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The Prodrome of French vegetation: a national synsystem for phytosociological knowledge and management issues

F. Bioret[1], V. Gaudillat[2] & J.-M. Royer[3]
[1]EA 2219 Géoarchitecture, Université de Bretagne Occidentale, Brest, France.
[2]Service du patrimoine naturel, Muséum national d'Histoire naturelle, Paris, France.
[3]Société française de phytosociologie, 42 bis rue Mareschal, 52000 Chaumont, France.

Abstract
The Prodrome of French vegetation is presented from its beginnings in 1996 to the publication in 2004 of the first version of the national synsystem detailed up to the level of suballiance (PVF1). Work began in 2006 to produce a second edition, called PVF2, which aims to describe 74 of the 76 classes recorded in mainland France and Corsica, up to the level of association and subassociation. So far, 15 classes have been published, 5 classes are ready for publication and 60 classes are under preparation. The PVF2 should be finished in 2015.

Key words: Prodrome of French vegetation, France, phytosociology.

Historical context

A few initiatives have been dedicated to the elaboration of synsystems at the international level. Such projects were proposed under the term "Prodrome" which comes from the medical literature where it means the preliminary signs of a disease. It has been borrowed by phytosociologists for preliminary work towards the elaboration of a detailed synsystem (Géhu, 2006).

In 1933, began a first European project developed under the umbrella of the International Committee of the phytosociological Prodrome, coordinated by Josias Braun-Blanquet. This project stopped rapidly after the description of a small number of classes.

In 1973, Reinhold Tüxen started a new project entitled "Prodromus der europäischen Pflanzengesellschaften" (Prodrome of the European plant communities), under the aegis of the International Association of Phytosociology. The first volume was dedicated to the *Spartinetea* class (Beeftink & Géhu, 1973). By 1981, R. Tüxen edited only 4 volumes.

At the regional scale, Braun-Blanquet, Roussine & Nègre published in 1952 the Prodrome of plant communities of Mediterranean France (Braun-Blanquet, Roussine & Nègre, 1952).

The 26th phytosociological Colloquium of the Amicale internationale de phytosociologie, entitled "*Données pour un prodrome des végétations de France*" was organized in 1996 in Orsay (France) by Prof. A. Lacoste and Prof. J.-M. Géhu. One of the recommendations from this meeting was to produce a Prodrome of French vegetation, in order to provide a national reference classification for vegetation following the principles of sigmatist phytosociology (Lacoste & Géhu, 2005).

The Prodrome of French vegetation: PVF1 (1996-2004)

A group of 12 French phytosociologists started to work in 1996: its aim was to build up and validate a Prodrome of French vegetation. After its creation in 2002, the Société française de phytosociologie (SFP) became logically the leader of this programme up to its publication in 2004. Facing the huge amount of work and in order not to delay too much the final issue, the authors decided to describe the synsystem only up to the level of alliance and suballiance.

During numerous working sessions dedicated to the description of 76 classes the crucial question of the syntaxonomical validation of the units became apparent. An important work of identification of valid names of syntaxa was undertaken by Vincent Boullet (Conservatoire botanique national de Bailleul), giving a scientific backing for positioning the Prodrome as a first scientific national reference classification of French vegetation organized according to the sigmatist approach.

The *Prodrome des végétations de France* (Bardat *et al.*,2004) (Figure 1) presents 76 classes, 142 orders, 7 suborders, 371 alliances, and 116 suballiances. It was conceived as a first step (PVF1) towards further more detailed work up to the level of association. It was first

Corresponding author: Frédéric Bioret. *EA 2219 Géoarchitecture, Université de Bretagne Occidentale, Brest, FR-29200, France; e-mail: frederic.bioret@univ-brest.fr*

used as a national reference classification within the frame of the European Union Habitats Directive, for the French *Cahiers d'habitats*, particularly for identifying the correspondences between syntaxa and natural and semi-natural habitats listed on Annex I of the Directive (Bensettiti *et al*., 2001-2005). The main criticisms from the French phytosociological community and from site managers concerned i) the absence of characteristic species for each syntaxonomic unit, ii) the absence of determination keys, iii) the synsystem stopped at the suballiance level.

