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ANALYSIS

# Maintaining the integrity of the French *terroir*: a study of critical natural capital in its cultural context

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**Abstract**

This paper appraises the integrity of France's *patrimoine naturel* as carrier of collective cultural meanings and as biophysical life support infrastructure. First we situate philosophically the French *patrimoine naturel* concept with its connotations of cultural heritage or transmission, in relation to the 'strong sustainability' precept of maintaining key environmental functions as critical natural capital (CNC). The main results are then presented of a recent survey by the French Institut Français pour l'Environnement (IFEN) exploring perceptions of natural capital—and its criticalness—for the French society and economy. Building on the IFEN survey base, a qualitative analysis highlights France's natural capital as a life support infrastructure vulnerable to breakdown or contamination through pollution, accidents and the production of wastes. Ecosystem contamination is, moreover, closely associated with defilement of food—dioxin in chickens, mistrust of GMOs in agriculture and food, and the *vache folle*—mad cow disease. The 'sink' function of natural capital is thus in conflict with the culturally determined 'site' and 'scenery' functions. To conclude, we discuss (very briefly) some features of the French political culture that bear on prospects for a successful sustainable development strategy.
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"... Something is rotten in the state of Denmark ..."

Marcellus (an army officer), Act I, Scene 5 of William Shakespeare's Hamlet, Prince of Denmark

## 1. Introduction: 'Le revers du progrès'

The Western motif of Progress, closely allied to that of purposeful control of nature for production, was forcibly articulated in the famous works

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of Francis Bacon, Descartes, and Leibniz[1]. In contrast with societies who saw humanity as a permanent cyclical movement of emergence, maturity and dissolution, one finds the persuasive theme of the perfectibility of man through reason, and the perfectibility of nature through the application of reason. An epitome of this sentiment was the French Marquis de Condorcet (1795), who in his *Sketch for a Historical Picture of the Progress of the Human Mind*, set out to show (pp. 4–5):

> ''by appeal to reason and fact that nature has set no term to the perfection of human faculties; that the perfectibility of man is truly indefinite; and that the progress of this perfectibility, from now onwards independent of any power that might wish to halt it, has no other limit than the duration of the globe upon which nature has cast us. This progress will doubtless vary in speed, but it will never be reversed as long as the earth occupies its present place in the system of the universe, and as long as the general laws of this system produce neither a general cataclysm nor such changes as will deprive the human race of its present faculties and its present resources''.

Yet, societies in the Western tradition, having pushed to their limits the concepts of instrumental reason and productive efficiency, have found that they must nonetheless live with two sets of outcomes together—the intended and the unintended. The first of these categories is linked plainly to Progress. The second is an aspect of what we might call *le revers du progrès*[2] as seen in litter, trash and chemical pollution, urban and rural habitat degradation, industrial accidents, side-effects of medicines, ozone-layer depletion, the as-yet unevaluated mad cow disease, and a great diversity of 'environmental problems'. Man *(sic)* makes history, but it is not wholly the history that he had in mind. Along with the benefits of technological progress and mass-consumption society come the problems of massive waste production and disposal, and the associated degradation of habitats, urban and rural. This paper, an outcome of the European CRITINC project (see the introduction to this special issue), explores some aspects of this phenomenon of the *revers du progrès* as it manifests itself currently in French society Fig. 1.

Section 2 outlines the key contemporary notions of environmental functions and critical natural capital (CNC), and then presents the environmental accounting framework developed in France during the 1980s, aiming at a systematic inventory of the *patrimoine naturel*. This refers to all elements of landscape, living species and ecosystems that, having been modified through human action and interaction, constitute a part of the 'patrimony' or collective wealth of a society. It then presents results of a recent survey carried out by the French Institut Français pour l'Environnement (IFEN) which made an investigation of the significance attached to the concept of CNC in current French society. In this work, a questionnaire was applied to a wide sample of persons active in public administration, industry and the community, active in the environmental policy and resource management domains, exploring perceptions of 'sustainability' and perceptions of the most important categories of 'natural capital'—and their criticalness—for the French society and economy.

Section 3 addresses the theme of the integrity of France's *patrimoine naturel* considered simultaneously as carrier of collective cultural meanings and as biophysical life support infrastructures. Starting from a discussion of the availability of fundamental categories of 'natural resources' in the French economy—notably energy sources, forest assets, water resources and air quality—it demonstrates a recurrent theme: the fragility of natural capital as a life support infrastructure vulnerable to breakdown or contamination. We trace an array of diffuse and accidental pollution such as nitrate and pesticide contamination of drinking water sources, heavy metals in the sludge

[1] Glacken's *Traces on the Rhodian Shore* (Glacken, 1967, pp. 471–503) gives a useful survey. On the real and imaginary march of Progress, see also Latouche (1989) and Bury (1932).

[2] Adapting from *Le revers de la production* (Hanak et al., 1978). See also Latouche (1977), Dupuy and Robert (1976), Baudrillard (1976) and O'Connor (1994a).

