Moderate naturalness may be seen as moderate in a given location or as a result of a mix of intensity over a landscape.



3

2

1

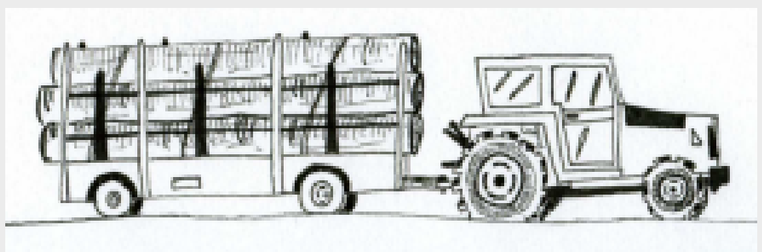
Taglio = interruzione del ciclo naturale di vita dell'albero, la specie non esprime appieno le sue potenzialità dimensionali e di longevità

Semplificazione strutturale = - biodiversità

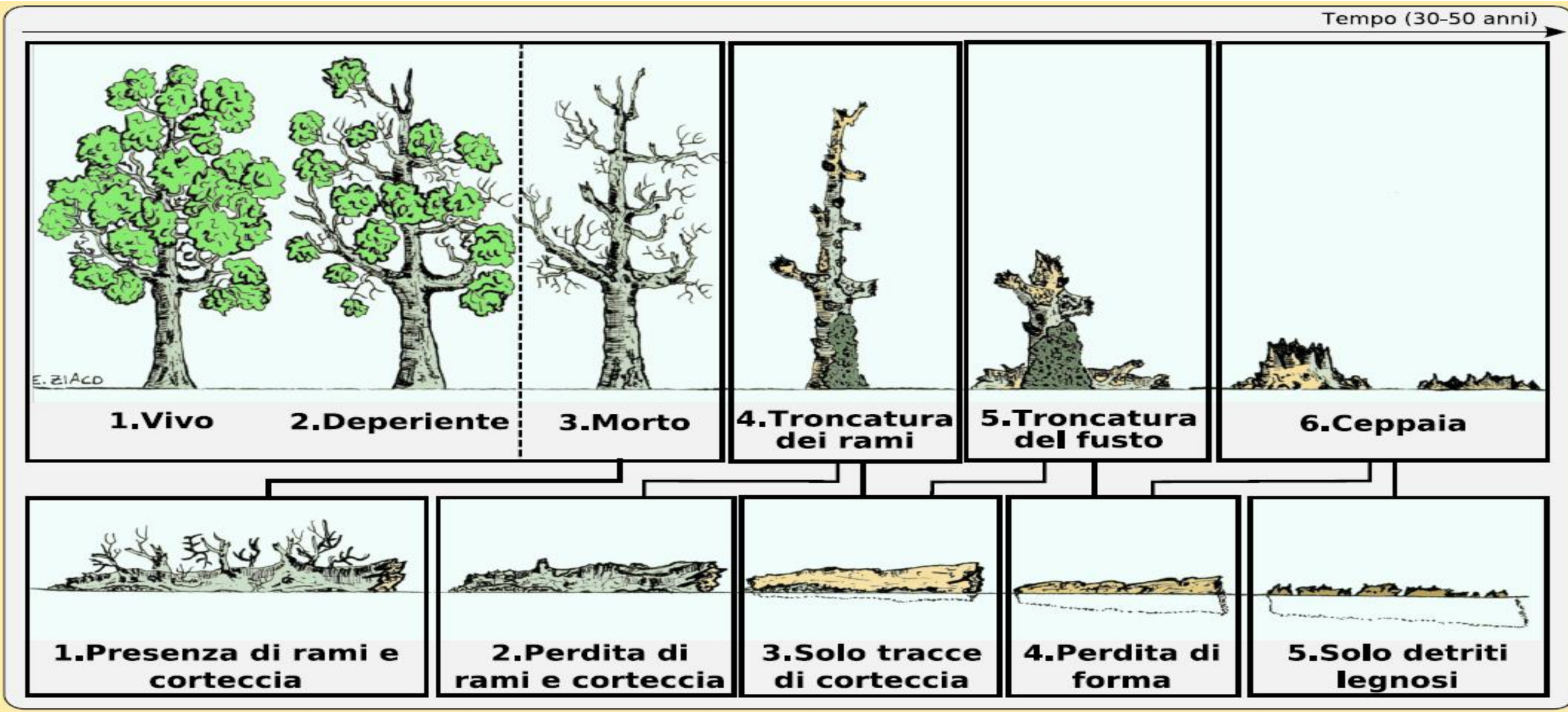
Tagli frequenti e intensi = + erosione del suolo (perdita di fertilità)

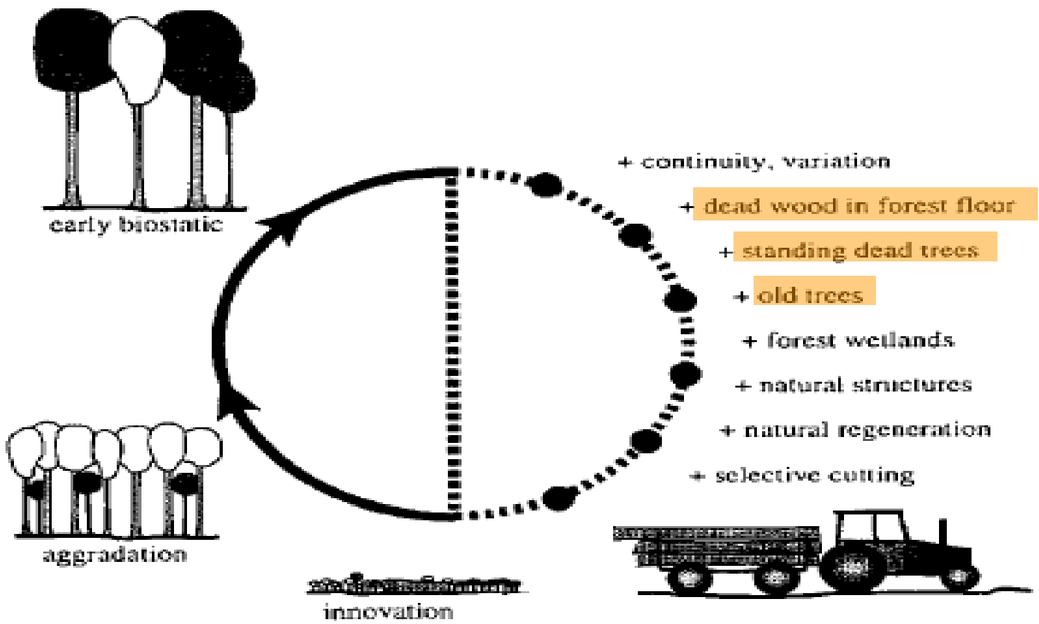
Assenza di alberi habitat = - biodiversità

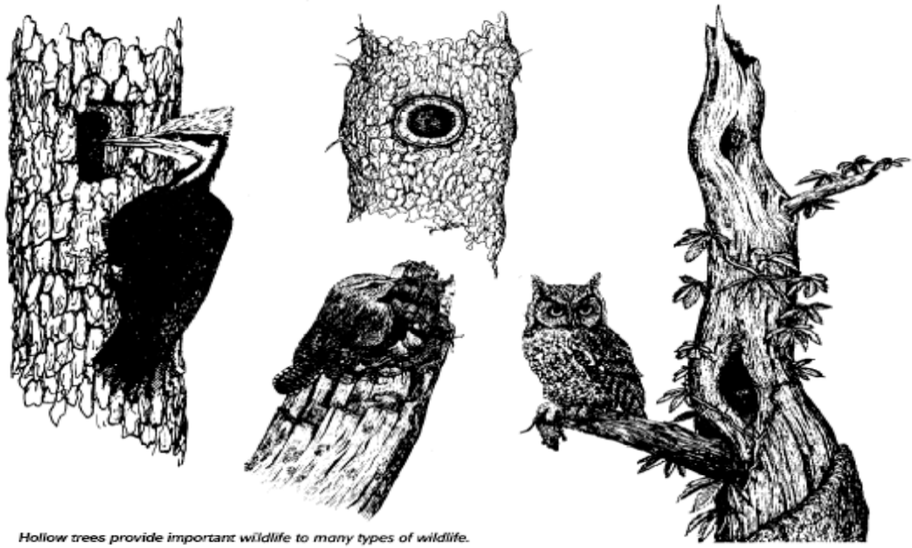
Minore necromassa = - biodiversità



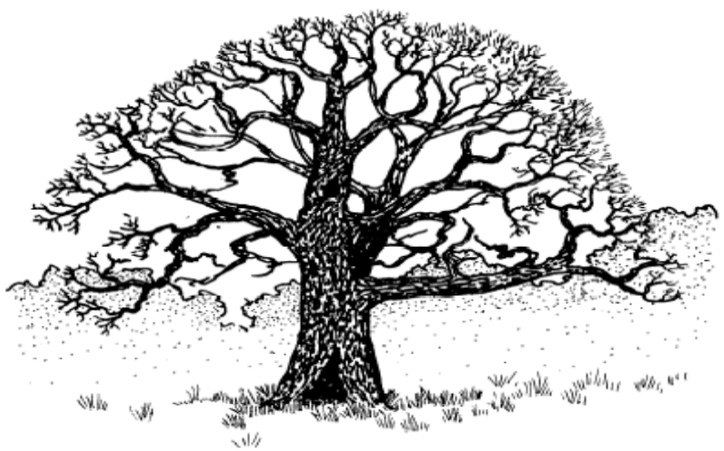
Ciclo ontogenetico degli alberi e necromassa