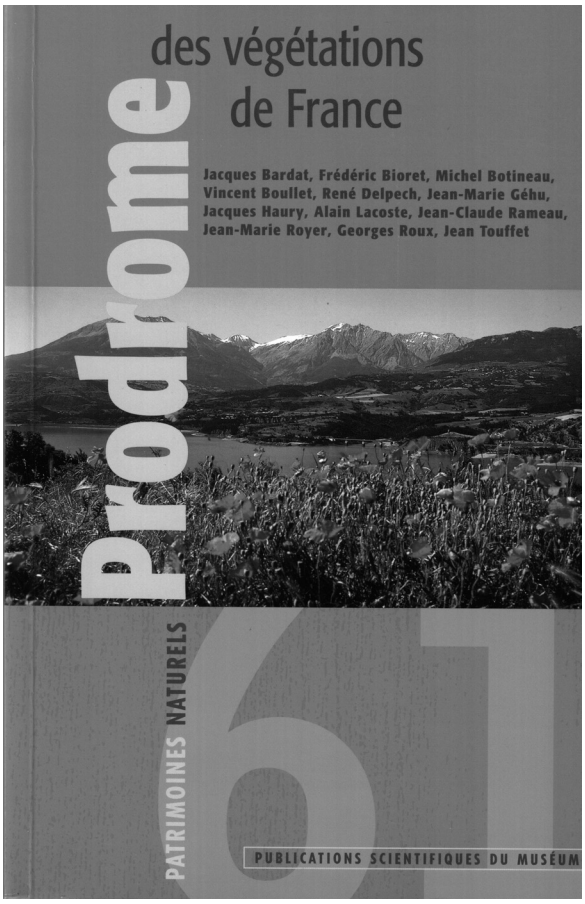

Fig. 1 - Prodrome des végétations de France (2004).

The current Prodrome of French vegetation: PVF2 project

The current project "Prodrome des végétations de France 2" (PVF2), aims to complete the preliminary work (Bioret & Royer, 2009). Initiated in 2006 by the SFP, it addresses several objectives: i) complete the description of the synsystem up to plant associations and subassociations, ii) facilitate the identification of syntaxa, iii) propose correspondences with European classifications of natural and semi-natural habitats (CORINE Biotopes, Annex I, EUNIS). This project is coordinated by the SFP, in partnership with the Muséum national d'Histoire naturelle de Paris and realized with phytosociologists from the Conservatoires botaniques nationaux, AgroParis Tech Nancy and the Office national des forêts.

The work is organized class by class. Each class is under the responsibility of a national coordinator, who can aggregate national and regional skills. For the higher units (class, order, alliance, suballiance), a short description accompanied by a list of diagnostic species is given. For each plant association, the following fields are completed (Table 1):

- valid complete name of the syntaxon;
- synonymy;
- higher syntaxonomic units;
- bibliographical reference, site and year of publication of the type;
- nomenclatural type (holotype, lectotype, neotype);
- physiognomy: dominant or more frequent species;
- characteristic floristic combination;
- ecology: including dynamic;
- variations: subassociations;
- distribution: Europe, France;
- correspondences with European habitat classifications (CORINE Biotopes, Annex I, EUNIS);
- topics to be investigated;
- bibliography.

A national Nomenclature Commission with 9 members is devoted to the phytosociological nomenclature and assists the authors with bibliography. The Service du patrimoine naturel (SPN) of the Muséum national d'Histoire naturelle ensures the coherence of the synthesis written by different authors and is responsible for editorial tasks and establishing correspondence with European habitat classifications. Every draft is submitted to a working group of about 40 experts for advice.

