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Ten year progress report 2011-2022. Scientific partnership FEGVE/MNHN

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Ten Year
PROGRESS
REPORT
2011-2022

SCIENTIFIC PARTNERSHIP FEGVE / MNHN



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Laurent PONCET/
Julien TOUROULT
& Catherine FOURNIL

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PatriNat is a data and expertise centre on natural patrimony. The unit is in charge of expertise missions and knowledge management on biodiversity and geodiversity under the joint authorities of the French Biodiversity Agency (OFB), the French National Museum of Natural History (MNHN) and the French National Centre for Scientific Research (CNRS).

<https://www.patrinat.fr/fr>



The Vidauban golf club foundation for the environment (FEGVE) was created by Mr Michael Hilti in 2007 and is fully dedicated to the environmental management of the natural areas over the private “Bois de Bouis” property, golf course included, in the heart of La plaine des Maures. Through its actions, the foundation actively contributes to spreading the Vidauban golf club prestige among golf industry stakeholders. <http://www.fondation-plainedes-maures-environnement.fr>

The Vidauban golf club Foundation for the environment (FEGVE) and the [French National Museum of Natural History](#) (MNHN) entered an initial five-year partnership in 2011 to characterize the biodiversity in the private property of le “Bois de Bouis”. This property of 800 ha is located in the Plaine des Maures and displays major ecological challenges. The second partnership signed in 2017 is devoted more to the golf course. The scientific and technical coordination and the management of the partnership were directed by the MNHN and PatriNat (OFB-CNRS-MNHN).

After ten years, the present brochure aims at presenting the key challenges of the collaboration, providing a synthesis of the topics explored.

This document presents some actions in connection with acquiring, structuring and promoting the data collected from inventories and naturalist monitoring. The ecological management of the golf course, the R&D actions as well as staff and wider public training and awareness-raising are also detailed.

Laurent PONCET et Julien TOUROULT Co-managers PatriNat

PatriNat is the result of the cooperation between the French National Museum of Natural History, the French Biodiversity Agency and the French National Centre for Scientific Research to develop expertise and knowledge on natural heritage. Historically involved in scientific partnerships with socio-economic actors, PatriNat develops methods that are compared with work from the field. The challenge is to give managers the skills to better take into account biodiversity for the management of their sites. Since 2011, the partnership with the FEGVE has been a driving force behind innovative work. It has led to an increased knowledge on biodiversity in a Mediterranean hotspot as well as the integration of this site into the functioning of the ecosystem of La plaine des Maures. The actions carried out over the past ten years and described in 86 reports including 5 scientific articles, have enabled to develop an inventory of the 800 hectares of the site, to experiment with alternative management, to set up scientific monitoring and to propose concrete and



Laurent PONCET Julien TOUROULT

replicable ways for other golf courses to better integrate biodiversity into course management. These results are intended to be widely disseminated and used by local managers such as the Natural Reserve. Finally, Vidauban's golf course has been a place of meetings and positive synergies with actors of the French golf industry.

« to propose concrete and replicable ways for other golf courses to better integrate biodiversity into course management »



Catherine FOURNIL

Executive Manager
Vidauban golf club Foundation for the environment

Over the last 15 years and as a unifying element between science and golfing activities, our Foundation had been perfectly in line with the international environmental strategy. Taking biodiversity into account to preserve the economy of our activity while reducing our impact on the environment is our strategy based on three mainstays : better knowledge for better preservation and sharing

knowledge with the greatest number of people. In collaboration with PatriNat, and for more than 10 years, that "d'avant-garde" strategy, has been supporting : knowledge improvement and sharing, R&D, social mobilisation around biodiversity challenges. To date, we have established a transversal reliable dialogue with territory's, departmental and regional actors, as well as with the Ministry for Sports and for Ecology.

« changing our impact on the environment to preserve our golfing economy »

THE SCIENTIFIC PARTNERSHIP BETWEEN THE FEGVE AND PATRINAT

A long-term partnership

The scientific partnership between the FEGVE and the MNHN was achieved through two research and expertise conventions. These five-year agreements were focused on the characterization of the “Bois de Bouis” biodiversity and the integration of the golf course with the local biodiversity. The first convention was signed in 2011 and the second one in 2017.

The scientific and technical coordination and management were directed by the MNHN and PatriNat (OFB-CNRS-MNHN). The general management and awareness actions were directed by the Executive Director of the FEGVE.

Such a collaboration also implies an active participation of the head greenkeeper and the biodiversity manager on the course, in direct connection with the scientific project manager and the PatriNat policy officer, both co-ordinating the convention.

A win-win partnership

For the benefit of nature and society, the MNHN has been implicated in a longstanding commitment in favour of knowledge improvement and nature conservation.

Such a commitment takes its full meaning in supporting territorial actors, such as golf facilities managers involved in an environmental strategy.

In this context, the FEGVE benefits on one side from PatriNat’s expertise in terms of public policies’ knowledge and French natural patrimony preservation. On the other side, PatriNat gets a better understanding about the targets and constraints linked to managing a golf course.