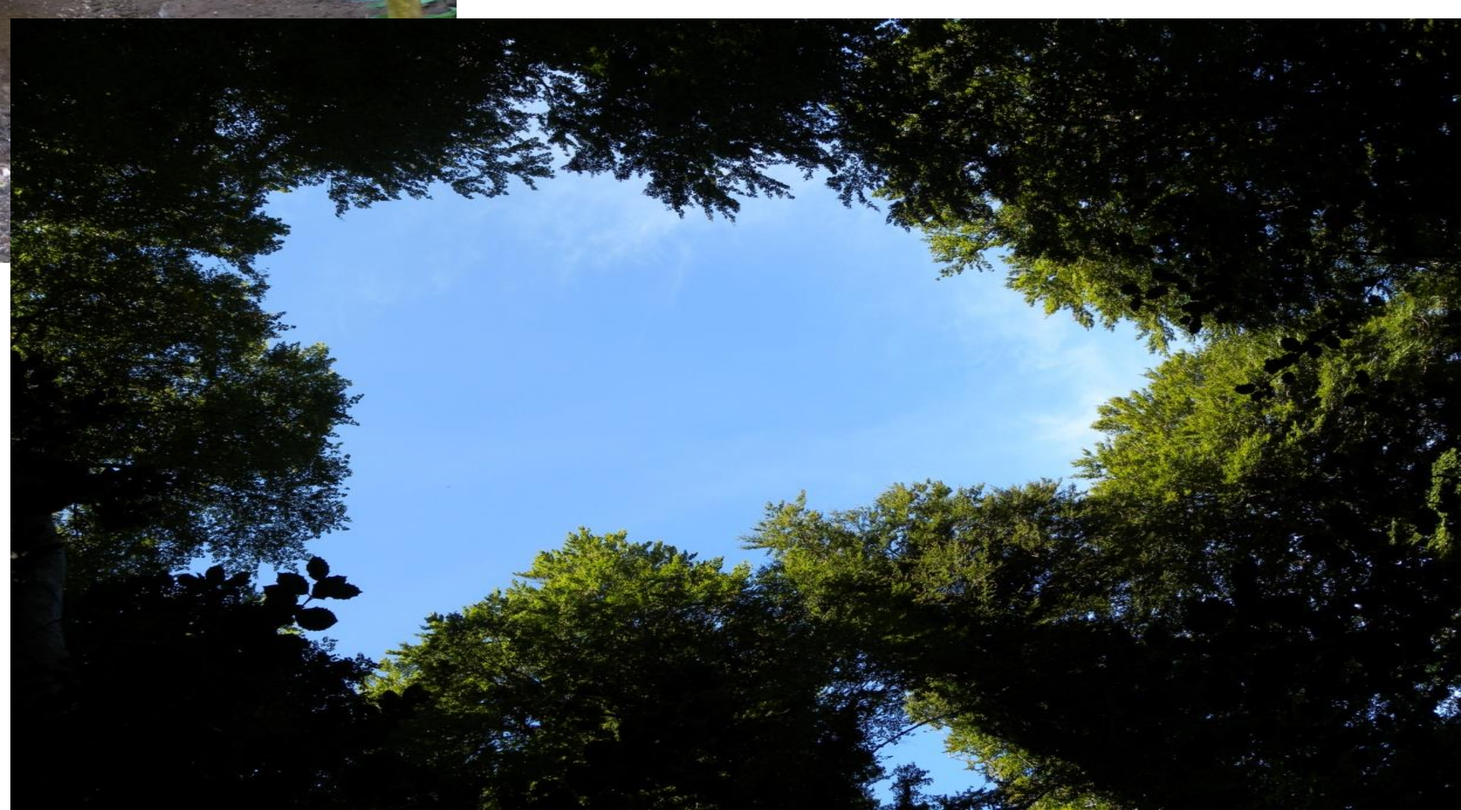


Hollow trees provide important wildlife to many types of wildlife.