This work can lead to changes in the initial national phytosociological system (Bardat *et al*., 2004) including partition of one class into two, description of new syntaxa, transfer of a syntaxa from one class to another, etc. For example, the order *Holoschoenetalia vulgaris* Braun-Blanq. ex Tchou 1948, previously placed into the class *Molinio caeruleae-Juncetea acutiflori* Braun-Blanq. 1950 (Bardat *et al*., 2004), has been transferred into the class *Agrostietea stoloniferae* Oberd. 1983 (Foucault de & Catteau, 2012). It should be mentioned that 2 marine phytosociological classes are not taken into account: *Halodulo wrightii-Thalassietea testudinum* Rivas-Mart., Fern.Gonz. & Loidi 1998 and *Posidonietea oceanicae* Hartog 1976 ex Géhu 2004.

The synthesis of about 80 classes, including about 2640 associations, will be finished by the end of 2015. At the beginning of 2013, the synthesis of three quarters of the classes are finalized or close to finalized, with 764 association description sheets validated or under correction.

In order not to wait till the detailed description of the

Tab. 1- Example of a plant association description sheet (De Foucault *et al*., 2012).

FICHE N° 19-08

Association : *Cisto salviifolii – Halimietum halimifolii* Géhu & Biondi 1994 (*Braun-Blanquetia* **13** : 96).

Synonymes : -.

Unités supérieures : *Teucrion mari* Gamisans & Muracciole 1984, *Lavanduletalia stoechadis* Braun-Blanq. *in* Braun-Blanq., Molin. & Wagner 1940.

Type nomenclatural : rel. 8 du tab. 54 *in* Géhu & Biondi 1994 (*Braun-Blanquetia* **13** : 99).

Physionomie : lande très dense à fermée, dominée surtout par les deux chaméphytes éponymes, particulièrement spectaculaire avant l'été, lors de la floraison jaune et massive de l'*Halimium* ; illustration *in* Piazza & Paradis (1998 : photo 10).

Combinaison caractéristique d'espèces : *Cistus creticus*, *C. salviifolius*, *C. monspeliensis*, *Halimium halimifolium*, *Helichrysum italicum*, *Lavandula stoechas*.

Synécologie : lande littorale corse des arrière-dunes sablo-graveleuses décalcifiées et acidifiées.

Variations
- *typicum*, différencié négativement, des arrière-dunes planes ;
- *helichrysetosum microphylli* Paradis *et al*. 1999 (*Trav. sci. Parc nat. rég. Rés. nat. Corse* **59** : 35), typifié par le rel. 3 du tab. 13 *in* Paradis *et al*. 1999 (*Trav. sci. Parc nat. rég. Rés. nat. Corse* **59** : 77), différencié par le taxon éponyme et une régression de *H. halimifolium*, sur des dunes perchées fortement exposées aux embruns.

Synchorologie
- territoire d'observation : littoral oriental et sud-occidental de la Corse (Géhu & Biondi, 1994 ; Paradis & Piazza, 1993 ; Piazza & Paradis, 1995, 1998, 2000 ; Paradis *et al*., 1999) ; cartographie *in* Géhu & Biondi (1994 : carte 54 p. 100), Piazza & Paradis (1998 : 164) et Bensetteti *et al*. (2004 : 339) ;
- sous-associations ou variantes géographiques : -.

Axes à développer : -.

CORINE biotopes : 16.28, 32.34 ? ; Eur 27 : 2260(-1) ; EUNIS : B1.64, F5.24.

Bibliographie
Bensettiti *et al*., 2004
Géhu J.-M. & Biondi E., 1994
Paradis G. *et al*., 1999
Paradis G. & Piazza C., 1993
Piazza C. & Paradis G., 1995, 1998, 2000

whole set of classes are available, the results have been published class by class in the *Journal de Botanique* following an agreement with the Société botanique de France (Bioret & Royer, 2009). Since 2009, 15 classes have been published (Table 2). 5 classes are ready to be published and 60 are under preparation. The phytosociological classification and the correspondences between plant associations and European habitat classifications are organized into databases set up by the SPN following agreed standards and made available via the National Inventory of Natural Heritage (inpn.mnhn.fr).

Applications and perspectives

This project will give a reference classification of French vegetation, for use by field phytosociologists as well as managers of protected areas and policy makers.