The partnership aims at federating teams around a common project - the integration of biodiversity into Vidauban golf club activities - and in particular:

- ☐ **Take the lead in innovation to inspire** the golf industry, through course management actions, established arrangements and development of tools.
- ☐ **Assess ecological challenges** over the “Bois de Bouis” property, focusing on poorly researched areas and species as indicators of the relation between the course and its environment.
- ☐ **Monitor the golf management practices** over the property and on the course itself.
- ☐ **Develop and promote** the scientific results collected during this partnership to managers, members of the golf club and a wider public.
- ☐ **Raise awareness and train** people about the site biodiversity challenges at stake.

Scarce Swallowtail
Iphiclides podalirius
(Linnaeus, 1758)
©Roquinarç'h O.



Vidauban golf course ©Gourdain Ph.

SCIENTIFIC AND TECHNICAL AWARENESS: INTERLINKED PORTRAITS

Océane ROQUINARC'H
Policy Officer
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Partnership's Unit Head
OFB/DRED/PatriNat

Stephen BYRNE
Head greenkeeper
Vidauban golf club

Didier NOVELLI
Greenkeeping team - Biodiversity manager
Vidauban golf club



« supporting greenkeeping teams, to raise awareness about biodiversity challenges at stake and build action plans with them »

Our partnership with the Vidauban golf club opens up a broad range of possibilities among which, the monitoring of anthropic activities, such as golfing, over the amazing biodiversity of the Plaine des Maures. The site is a genuine out-door laboratory! Thanks to the collected data, we can contribute to improving the knowledge, assessing the health of biodiversity and providing the greenkeeping teams with measures aiming at reducing the daily management impact on the natural habitats. Our target is to support the team in consolidating its understanding of the territorial ecological challenges, in order to build operational action plans together. Experience feedbacks are then promoted within the framework of the National plan for Biodiversity over French golf courses, a driving force behind innovations to inspire the golf industry.

« this partnership has helped us realise our key role in preserving our natural environment »

Our partnership between scientists and the golf course team is based on constructive exchanges. Beyond the studies and actions launched on the course, we have understood how paramount the preservation of our natural working environment is. The team is now aware that we are part of the overall biological diversity and as such we have a role to play to preserve the natural stability of our surroundings. We are convinced it is essential to implement concrete actions on the long term, to keep on informing and passing on values of respect about our common environment.

SCIENTIFIC COLLABORATION

TOPICS DEVELOPED

Vidauban golf course, a biodiversity laboratory

The FEGVE/PatriNat collaboration aims at **measuring the impact of the daily course management on the local biodiversity** both from a qualitative and a quantitative point of view. A specific and acute monitoring has been implemented on the very sensitive aquatic habitats. In order to preserve and reduce the impact (or the pressure) on the most remarkable and vulnerable habitats, installations and measures are proposed and implemented. Fire protection¹ recommendations are also geared to efficiently protect and respect the local biodiversity.

(voir focus 1-2-3)

Ecological challenges at stake – Partnerships with local organisations

Complementary inventories are also launched, in connection with local naturalist organisations and state services, in order to **improve the knowledge and propose provisional management practices to optimize the management**. Such works take into consideration the golf course influence on the natural surroundings and knowledge data in the perimeter of the **Natural Reserve (RNNPM²)**. An All Taxa Biodiversity Inventory (ATBI³) is under process over the whole property since 2011, focusing on poorly researched taxonomic groups.

(voir focus 1-2)

Promotion of the scientific results – Communication around biodiversity

The Vidauban golf course is a national and international showcase site for the golf industry. Club and staff members, as well as local stakeholders (associations, scientific bodies, wider public) are informed about its role in the preservation of the outstanding local biodiversity. Research and development works are equally conducted on innovative topics. **(voir focus 1-4)**

1. DFCI - Forest protection against fires - 2. RNNPM : Natural National Reserve of la Plaine des Maures <https://www.reserves-naturelles.org/plaine-des-maures>
3. ATBI : *All Taxa Biodiversity Inventory* - 4. IQE : Ecological Quality Index : Semi-standardized protocol developed by PatriNat <http://iqe.spn.mnhn.fr/>

Achievements

- ❖ Drafting of the “golf course environmental management manual” on hole n°2. An innovative manual integrating the ecological challenges on the course to the daily management
- ❖ Biodiversity assessment on the course, through high roughs’ flora and entomofauna and vegetal tests with local seeds
- ❖ Accurate mapping of humid and aquatic areas on the course (mainly small streams and temporary ponds)
- ❖ Grazing with donkeys for fire protection purposes on the golf course natural areas. Drafting of an ecological recommendations data sheet for the breeder and identification of the less-concern areas
- ❖ Embedding Vidauban golf course in the “French golf courses National study program” as an experimental site

Achievements

- ❖ Inventories campaigns - biodiversity and geodiversity monitoring on the property: flora, insects, lichen, crustacean, chiropterans, patrimonial habitats, geology (...)
- ❖ ATBI methodology over the property, focus on the taxonomic groups for which we have the least data
- ❖ Monitoring of patrimonial habitats on the course : state of conservation assessment on the habitats listed in the Habitats Directive-Fauna and Flora – Community of serapias’ lawns and temporary ponds, suggestion of action plans to reduce the impact of the daily management
- ❖ Co-supervision of a Master 2 internship – option Ecology – in a national assessment method on the Habitats Directive conservation status – Vidauban golf course as a study site
- ❖ Implementation of 3 Ecological Quality Index⁴ studies over the golf course to study the evolution of natural habitats (2012-2014-2021), and over the property as well, outside the course (2013-2014)
- ❖ Co-supervision with the RNNPM of a Master 2 internship – option Ecology – to identify the conservation challenges at stake in connection with bat communities over the property