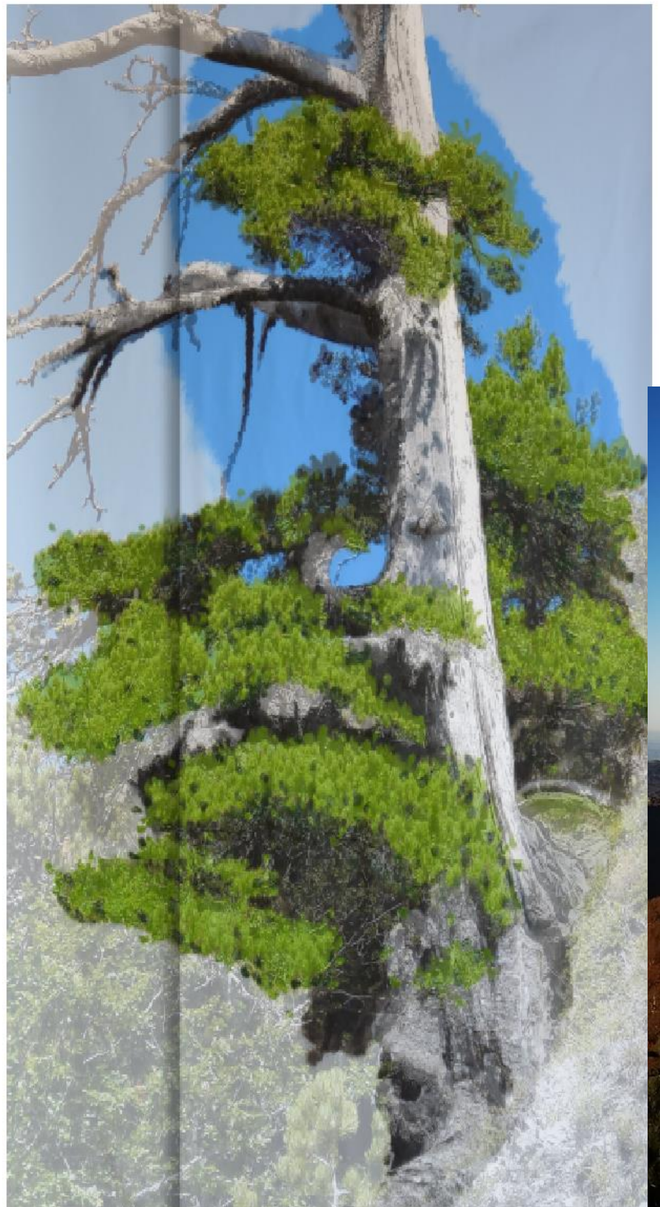
Foresta Umbra –
Gargano Italy

Ecological Integrity: Natural death of dominant trees

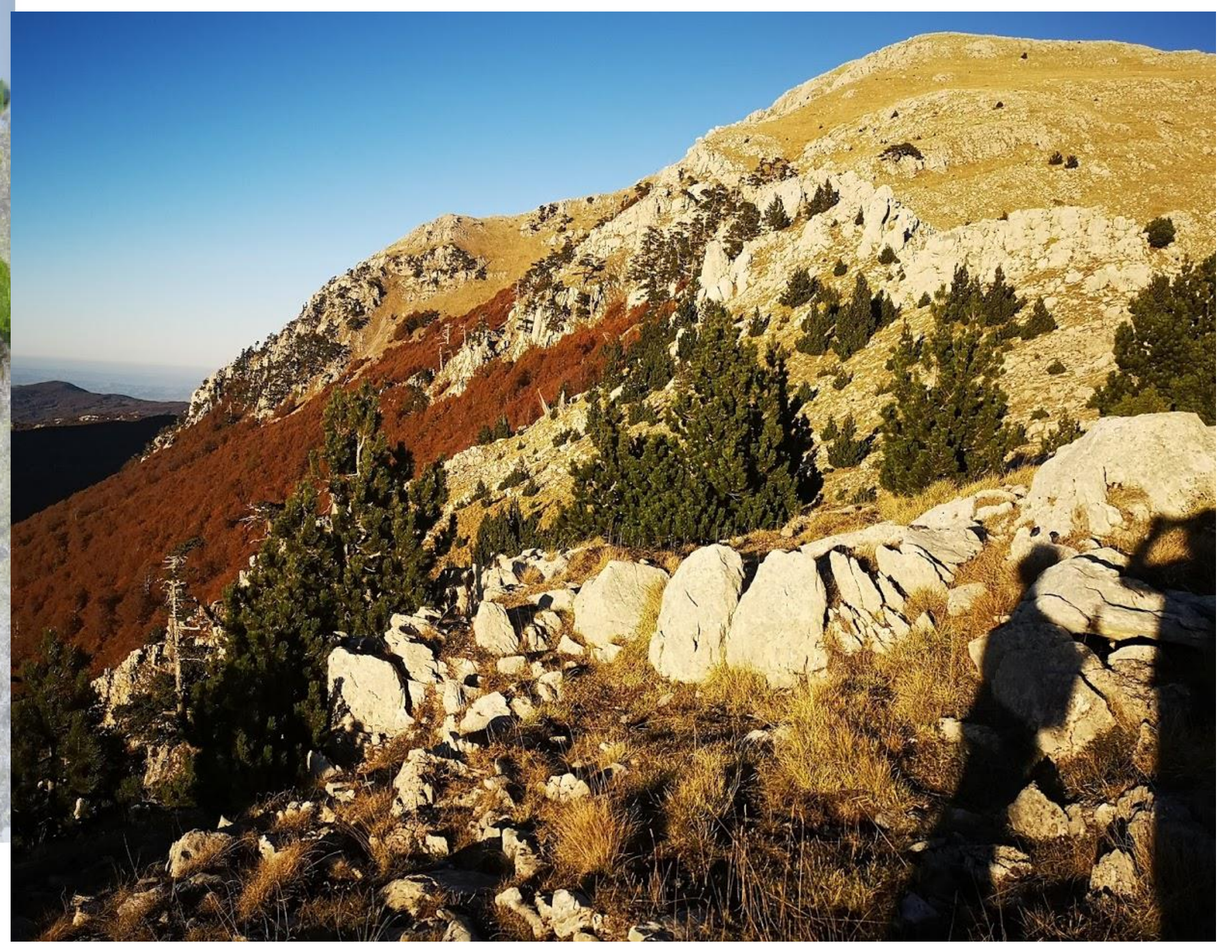


Key structural process: canopy gaps and mounds generated by physical disturbances such as storms

Le foreste vetuste, gli ecosistemi naturali dove il tempo degli alberi è stato rispettato:
loricati millenari e paesaggi del rewilding

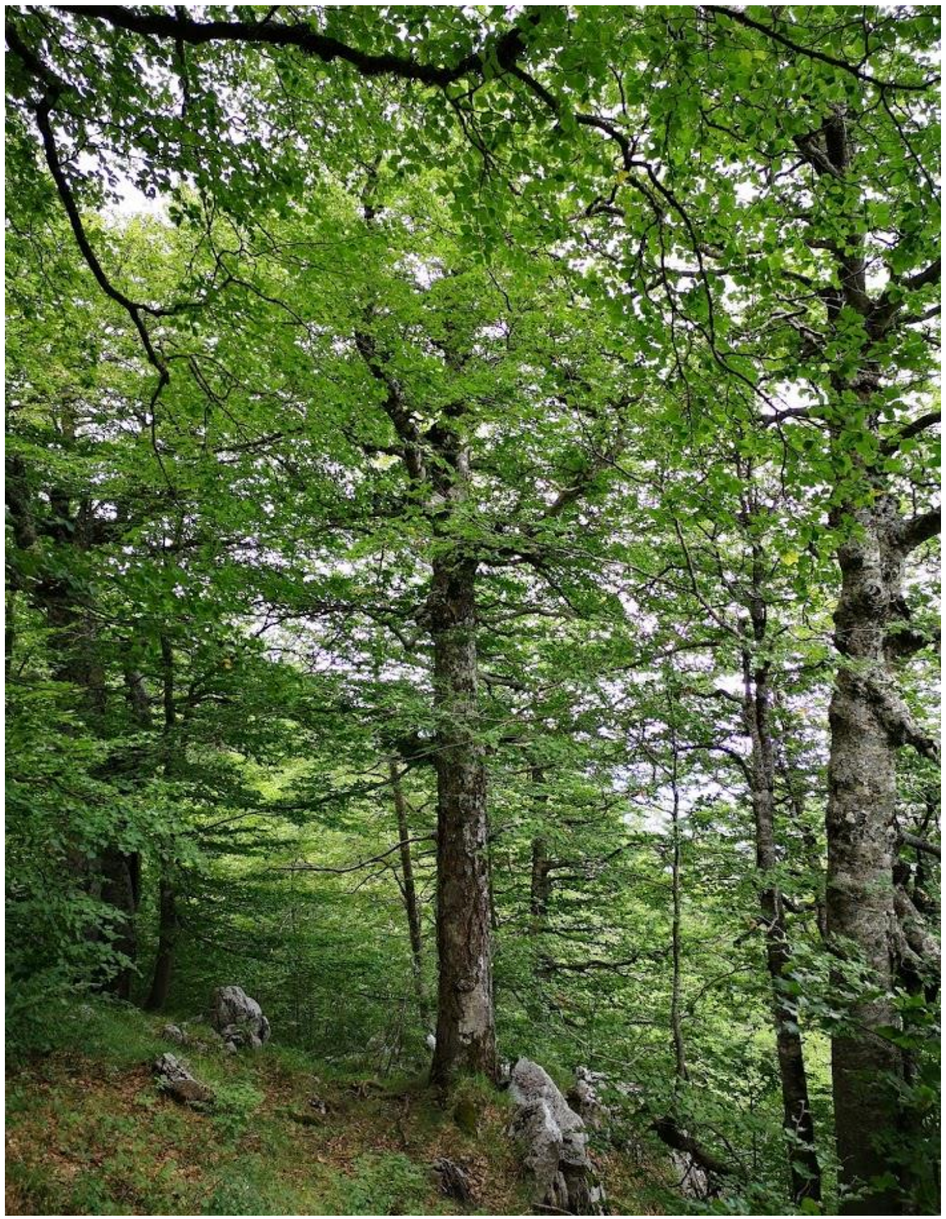


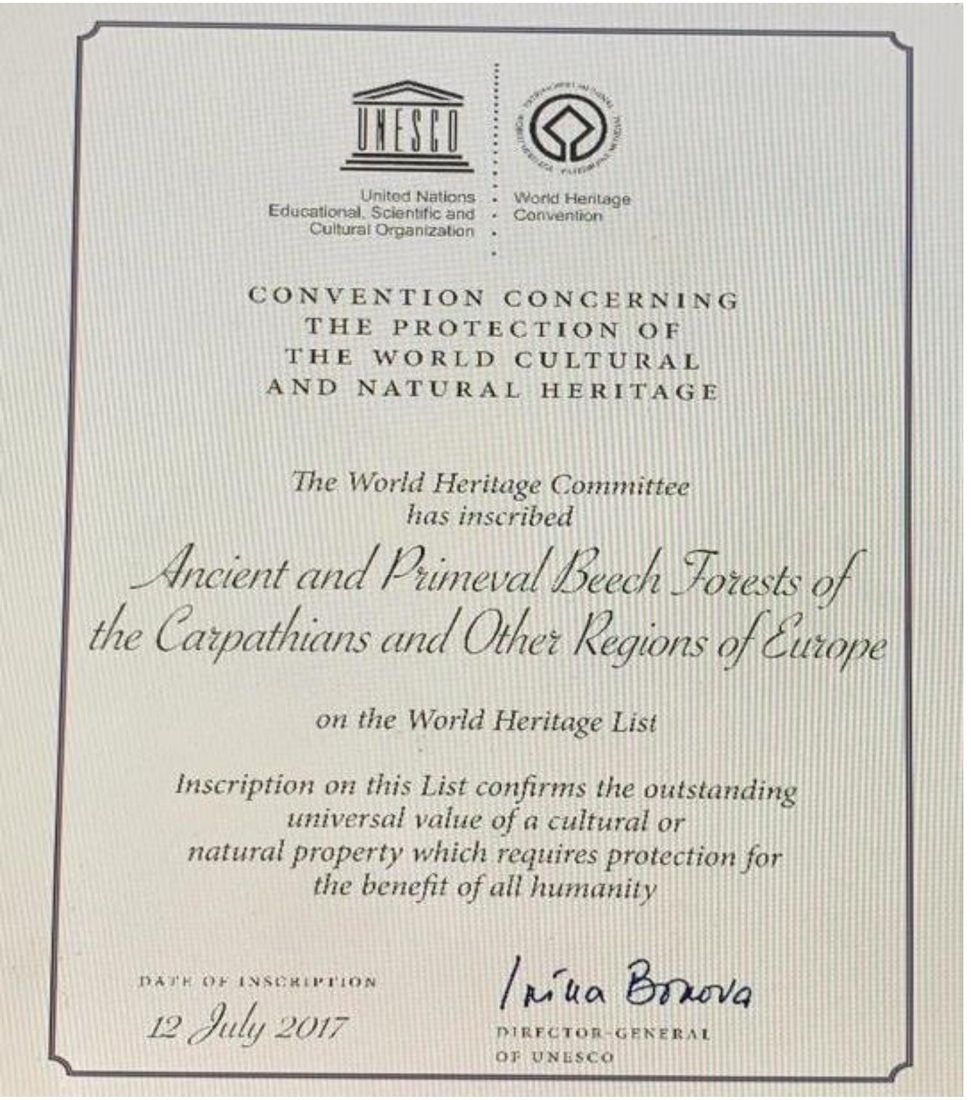
Mery Rigo, *Italus 1230*, 2019,
Elaborazione pittorica fotografica digitale FPF1, su carta patinata,
2 fogli, cm. 200x100 cadauno
(Contributo fotografico Gianluca Piovesan)
Collezione, BoCS Museum, Cosenza