This national classification will be helpful for the production of regional synopsis, such as those already published for Bourgogne-Champagne (Royer *et al*., 2006) and Franche-Comté (Ferrez *et al*., 2011) regions. It could be also compared to other European national synsystems: for example Spain and Portugal (Rivas-Martínez *et al*., 2001, 2002; Costa *et al*., 2012) and Germany (Pott, 1995; Schubert *et al*., 2001).

At the end of the PVF2 programme, a single volume will present the national synsystem of the vegetation of France, gathering all the association descriptions.

Although not yet complete, we estimate that about 2640 plant associations are recorded in France.

As plant associations can be considered as being a component of the biodiversity of a territory, they become progressively taken into account in numerous management issues and bioevaluation processes, including the production of management plans of protected areas (Réserves Naturelles de France, 2006), identification of natural and semi-natural habitats of community interest (Annex I of the European Union Habitats Directive) (Biondi *et al*., 2012), red lists of plant associations (Rennwald, 2000), assessment of the conservation status of the vegetation (Batista *et al*., 2012) and restoration ecology (Sawtschuk, 2010)…

Started in 2011, the CARHAB programme aims to map the vegetation of mainland France and Corsica at

N°	Class	Author(s)	Number of associations	Year of publication
14	*Cardaminetea hirsutae* Géhu 1999	Foucault B. de	22	2009
53	*Polygono-Poetea annuae* Rivas-Mart. 1975 *corr*. Rivas-Mart. *et al.* 1991	Foucault B. de	12	2010
60	*Saginetea maritimae* Westhoff *et al.* 1962	Foucault B. de & Bioret F.	18	2010
38	*Littorelletea uniflorae* Braun.-Blanq. & Tüxen *ex* Westh., Dijk, Passchier & Sissingh 1946	Foucault B. de	28	2010
28	*Filipendulo ulmariae-Convulvuletea sepium* Géhu & Géhu-Franck 1987	Foucault B. de	52	2011
48	*Oxycocco palustris-Sphagnetea magellanici* Braun-Blanq. & Tüxen *ex* Westh., Dijk, Passchier & Sissingh 1946	Thébaud G.	16	2012
19	*Cisto ladaniferi-Lavanduletea stoechadis* Braun-Blanq. *in* Braun-Blanq., Molin. & Wagner 1940	Foucault B. de, Argagnon O. & Paradis G.	10	2012
46	*Nerio oleandri-Tamaricetea africanae* Braun-Blanq. & O. Bolòs 1958	Foucault B. de, Bensettiti F., Noble V. & Paradis G.	9	2012
66	*Sisymbrietea officinalis* Kornek 1974.	Foucault B. de	38	2012
3	*Agrostietea stoloniferae* Oberd. 1983	Foucault B. de & Catteau E.	90	2012
18	*Charetea fragilis* F. Fukarek 1961	Felzines J.-Cl. & Lambert E.	37	2012
37	*Lemnetea minoris* Tüxen *ex* O. Bolòs & Masclans 1955	Felzines J.-Cl.	18	2012
45	*Nardetea strictae* Rivas Goday *in* Rivas Goday & Rivas-Mart. 1963	Foucault B. de	80	2012
65b	*Serapiadetea cordigero - linguae* de Foucault 2012		1	
10	*Betulo carpaticae-Alnetea viridis* Rejmánek *in* Huml, Lepš, Prach & Rejmánek 1979	Foucault B. de	18	2012

Tab. 2 - List of published classes of the PVF2 programme.

the scale of 1/25 000, using the synphytosociological and geosynphytosociological approaches. The PVF2 will be the basis for the identification of series and geoseries, description, and mapping (Blasi *et al*., 2010; Biondi *et al*., 2011). It will also be used in the creation of the future national vegetation database VegFrance. (Bonis & Bouzillé, 2012).

Conclusion

This collective project gathers the national skills in sigmatist phytosociology bringing together the national community of sigmatist phytosociologists.

It will constitute a basis for the elaboration of typologies and mapping of natural and semi-natural habitats as well as vegetation series and geoseries. Updating and syntaxonomic modifications will be possible.

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