Achievements

- ❖ Regular exchanges of information with local scientific actors, about the partnership results
- ❖ Invited speaker at the “Dialogues de Vidauban” event 2011 & 2013
- ❖ Update of the collected naturalist data and data integration into the National Inventory of the Natural Patrimony (INPN-MNHN)
- ❖ Publication in the MNHN’s journal *Naturae*, of an article about golf courses’ biodiversity « [Golf: nature-incompatible activity or ecological opportunity](#) »
- ❖ Invited speakers PatriNat-FEGVE in 2018 at the event in Paris “10 year partnerships with the MNHN”
- ❖ “Golf and Biodiversity” events organised at Vidauban golf club and publication of the seminars’ proceedings
- ❖ Elaboration of a patrimonial diagnosis : what kind of biodiversity in the natural areas of the course compared to the biodiversity outside the fence
- ❖ Co-supervision with Belfast University/AFBI of two master 2 internships – option Ecology, about the influence of course management on nematods communities. Development of new avenues taking into account the ground fauna ecology in the management of golfing areas.(topic proposed by the Vidauban golf club head-greenkeeper- Steve Byrne)

Raising awareness - Training

Training sessions, awareness-raising actions and information events were organised on site for club members and staff about biodiversity challenges.

(voir focus 4)

Achievements

- ◉ A foundation's production : « [Vidauban a biodiversity itinerary](#) » – a 55' movie fully dedicated to the 10 year-partnership FEGVE/MNHN. Projection at the Vidauban multimedia-centre in January 2020 – were attending a PatriNat and a National Natural Reserve representative in addition to the film director Mr Bertrand Mussotte - 60 local attendees
- ◉ 3 training sessions about biodiversity challenges on site for the staff
- ◉ 2019 – Head management and staff trip to Paris over a weekend. Visit of the Museum's gardens and discovery of the Museum's private collections (CSR⁵)
- ◉ Photo exhibition at the "House for Nature" – Natural National Reserve – 1 200 visitors
- ◉ Completion of two pedagogic brochures designed for Members, visitors and staff about temporary habitats on the course and entomological communities
- ◉ Support on the [website](#) species datasheets drafting

Scientific Expertise and punctual counselling

PatriNat delivers **assessments and punctual expertise** in the context of operations which could potentially impact the local biodiversity (storing areas for materials, organic green waste, green areas management, rough management, etc.)

Achievements

- ◉ Vegetal species counselling: plantation and seeding
- ◉ Photographic monitoring of the seeds' settlement on the maintenance building roof
- ◉ Guidance in the framework of the bunkers' renovation to favours and improve the landscaping and ecological integration
- ◉ Attendees at site meetings with subcontractors
- ◉ Counselling about the ecological management of harmful organisms on the course
- ◉ Counselling on the golf course green waste management (composting platforms)

5. CSR : Corporate Social Responsibility

Red-veined Darter
Sympetrum fonscolombii (Selys, 1840)
©Latour M.



Mediterranean temporary pond
and associated plant and animal communities
©Roquinarç'h O.



INVENTORIES AND NATURALISTS MONITORING DATA ACQUISITION – PROMOTION AND STRUCTURING

All Taxa Biodiversity Inventory (ATBI)

Within the framework of the partnership, **inventories have been launched over the entire property since 2012**. The identification of a maximum of species and the understanding of their relations with their living environment were targeted. Most of the Plaine des Maures species are so tiny and discreet, that it is hard to appreciate their diversity (insects in particular).

In that context, two insect collection systems called “Malaise traps” were installed on two sectors of the property, to collect insects samples. To date, **only several sites in continental France have accounted more than 2 000 insects’ species**. Over the Bois de Bouis property, more than 2 600 species across all groups were identified, ranking the site among the most well-known natural area in France.

Other inventories took place between 2013 and 2021 to explore poorly researched taxonomic groups among which : centipedes, land and fresh-water crustaceans, lichens, bryophytes as well as fresh-water algae. Additional studies were also conducted to improve the knowledge about the vascular plants and natural habitats of the site, bats communities (diversity, abundance, hunting grounds, hibernation sites, etc.) and the Hermann tortoise (*Testudo hermanni*) populations through a “Capture-Recapture” method. These studies were supplemented by a site **geodiversity study**. All in all, more than 50 experts across all groups participated in the inventory missions.

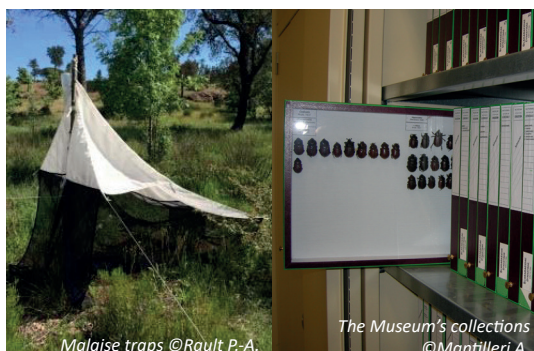
These ongoing inventories can thus be considered as absolutely outstanding!