Demetra, 930 anni

Michele, 622 anni



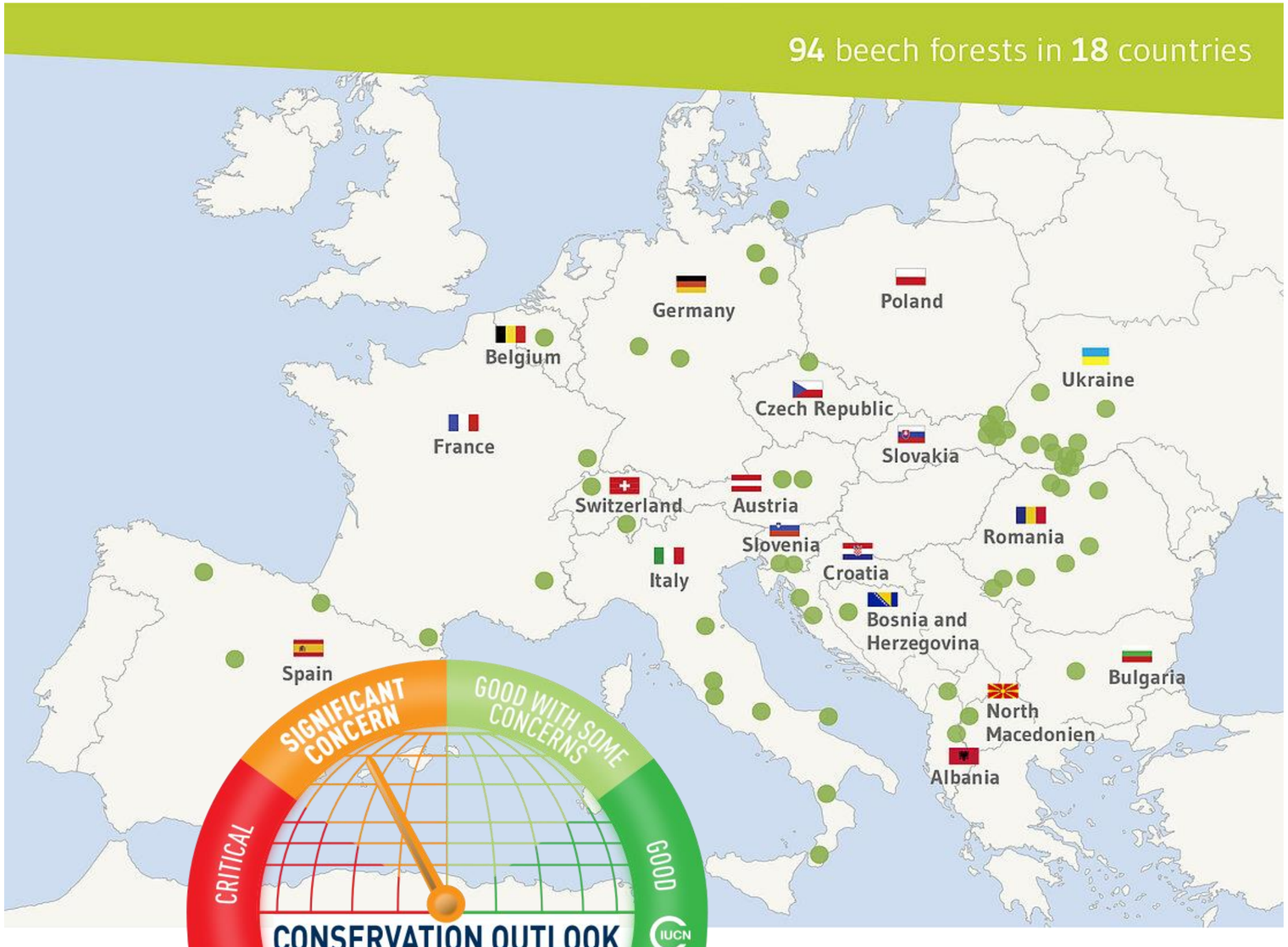


The largest serial World Heritage property gets even larger: Unesco World Heritage Series "**Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe**"

This World Heritage series is currently the largest serial World Heritage property. With 94 components part in 18 countries

https://www.europeanbeechforests.org/world-heritage-beech-forests/our-beech-forest-family

A total of 98.000 hectares of the last old-growth beech forests and primeval beech forests in Europe



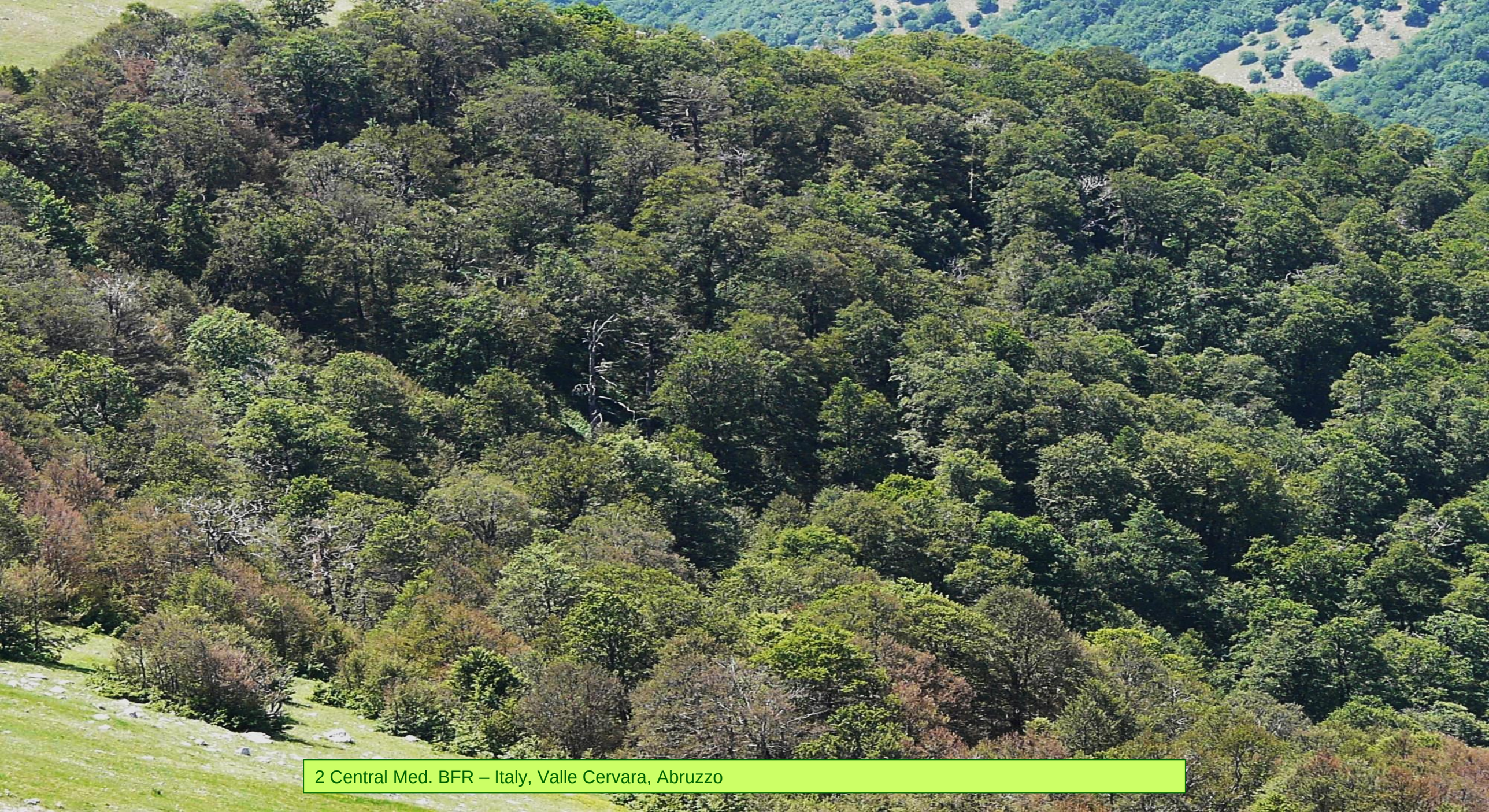
It is the only World Heritage Site globally that connects so many component parts. It covers areas in Albania, Austria, Belgium, Bosnia& Herzegovina, Bulgaria, France, Germany, Italy, Croatia, Czechia, North Macedonia, Poland, Romania, the Slovak Republic, Slovenia, Spain, Switzerland, and the Ukraine.