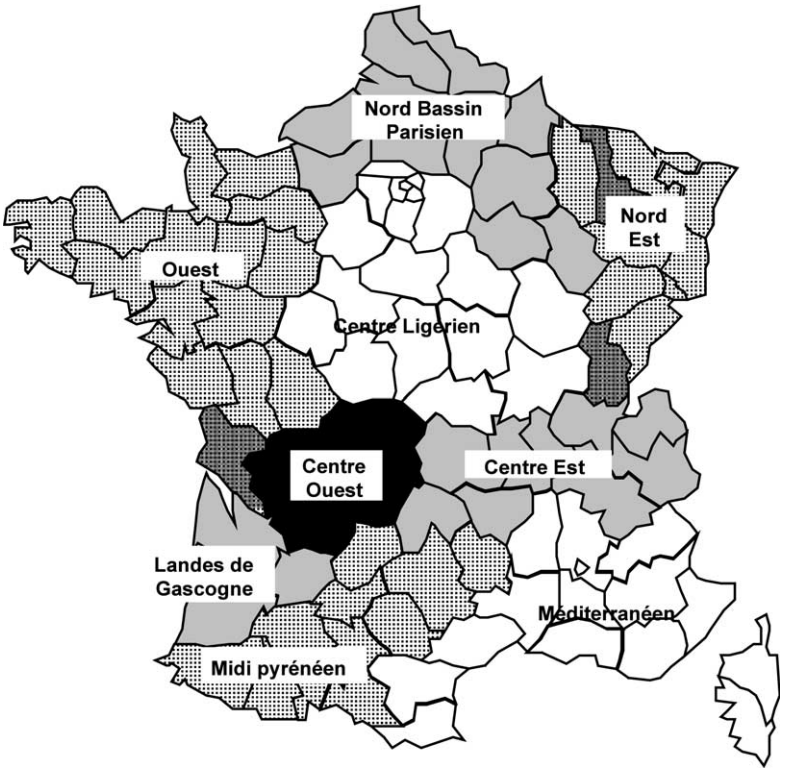


Fig. 1. Changes in land use by first region.

of water treatment plants, oil tanker break-up off the Bretagne coast, and so on. Ecosystem contamination is closely associated with the defilement of food—the image of dioxin in chickens—and more generally the loss of food integrity ranging from visceral doubts about the use of genetic modification technologies in agriculture and food, to the public outbreak in 2000 of French concern about the transmission of the *vache folle* (mad cow disease), to the early 2001 British and European bout of foot-and-mouth disease.

In Section 4, by way of conclusion, we discuss very briefly some distinctive features of the French political culture, a sort of dualism between the governing elites and the governed classes) that bear on prospects for a successful sustainable development strategy in a society torn between hopes in technology and a visceral attachment to 'tradition'.

## 2. Natural capital and sustainability in the French context

### 2.1. Maintaining environmental functions

In the language of two contemporary biologists, Humberto Maturana and Francisco Varela, the life process is fundamentally a process of cognition (Maturana and Varela, 1987). For the study of living organisms, we can represent the living 'system' in relation to its environment; and then we can apply various concepts, measurements and tools of open systems theory in order to discuss the relationship and co-evolution of this system and its environment (Morin, 1977, 1980). By extension and analogy, it is possible to consider built economic structures, and ecosystems, as processes or systems that are autonomous on the one hand (with their characteristic internal functioning) and

inter-dependent with the rest of the world on the other hand (Norgaard, 1988; O'Connor, 1994b). We realise that a system that is 'open' in this way, can evolve, change or die. An organism aware of its own being, is also aware of becoming: it may change or die. This accounts for why, often, environmental knowledge (or lack of it) is taken for granted until a threat is perceived.

In the ecological economics tradition, 'natural capital' covers far more than specific minerals and fuel sources, it refers to the earth as a life-support system (Faucheux and O'connor, 1998). A corresponding approach to policies for sustainability is based on the requirement that present generations' economic activity not prejudice the welfare of generations to come by running down irreversibly the stocks of key environmental assets. Yet, environmental resources are not just stocks, they are dynamic systems and infrastructures that have a multiplicity of functions including life-support for human as well as non-human communities. The question may be asked, whether or not a given system—economic or ecological—is able to maintain its 'integrity' in the face of changing conditions? Such a perspective was expressed by French economist René Passet who, in *L'Economique et le Vivant* (Passet, 1979), tried to reorient economics 'to define the conditions which economic activity ought to respect, in order not to compromise the major adjustments of a natural milieu to whose reproduction all others are subordinate[3]'. For any chosen sustainability problem, it is then necessary to specify the criteria by which durability and integrity will be judged.