The national study program about biodiversity on French golf courses

The French golf federation (ffgolf) has been committed since 2006 in environment awareness and preservation actions on golfing areas. Such actions were achieved through the signature of the Golf and Environment Charter and a partnership with the MNHN in 2016, drawn from the first FEGVE/MNHN convention signed in 2011. In that context, **a national study program for biodiversity** has been launched to assess, at the national scale, the biodiversity challenges at stake on golfing areas, in order to improve the knowledge, taking biodiversity and its conservation into account⁶.

The program includes a taylormade action plan for golf facilities, in order to support them in identifying, enhancing and promoting their natural patrimony. Among these actions, the ffgolf and the MNHN have developed a commitment process entitled **Golf Label for Biodiversity**. The ffgolf strategy is based on clubs’ engagement for a better knowledge of the national biodiversity and for the integration of biodiversity challenges in the French golf clubs’ development.

The Vidauban golf club joined the “Golf Program for Biodiversity” as the club leading the way and got the silver label in 2017⁷.



Malaise traps ©Rault P.-A.

The Museum's collections ©Mantilleri A.

6. Ecological transition - the ffgolf’s action plan: <https://www.ffgolf.org/Transition-ecologique/Le-plan-d-action-ffgolf/Preservation-de-la-biodiversite-la-labellisation-des-golfs>

7. Please refer to the map of the clubs involved in the programme: <https://guidegolfs.ffgolf.org/map/fr/golfs-labels-bio>

Scientific data promotion: from knowledge to action

The creation of a specific data base, born from the partnership with the FEGVE, has allowed an improved data centralisation and thus a better use of the collected data on biodiversity. Loaded into the National natural patrimony inventory (INPN), these scientific data are strongly contributing to improve knowledge of the national biodiversity.

More than **20 000 data** have been collected on the property from **3 000 species** of fauna, flora and fungus. The integration of these data into the INPN data base is under process.

The partnership with the FEGVE also includes:

- A data analysis,
- The translation of these scientific data into operational actions,
- The construction and definition of an action plan across the overall property and the golf course in particular.

In addition, a **data paper** about the studies launched between 2011-2022 as well as an article about the ATBI approach developed on the property will be published, **contributing to the valorisation and wider dissemination of the knowledge.**

KEY FIGURES:

10 years of collaboration

86 publications, valuation reports, synthesis achieved

+20 000 collected data loaded into the INPN database



The INPN is the French territory and overseas departments biodiversity and geodiversity doorway.

The structure circulates the knowledge about fauna, flora and fungus species, natural habitats, protected areas and the geological patrimony.

These overall benchmarks, approved by the experts networks, are made available for all, professional, amateurs and citizens.

This gateway is part of the Biodiversity information system and of the Natural patrimony inventory information system. It is integrated into the NatureFrance Ecosystem.

Website: <https://inpn.mnhn.fr/accueil/index>



The Natural Patrimony Inventory information system, is a partnership body aiming at creating a synergy between all stakeholders working for the production, the management, the treatment, the valorisation and spreading of geo-references about the natural patrimony inventory (Biodiversity and geodiversity).

Website: <https://sinp.naturefrance.fr/>



+ 50 experts mobilised

+ 3 000 identified species

Installation of a detector to record the ultrasound emitted by bats @Lacoeuilhe A.



MONITORING BIODIVERSITY EVALUATION METHODS AND TOOLS

The Ecological Quality Index (IQE)

The **IQE** was developed by PatriNat between 2008 and 2013. It is based on a semi-standardized diagnosis protocol about fauna and flora naturalistic challenges. Such a monitoring index allows the assessment of the biodiversity and ecological functionality of a site, for the purpose of implementing, monitoring and adapting ecological management measures.

Five IQE studies, two of which on the golf course, were conducted over the property between 2013 and 2021.

The ecological quality of the different areas investigated, the identification and location of the ecological issues and their monitoring were assessed thanks to these works, with a focus on the evolution of the golf course's natural habitats.

Actions were proposed to enhance fauna and flora hosting potentialities within the course perimeter. **Thanks to the implementation of such actions and additional voluntary measures, the hosting capacity of the golf course has greatly improved.** Among the actions that have enabled this are: a significant narrowing of the fairways (cut very short) replaced by semi-roughs and high-roughs favouring biodiversity, the implementation of nesting boxes, the partial extinction of the village lights and artificial ponds revegetation.

Hermann's Tortoise
Testudo hermanni Gmelin, 1789
©Latour M.



Monitoring of the Hermann's Tortoise populations

In Europe, the Hermann's Tortoise (*Testudo hermanni* Gmelin, 1789) is **one of the emblematic species of the Mediterranean landscape** but populations are showing a great decline. In that context, monitoring the populations of the Plaine des Maures area is vital to provide additional scientific knowledge about this species. A first study was carried out between 2007 & 2009 by the Natural History Company "Alcide d'Orbigny". Adopting their conclusions, the MNHN initiated in 2012, a major assessment about the conservation status of the populations through a **Capture-Recapture method**. Thanks to that experiment, the site was identified as essential for the Hermann Tortoise populations. The aim was to better understand the impact of the course and to propose measures in favour of this species.