This requires collaboration across boundaries and illustrates the close relationship of the beech forest with European culture.

- Albania
- Austria
- Belgium
- Bosnia and Herzegovina
- Bulgaria
- Croatia
- Czechia
- France
- Germany
- Italy
- North Macedonia
- Poland
- Romania
- Slovakia
- Slovenia
- Spain
- Switzerland
- Ukraine

Date of Inscription: 2007
Significant modifications to the boundaries : 2011,2017,2021
Criteria: (ix)
Property : 98,124.96 ha
Buffer zone: 294,716.32 ha
Dossier: 1133quater

N48 54 0 E22 11 0



2 Central Med. BFR – Italy, Valle Cervara, Abruzzo

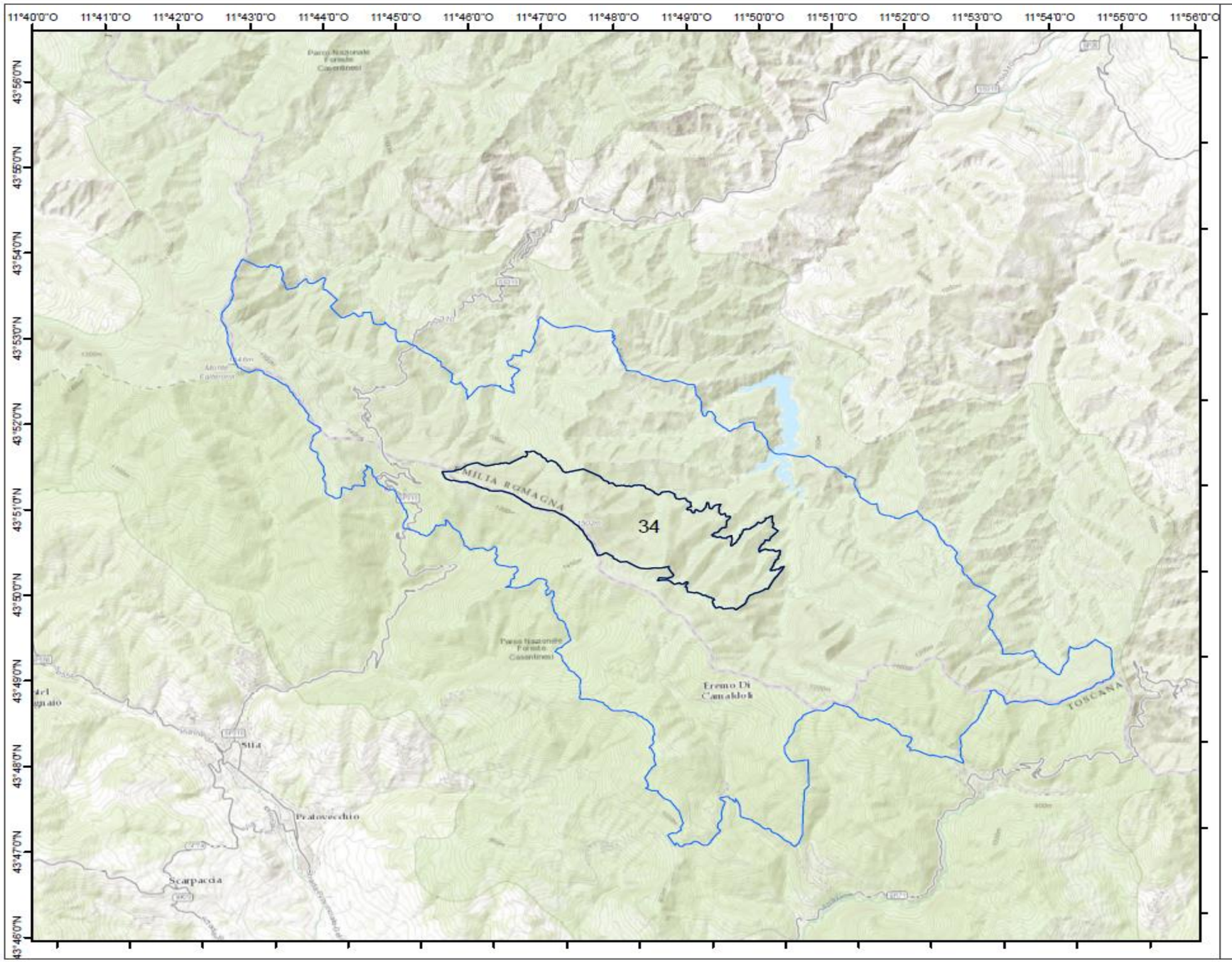
Foresta Umbra, Parco nazionale del Gargano

Large trees and *Lobaria sp.: a valid* old-growth bioindicator

Michele, 625 anni, opera di Me

Sasso Fratino, prima riserva integrale italiana
Parco nazionale Foreste Casentinesi

Faggi di oltre 500 anni



Annex 1.e.IT_SASS

Topographic map of the nominated component part(s)
Sasso Fratino
Italy
Beech Forest Region:
Central Mediterranean

Component part number(s):	034
Size of property in hectar:	781.43
Size of buffer zone in hectar:	6,936.64