As far as **the viability of the species** is concerned, considering the present level of knowledge, and despite the fact that survival parameters could not be measured, abundance estimates about the populations of the Plaine des Maures inside the golf course augured well. It would now be interesting to carry out **telemetric tracking** or « homing » operations to assess individuals' vital perimeter and finetune their use of the habitats⁸. Two points were highlighted thanks to the above-mentioned studies:

- **Clearing operations:** it has been pinpointed on the golf course that the Hermann's Tortoise favours high maquis habitats. Clearing operations aim to maintain such habitats. It is thus paramount to preferably open up habitats in mosaic, to get functional vegetal islands. In addition, and to avoid any impact on the species, it is essential to respect the period of time when it's active.
- **The base of the course fence** has been reinforced with a fine wire mesh to prevent tortoises from being trapped.

⁸ Rault P.-A., 2015. Evaluation de l'état de conservation de la Tortue d'Hermann sur la propriété du Domaine de Bouis. Bilan de trois années de suivi. Rapport MNHN-SPN, 33 p.

Mesophile serapias lawns assessment in crystalline Provence

An assessment of the “mesophile serapia lawns in crystalline Provence” was achieved on the property between 2018 and 2019. **This rare environment of European and national patrimonial interest is listed on the Habitats Directive.** It is composed of a wide floristic and faunistic diversity to be preserved. Serapia lawns mainly develop in Provence along humid zones. They cover around 150 ha over the metropolitan French territory⁹ out of which **10 ha have been estimated to be on the Bois de Bouis property.** The study launched in collaboration with the National Mediterranean Botanical Conservatory of Porquerolles (CBNMed¹⁰) has allowed, at a national scale, the implementation of a method to assess these lawns’ health status¹¹.

Following this work, **a fine mapping of the golf course river system (streams and temporary ponds included) has been carried out in order to further refine the diagnosis.** Thanks to the results of the study, a first overview of these natural habitats’ status, inside the golf course perimeter and outside the fence (over the not fenced property and within the Natural reserve sector) has been drawn up.

The communities’ response to human activities pressure, such as golfing activities (game of golf and maintenance) has been targeted.

Reflexions are conducted to **implement concrete measures to limit the enrichment of aquatic environments and avoid their ruderalisation** (delineation of areas at stake, enlargement of rough zones, relocation of fertilizers application, etc.) linked to the golfing activity.

To widely broadcast the knowledge about these exceptional natural habitats as well as their hosted species, a **pedagogic synthesis** has been produced. The assessment methodology and the initial results obtained have also been drafted.

On-line available resources:

Conservation status of community interest standing waters. Assessment methods at Natura 2000 sites scale. Assessment form. [Mistarz M. & Latour M. 2019. UMS PatriNat – AFB/CNRS/MNHN, Paris. 252 pp.](#)

KEY FIGURES:

159 Hermann’s Tortoises individuals estimated on the golf course

10 ha of the property shelter serapias lawns (that is to say 15% of the national estimated surface for this specific habitat)



Natura 2000 is a network of core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are protected in their own right. The Habitats Directive aims at getting a “favourable status of conservation” for all habitats and species of community interest. The monitoring of the conservation status is a requirement arising from the article 11 of the Habitats Directive for all habitats (listed on the annex 1) and species (listed on the annexes II, IV, and V) of community interest. For more information:

<https://inpn.mnhn.fr/programme/natura2000>

<https://ec.europa.eu/environment/nature/natura2000>

9. Data: MNHN, 2018 - 10. CBNMed: National Mediterranean Botanical Conservatory of Porquerolles <http://www.cbmed.fr/src/prez.php> - 11. Mistarz & Latour, 2019

Scarce Tonque-orchid (Serapias neglecta De Not., 1844) ©Latour M.



GOLFING AREAS ENVIRONMENTAL MANAGEMENT

Environmental management manual – “Hole by hole”

In line with the “**Property management plan**”, co-created between 2012 and 2016, management recommendations have been proposed at the golf course scale. In order to fit in order to be **operational as possible in the management of the golf course**, a “hole by hole” declination has been produced. Firstly, a comprehensive review of the course biodiversity has been drawn up in order to **highlight ecological zones at stake** which are in direct contact with playing areas and in particular temporary humid habitats and protected species. Such areas have been characterised and located and recommendations have been produced, **to limit as much as possible, the impact of management on habitats and species.**

A first version of the manual-model has been presented in 2020, with the objective of inspiring a similar approach to other French golf courses and collecting feed backs on its implementation, within the framework of the “Biodiversity Program for Golf courses”.



Donkey’s grazing for fire protection purposes

Since 2017, a donkey’s grazing program has been implemented on the natural and high roughs areas over the course to limit the risk of fires. The following objectives are targeted :

- **A contribution to the forest fire protection,**
- **An enhancement of the landscape,**
- **A de-densification of the vegetation cover,**

Different grazing areas have been identified and prospected in order to list recommendations and thus limit the impact (trampling, grazing pressure, etc.) over remarkable species and habitats. After several years of conserving a reasonable grazing pressure, habitats seem to remain in a favourable conservation status. The closing of the landscape was avoided as well as a competitive seeds colonisation (Paspale, Cynodon). The aim is to maintain relatively extensive grazing on a rotational basis preventing grazing pressure in priority areas.



High rough area with a late mowing season on the golf course ©Roquinarç'h O.