Borders

World Heritage Property

Buffer Zone

Primeval Beech Forests of the Carpathians and Other Regions of Europe

Background: ESRI Topografic Baselayer
Projection: Europe Albers Equal Area Conic

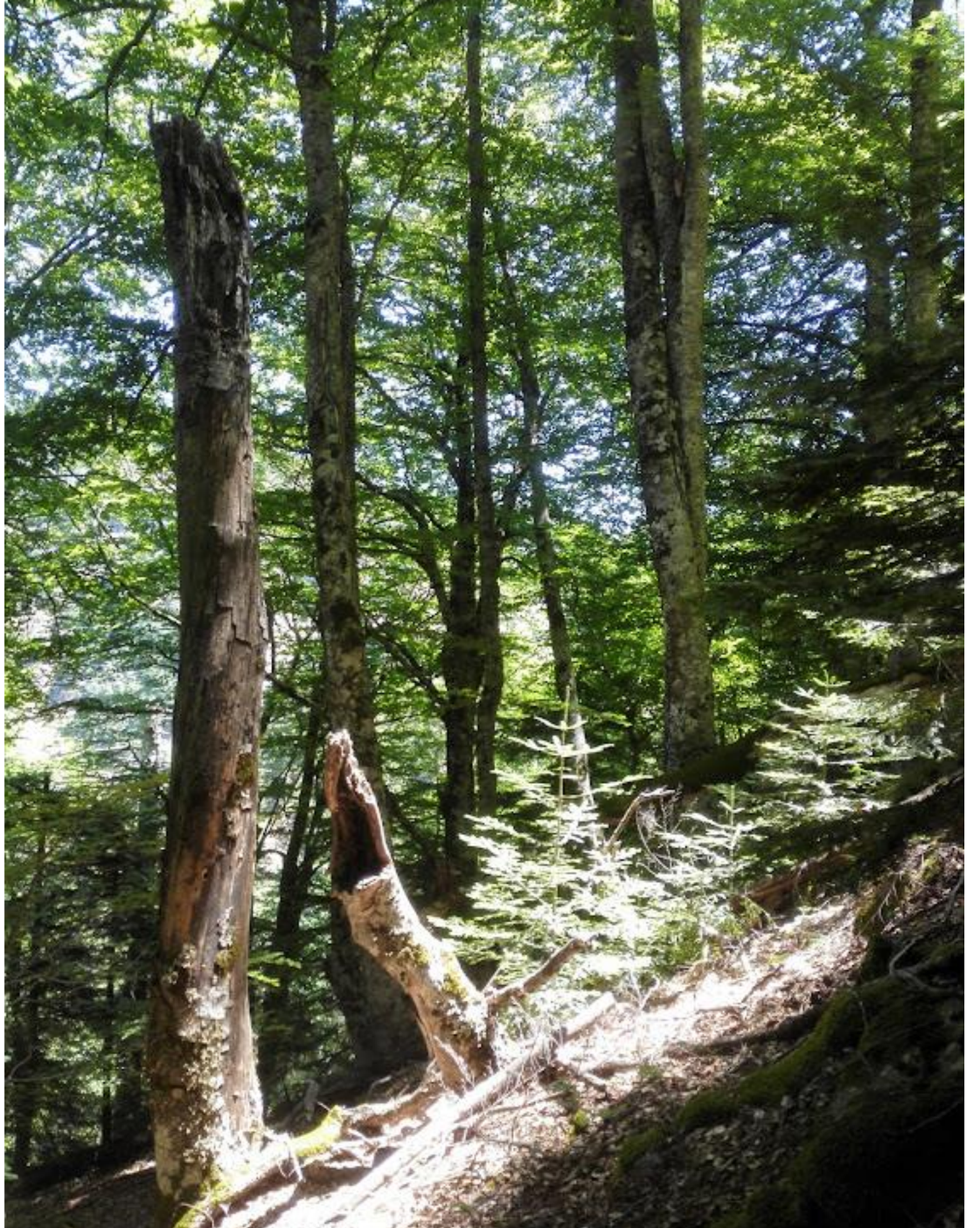
0 1 2 4 Kilometer

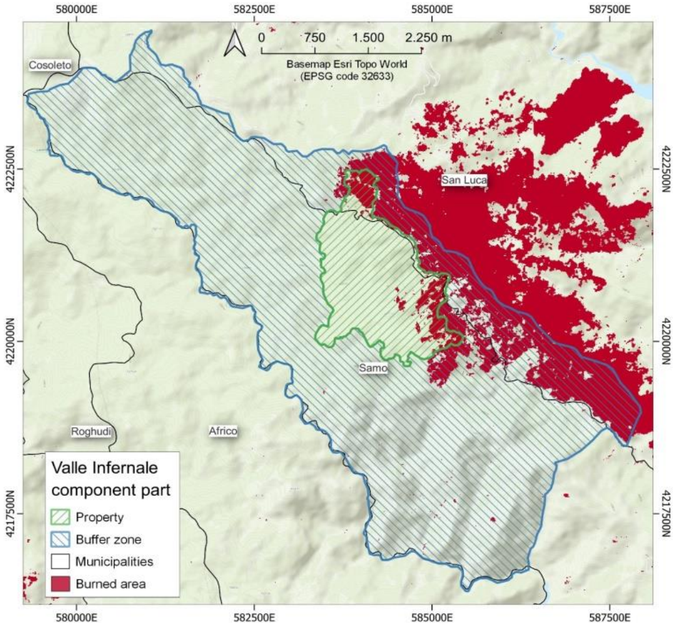
N

Scale: 1:75.000

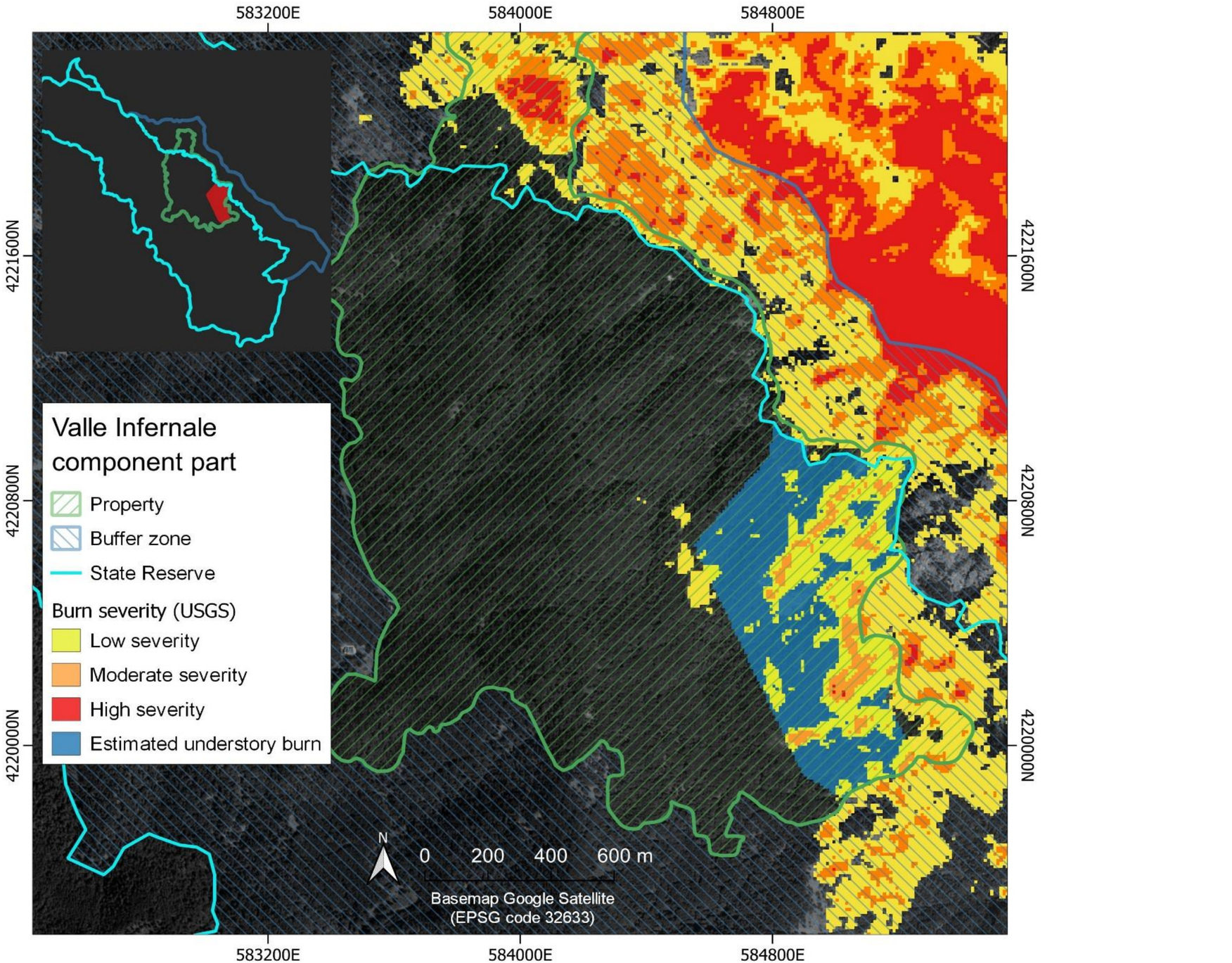
Date: 21.01.2016

Valle Infernale, Parco Nazionale di Aspromonte





Valle Infernale, Parco Nazionale dell'Aspromonte. Incendio agosto 2021 appena dopo due settimane l'iscrizione nella lista mondiale dei patrimoni naturali



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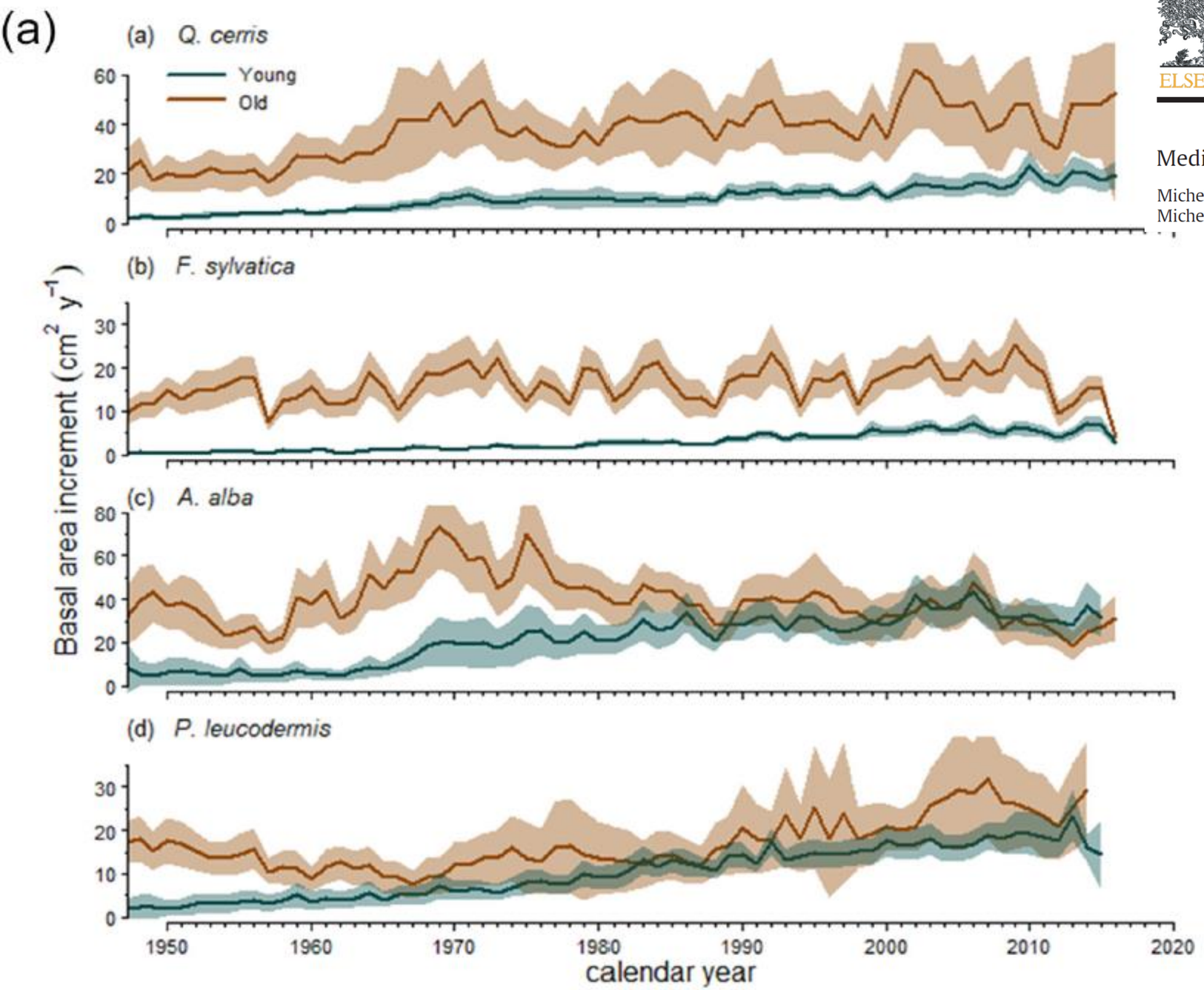
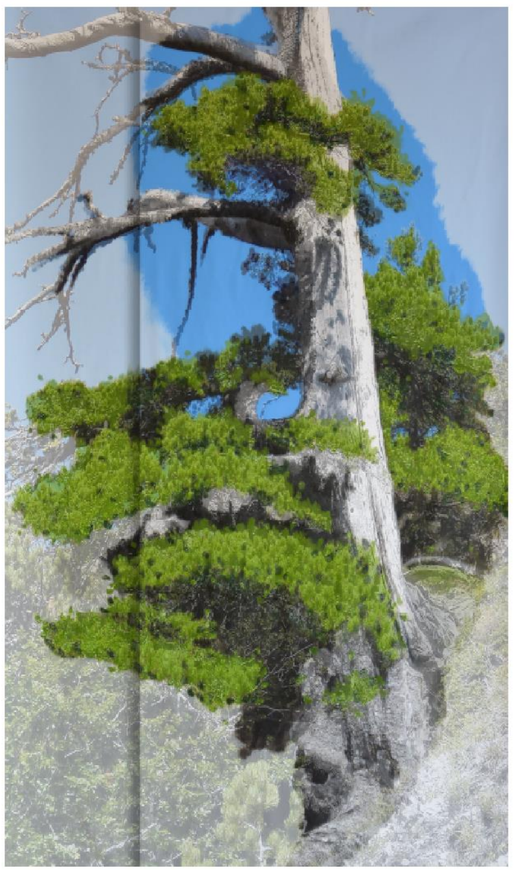
journal homepage: www.elsevier.com/locate/scitotenv

Mediterranean old-growth forests exhibit resistance to climate warming

Michele Colangelo [a,b,*], J. Julio Camarero [a], Antonio Gazol [a], Gianluca Piovesan [c], Marco Borghetti [b], Michele Baliva [c], Tiziana Gentilesca [b], Angelo Rita [b,e], Aldo Schettino [d], Francesco Ripullone [b]





Mery Rigo, *Italus 1230*, 2019,
Elaborazione pittorica fotografica digitale FPF1, su carta patinata,
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Collezione, BoCS Museum, Cosenza

Science of the Total Environment 810 (2022) 151338

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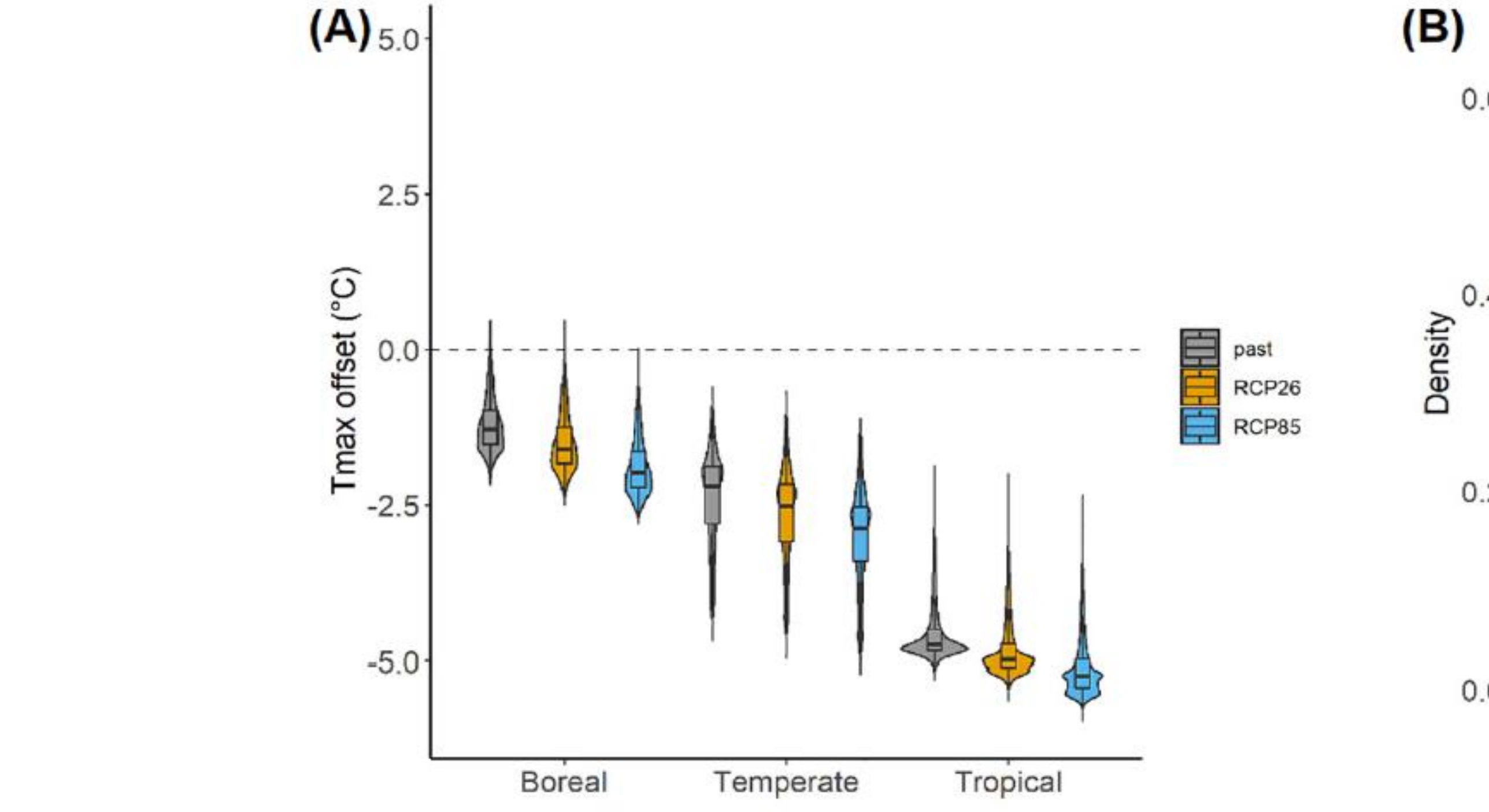
journal homepage: www.elsevier.com/locate/scitotenv

Maintaining forest cover to enhance temperature buffering under future climate change

Emiel De Lombaerde [a,*], Pieter Vangansbeke [a], Jonathan Lenoir [b], Koenraad Van Meerbeek [c], Jonas Lembrechts [d], Francisco Rodríguez-Sánchez [e], Miska Luoto [f], Brett Scheffers [g], Stef Haesen [c], Juha Aalto [h], Ditte Marie Christiansen [i], Karen De Pauw [a], Leen Depauw [a], Sanne Govaert [a], Caroline Greiser [i], Arndt Hampe [j], Kristoffer Hylander [k], David Klinges [l], Irena Koelemeijer [i], Camille Meeussen [a], Jerome Ogée [m], Pieter Sanczuk [a], Thomas Vanneste [a], Florian Zellweger [n], Lander Baeten [a], Pieter De Frenne [a]


(A)
5.0
2.5
0.0
-2.5
-5.0
Tmax offset (°C)
Boreal
Temperate
Tropical
past
RCP26
RCP85
(B)
Density