RESEARCH AND DEVELOPMENT

INNOVATIVE SUBJECTS FOR THE GOLF INDUSTRY

Local seeding tests in rough areas

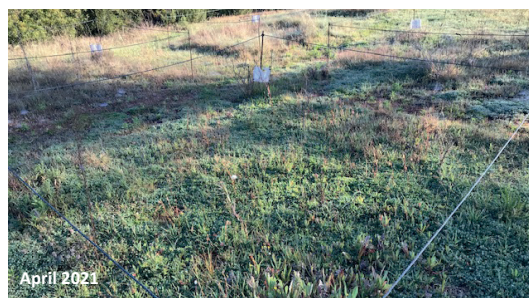
High-rough zones are currently seeded with American fescues. The seeding tests initiated since 2018 have been targeting at **enhancing the biodiversity hosting** capacity of these areas while allowing a **less demanding management** of the course specifically in terms of irrigation and pesticides use.

High rough zones located at the interface of playing areas (semi-rough, fairways) and natural areas have a paramount role to play inside the course as their specific setting display ecological challenges. Their playability depends on a sparse vegetation allowing to trace and play the golf ball and a physiognomy (or “configuration”) respecting the golf course design. We are currently facing some challenges on the Vidauban golf course in maintaining areas of high rough that meet these criteria, mainly because of Bermuda grass (*Cynodon dactylon*) varieties presence, which stems and leaves are too thick and because of the randomly thriving seeds (*Fescue grass*, *Festuca* spp.). Thus the experimentation aims at :

- **Enhancing the ecological interest** of the high rough zones,
- **Diversifying the species** to select the more resistant ones adapted to the local abiotic conditions (in comparison with the American fescues),
- **Optimizing the agronomic management** of these areas, limiting irrigation and pesticides use,

- **Safeguarding the rough areas playability** and their landscaping features (or pattern) (physiognomy, density, etc.).

Two test zones, representing 15 monitoring plots out of which 4 non-seeded control ones, have been seeded at the end of 2018 outside the rough areas, in collaboration with the National Botanical Conservatory and the ecological engineering office “Agir Ecologique”. Vegetation surveys were launched between 2019 and 2021, **to study the vegetation regrowth over the first three years**. Results indicate a good global regrowing, especially for perennial varieties. Nevertheless not all varieties are suitable for golfing activities (clover in particular). It is important to underline that a regrowing process started for some species on the 2nd or 3rd year and that the vegetation cover densification started as of the 3rd year. Following these observations, further consideration should be given to the choice of species and their location in the rough areas. Moreover it would be interesting to define an “acceptability gradient” depending on the fairways vicinity and to further analyse the rather changeable conditions of each rough to be seeded : hygrometry, daylight, ground physicochemical parameters. The objective is to share feedback at a wider scale on French golf course to encourage similar research over the French territory.



Evolution of a test zone between december 2018 and april 2021 ©Gourdain Ph.

RESEARCH AND DEVELOPMENT INNOVATIVE SUBJECTS FOR THE GOLF INDUSTRY

Geology and Ecology – Intersecting perspective and preliminary study on the natural patrimony.

The relations between living organisms and the abiotic components of nature, that is to say the landscape, the relief, the rocks, the ground (etc.) led to an innovative pathbreaking study over the site and within the partnership FEGVE-MNHN. As a matter of fact, at the MNHN, biosphere-geosphere interactions have been studied for a long time. These interactions are being studied at different scales of time and space to understand the functioning of the earth system but are barely used in the management, protection and valorisation of nature. Thanks to a strong will to combine this interdisciplinarity and make the best of the geological and ecological studies already conducted, a preliminary analytic work was initiated on the site.

Several abiotic factors are influencing the existing biodiversity located on the rocks and in particular the natural environments : the climate, the altitude, the exposure, but also the nature of geological substrates a major factor allowing natural habitats settlement.

Over the Bois de Bouis property, the first step carried out was an evaluation of the geological existing elements via field surveys at different scales : landscapes, outcroppings, rocks ages (etc.). The INPG ([National Inventory of Geological Patrimony](#)) methodology was applied. Following this evaluation an “interest patrimony note” and a “note of protection needed” were issued.

Two important sites were identified on the property : a conglomerate site and a rhyolite one. **Rhyolites are of geomorphological interest** considering the geological history of the region : the differential erosion of the softer basin has left the volcanic flows exposed which **designed the distinctive Plaine des Maures topography** and its very specific natural

habitats. **The conglomerate site is of pedagogic interest** for the wider public.

This geological study has shown the presence of rather acidic, hard and sometimes fractured rocks with little or no vegetation and growing bushes close to the crevices. It would be interesting to further investigate the growth of lichens from time to time. On the Permian conglomerates, which are rather unconsolidated rocks, the vegetation is bountiful. These preliminary observations call for a finetuning of the links between geodiversity and biodiversity.

Within the framework of this preliminary study a wide range of perspective have been identified and in-particular the consequences of this type of study on the natural patrimony surveying methods, combining these disciplines.

In terms of new ground study practices, it opens up **new perspectives connecting ecologists and geologists**. Taking the nature of the observed rocks as a starting point, new indicators could be developed. It would also be interesting to brainstorm about the interest of the geological approach to anticipate the coming ecological dynamics, in terms of sites management or natural patrimony conservation.



Typical rhyolite relief of the Plaine des Maures ©Roquinard D.

Bryophytic communities growing on rhyolites and Permian conglomerate ©Gourdain Ph.



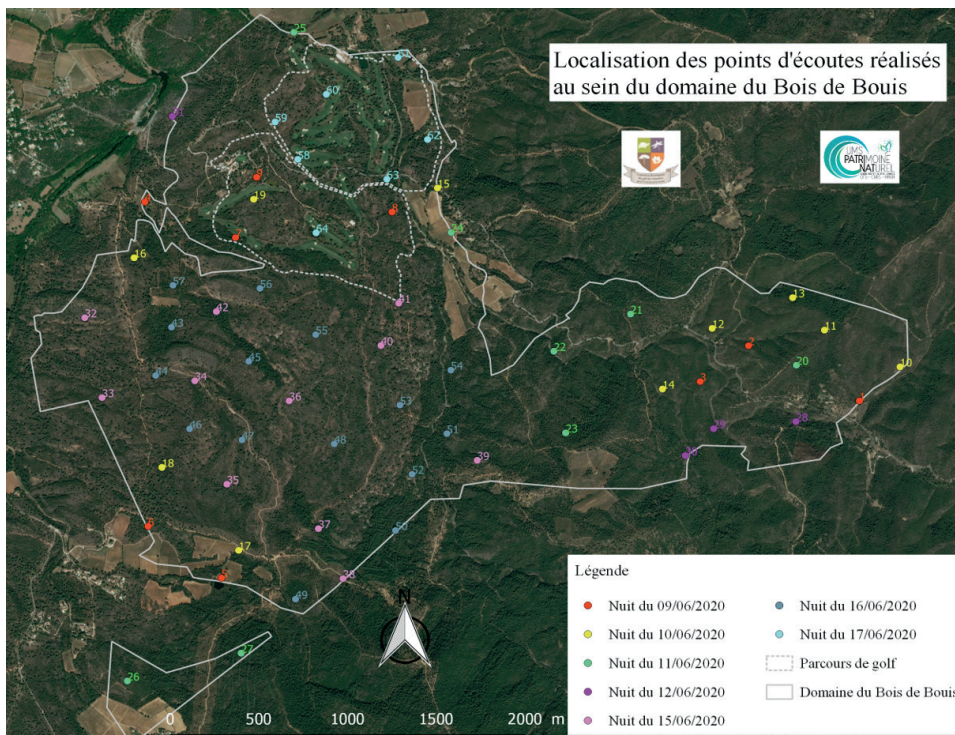
Bats communities – Conservation challenges over the Bois de Bouis property and the Natural National Reserve

In 2020, within the context of a Master 2-Option Ecology and in cooperation with the Natural National Reserve of La Plaine des Maures, a study was launched to improve the knowledge about bat species and evaluate the conservation challenges at stake on the property (golf course included).

In 2020, **more than 64 listening-posts were carried out over 7 nights using passive-sensor to record bats' ultrasounds**. The survey showed an abundant community of species and a high activity of bats on several areas of the property. **20 species have been recorded** out of which one species classified as "probable" on the 30 species found in the Provence-Alpes-Côte d'Azur region, among which 10 classified as "vulnerable" or "near-threatened" species at the national level. **Over the 16 species considered as priority species, 11 have been recorded on the property**. For the first time, the Noctule Bat, was detected during the survey : it is a new species for the National Natural Reserve. As far as the property is concerned, the activity of the species and the bats'

specific abundance are higher in the northern side, close to the golf course's water points and the open habitats. The stake is very high for the species inside the golf course perimeter, along the river l'Aille and the property's borders.

Micro-habitats, linear afforestation, water points and plants variety, creating a diversification in the vegetation structures, are paramount for bats. **The present study based on the comparison of chiropterans' data on a golf course and over a highly natural territory such as the Natural Reserve is unprecedented**. It allowed a significant improvement of the knowledge about bats' use of anthropogenic areas such as golf courses, surrounded by highly natural habitats. Recommendations were listed and in particular: the preservation of water areas, linear afforestation and riparian forests, an increase of dead or fallen timber and an enhancement of micro habitats' density and diversity. Thanks to the nocturnal activity phenology of each species at each recording point, potential shelter sites were identified. At the same time, surveys over the golf hamlet were carried out by the *Groupe Chiroptères de Provence* and common pipistrelle's breeding sites were located. Recommendations were forwarded to the golf management in order to take the species presence into account in the framework of roofs renovation works.



Localisation of the different listening-posts on the Bois de Bouis Property (PatriNat, 2020).

Bechstein's Bat
Myotis bechsteinii (Kuhl, 1817)
©Arthur L.