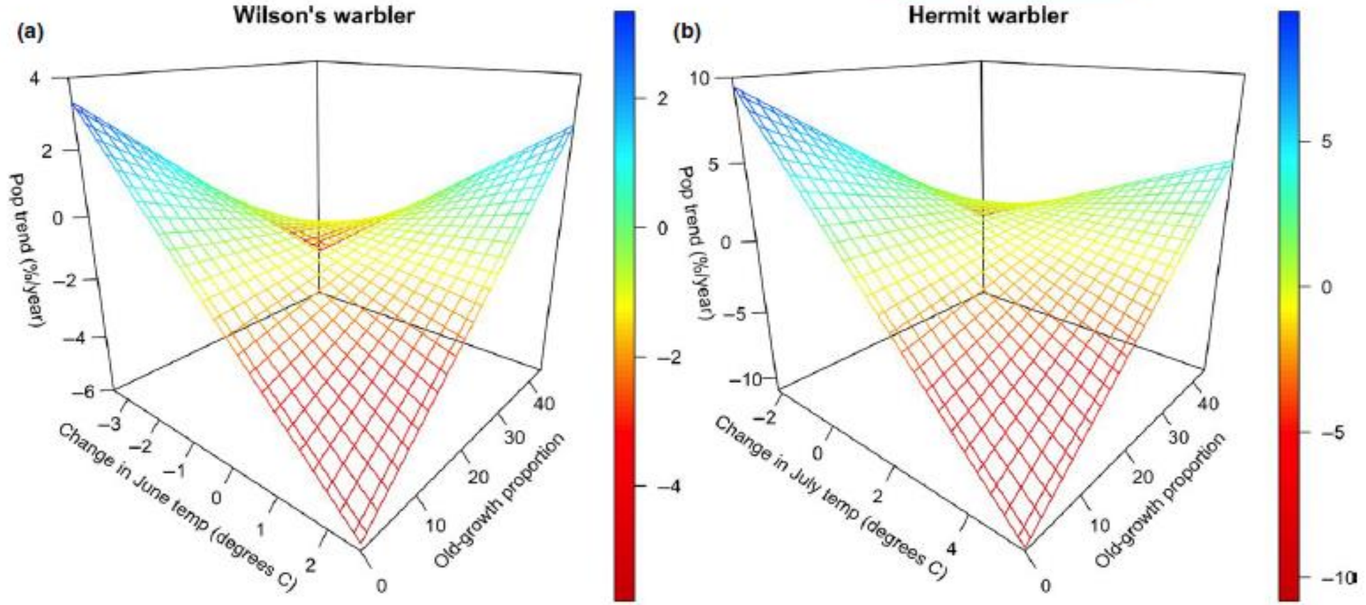
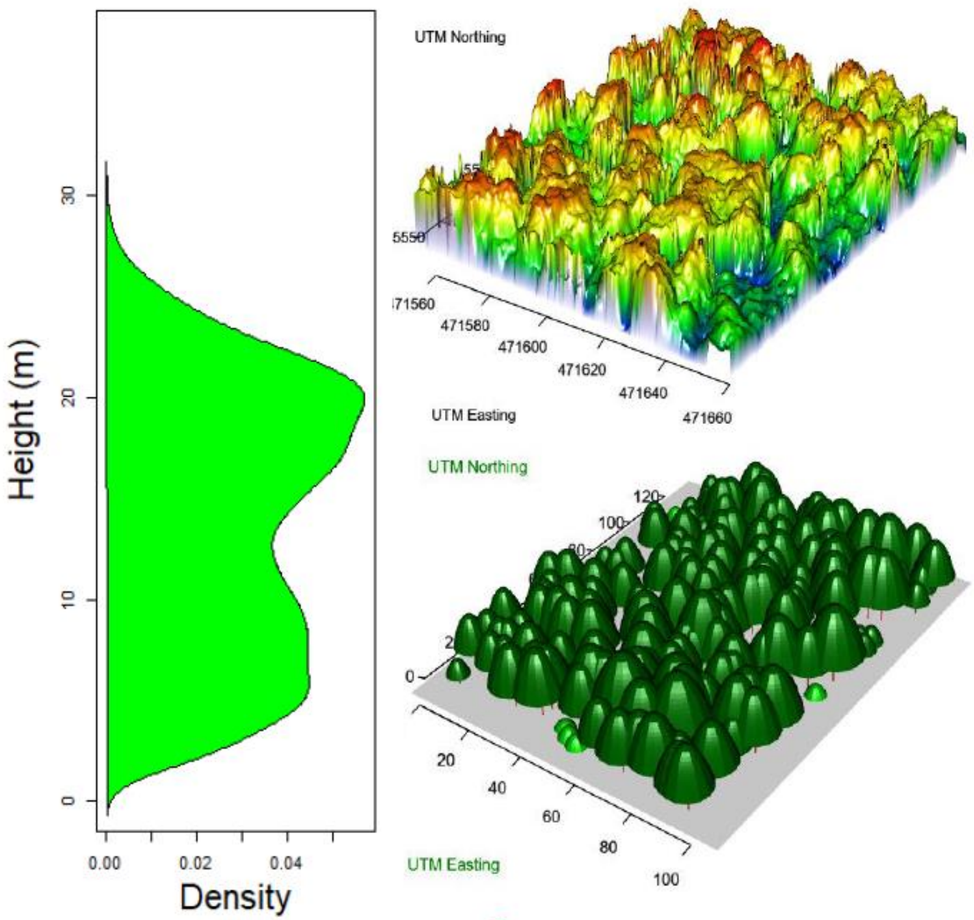


FIGURE 2 Surface plots showing fitted values of generalized linear models predicting population trends of Wilson's warbler (a, c) and hermit warbler (b, d) as a function of long-term changes in June maximum temperature (Wilson's warbler) or July maximum temperature (Hermit warbler), the amount of old-growth forest in the landscape (BBS route) and their interaction. Populations of both species tend to decline in landscapes that have warmed, but this effect is dampened or absent in landscapes with high proportions of old-growth forest. [Colour figure can be viewed at wileyonlinelibrary.com]

Betts, M. G., Phalan, B., Frey, S. J., Rousseau, J. S., & Yang, Z. (2018). **Old-growth forests buffer climate-sensitive bird populations from warming**. *Diversity and Distributions*, *24*(4), 439-447.



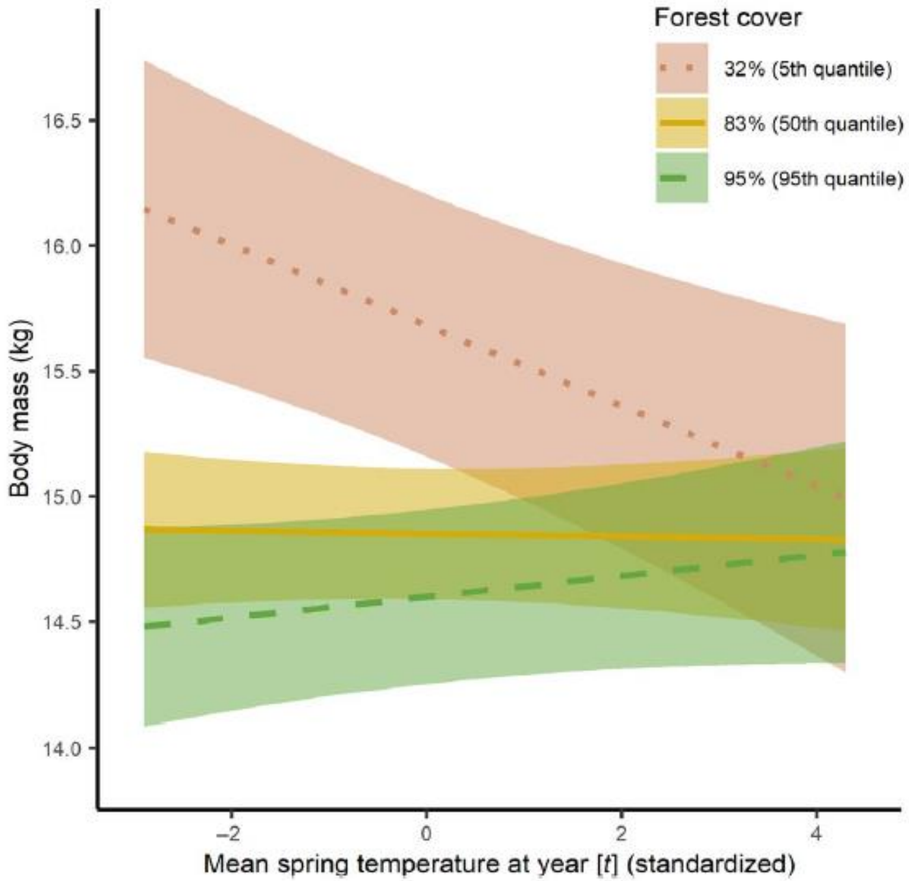


FIGURE 4 Marginal effects of the interaction between spring temperature at year [*t*] and forest cover, fitted to explain variation in yearling chamois body mass in Austria, between 1993 and 2019. The levels of forest cover correspond to the 5th (32% forest cover; red dotted line), 50th (83% forest cover; yellow solid line), and 95th (95% forest cover; green dashed line) quantiles. Shaded areas indicate 95% confidence intervals (all other terms of the model are kept at their mean values). The *x*-axis indicates the annual deviation (in °C) from the mean spring temperature for the entire study period

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Forests buffer the climate-induced decline of body mass in a mountain herbivore

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