COMMUNICATION, AWARENESS RAISING AND TRAINING

Film production and screening “Vidauban golf course a biodiversity itinerary”

The Vidauban Foundation for the environment produced in 2019 a **55 minutes movie** « [Vidauban golf course: a biodiversity itinerary](#) » **fully dedicated to the site’s biodiversity and a feedback of the partnership.** Both accessible to the golf industry actors and the general public, the movie reviews the environmental challenges linked to the golf course location and the cooperation modalities in place between scientists and the Vidauban golf course staff. The success of such a collaboration is based on a long term collaboration, supported and steered by PatriNat and the Foundation’s Executive Officer. Valuable insights are provided about the constraints and opportunities met during these ten 10 years, through the projects achieved and the new perspectives opened that have come to light, with the outstanding participation of Mr Gilles Boeuf, Professor at Sorbonne University (Paris) and former President of the MNHN. The movie is a valuable communication tool about a trendsetter partnership, more relevant than ever before. The purpose of the film is to inspire golf industry stakeholders, to encourage French golf courses’ existing initiatives and to foster the interest and reflexion of those who would not dare to commit to improving our relationship with nature. This pedagogic movie, acclaimed by the British press (articles published in [Golf Architecture Magazine](#) and [Golf Post](#)) and rich in testimonies and concrete actions is a key to the recognition of scientific and golf industry stakeholders’ necessary commitment. Bertrand Mussotte is the independent movie director.



12. Historical collections of the Museum (Paris, France)
<https://www.mnhn.fr/fr/les-collections-historiques-du-museum>

Corporate trip to the Natural History Museum in Paris

In 2019, within the framework of its Corporate Social Responsibility strategy, the Foundation organised for members and staff, **a trip to the Natural history Museum in Paris.**

Thanks to the partnership, staff members had the great privilege to visit the Botanic Garden and the Museum’s private collections, (not accessible to the public), in the basement area of the Natural History Museum’s Grand Gallery of Evolution. Rocks and minerals, fossil, still alive or stuffed animals and plants, prehistorical, anthropological or ethnological items, make up the naturalist collections of the Natural national History Museum. All in all, **68 million of specimens are conserved and assembled in collections.** Together with the documentary, artistic and archival collections, these collections cover close to 400 years of knowledge about natural history.

This unprecedented trip, gave staff members the opportunity to better discover the partner of the Foundation : the Museum institution, allowing them to better understand the convention’s stakes and giving them a chance to become actors of the partnership.

Ophrys bécasse
Ophrys scolopax Cav., 1793
©Gourdain Ph.



Photos exhibition « Le Petit Peuple des Maures » – Natural National Reserve house

« *Sharing acquired knowledge with as many people as possible and foster awareness raising.* »

The Foundation owns a travelling exhibition which is lent to multimedia centres, schools and all places accessible to the general public. The exhibition was displayed during 4 months at the Natural National Reserve house at les Mayons. **1 200 visitors** discovered the photos taken from the Foundation's book *Le Petit Peuple des Maures*.



Photos exhibition - Natural National Reserve house ©Roquinarç'h O.

The Wildlife sounds of the Plaine des Maures

A “sound siesta” was also offered to the visitors thanks to the sound recording titled “**The wildlife sounds of the plaine des Maures**”. This first CD of the Museums' sound library collection “Remarkable natural sites” was supported by the Foundation. It is a listening initiation to the Plaine des Maures acoustic landscape, a scenery made of the geophonic (rain, wind, water, etc...), biophonic (produced by living species) and anthropophonic (produced by human activities) sounds of the place.

This CD honours, “The great plaine des Maures animal orchestra” and provides the local public with a unique opportunity to perceive nature and its surroundings, fostering audition.

Over the last 50 years, **close to 50% of natural sounds would have disappeared**. As such and thanks to this valuable CD, the endangered patrimony of the acoustic signature of the plaine des Maures, is preserved for future generations.

CHIFFRES CLEFS :

1 200 visitors discovered the exhibition « Le Petit Peuple des Maures »

87 species recorded in the Museum's sounds library

50 % of natural sounds have disappeared over the last 50 years



13. Krause B., 2013 - Le grand orchestre animal

Exchanges between PatriNat and the golf teams on the golf course ©Latour M.





Nesting box installed near the village ©Gourdain Ph.



« Golf and Biodiversity » working seminar ©Gourdain Ph.



Glaieul douteux
Gladiolus dubius Guss., 1832
©Roquinarç'h O.



Collecting lichens on the golf course ©Roquinarç'h O.



Roe deer on the golf course ©Gourdain Ph.



Collection of local seeds ©Gourdain Ph.

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THE FEGVE AND THE MNHN: A 10 YEAR SCIENTIFIC COLLABORATION

The scientific collaboration between the FEGVE and the MNHN has resulted since 2011, in two five-year Expertise and Research conventions focused on the remarkable biodiversity of the Bois de Bouis property nestled in la Plaine des Maures. The second but equally important axis studied has been the impact of the golfing activities on the existing biodiversity. **The MNHN and PatriNat (OFB-CNRS-MNHN) have ensured the steering and animation of the partnership.**

This brochure presents a synthesis of the **main collaboration topics and achievements** done by the partnership throughout the 10 year collaboration.

This partnership provided an opportunity to **improve and enhance the scientific knowledge**, to implement **environmental management practices** adapted to golf activities and communication and awareness raising actions around biodiversity.

It has also enabled a **collaboration with local scientific stakeholders** around the knowledge and preservation of the Bois de Bouis outstanding biodiversity.

Up until now, several **perspectives** were identified and in particular: the integration of experiments on seedlings of local origin into a wider network of sites, ongoing inventories on rather unknown species and experience sharing on enhancements and management actions implemented in the golfing community and local clubs.