One useful concept here is that of *environmental functions*, meaning the capacities and performances of natural processes and components to provide goods and services which satisfy human needs. The physical environment is considered as a complex system, and one may speak of (1) the *functioning of* natural systems—the internal regulation, cycles of renewal, evolution and transformation by which biosphere activity is maintained; and (2) the specific roles or services provided by natural systems that support economic activity and human welfare—that is, the environment's *functions for* the human economy. Based on work by Hueting and, more recently in the CRiTiNC project by de Groot, Simon and others, it is now common to regroup the main types of environmental functions under broad categories[4]. In this paper, we will refer to 'the five S's' as articulated by Noël and O'Connor (1998):

> Source of biological resources, food, raw materials and energy in various forms.
> Sink, or place of controlled and uncontrolled disposal of 'waste' products and energy of all sorts.
> Scenery, covering all forms of scientific, aesthetic, recreational, symbolic and informational interest.
> Site of economic activity (including land uses and occupation of space for transportation).
> Life-Support for human and non-human living communities.

Various analysts have suggested, building on concepts already existing in environmental economics from the 1950s, that sustainability policy goals or standards for each type of pressure, each type of ecosystem, and each type of environmental function, may be set on the basis of assessment of the requirements to ensure maintenance of the environmental functions in question (Ciriacy-Wantrup, 1952; Bishop, 1978; Crowards, 1999). An operational approach is then the identification of categories of 'CNC' whose stocks ought to be maintained at or above identified minimum levels.

[3] Others who have introduced systems integrity and resiliency concepts into ecological economics include Berkes and Folke (1992) and Common and Perrings (1992) taking inspiration from Holling (1973).

[4] The pioneering argument is found in Hueting (1980). A detailed analysis and classification framework for environmental functions was developed by de Groot (1992). In the context of the CRiTiNC project, this framework has been adapted and refined; see Paul Ekins (2000) and Ekins and Simon (1999), and other papers in this issue.

CNC is defined as any set of environmental resources which, at a prescribed geographical scale performs important environmental functions and for which no substitute in terms of manufactured, human or other natural capital currently exist. Making applicable the CNC concept requires the following considerations to be addressed:

identifying the role and significance of different natural capital systems for supporting sustainable economic activity;
defining the relevant spatial and temporal scales for which the environmental functions and, hence, the natural capital systems may be critical;
identifying social and cultural factors which may contribute to making critical any natural capital components; and
the weight of the Precautionary Principle when environmental function losses in question are characterised by scientific uncertainty and irreversibilities.

Each country, people or region develops specific qualities of environmental information. Sustainability policy targets thus have social as well as functional (ecological) dimensions. We will now explore this dimension for the case of France, looking first at the development of environmental information, during the 1980s, in the form of systematic accounts for the nation's *patrimoine naturel* (natural heritage).

### 2.2. France's Comptes du patrimoine naturel

The year 1986 saw the publication in France of a monumental tome, *Les Comptes du patrimoine naturel* (INSEE, 1986) which laid out the conceptual framework and accounting schemas and which brought together a large range of empirical information[5]. Answering the obvious question, what is meant by the generic term *patrimoine naturel*, the 1986 report's *Introduction* states that this can be given a first response in terms of the *elements* or *components*: continental and ocean waters, soil, air, primary materials and energy, animal and plant species. It is then insisted that, as a complement to the exhaustive listing and categorisation of elements, there should be a division by *geographical zones* or *territories*; and this is closely linked to the description of *ecosystems*. Finally, the fact that there is an interest in the subject at all, implies human *agents*.

The *patrimoine naturel* is thus to be inventoried as a set of elements, associated with various categories of ecozones having territorial extension, and relating to the interests and uses of various human agents in the French society. Yet, this does not explain the specifics of the term *patrimoine*. For this, we must situate the accounting concern within the French societal heritage.

According to the *Comptes* report (p. 35), a patrimony is an inheritance from the past and/or an accumulated wealth transmitted to future generations. It may be enjoyed, passed on, or dilapidated. What makes the natural patrimony particular, is therefore, the dual quality that it is an element or geographical zone of nature that (a) is *attributed a value by human society* and (b) is *susceptible to change*. The definition thus excludes elements wholly produced by human hands (e.g. shoes or buildings, even if the raw materials are 'natural'); it equally excludes such elements as the sun and the stars or mountain masses, that are substantially exogenous for the span of human concerns. What it includes and emphasises is 'natural wealth' as the result of the human social process that invests an element or ecozone with value, with a value or significance (in French, *signification*) that is, at least potentially, to be transmitted into the future.

Hueting (1980) spoke of *competition for scarce environmental functions* for situations where the use of one environmental function is at the expense of some other function (or someone else's use of that same function). This competition implies there will have to be choices made as to the precise environmental functions, features or activities to

[5] This work is, in its turn, situated in a broad historical perspective of the development of accounts of national 'wealth' and 'patrimony', in the comprehensive *Histoire de la Comptabilité Nationale* (Vanoli, 2002), notably chapter 8 on the themes of production, revenue and patrimony.

be maintained or sustained[6]. With the French concept of *patrimoine naturel*, the framing of sustainability is immediately seen to be a socio-cultural as well as ecological–economic affair. The notion inherent in the *Comptes* of a *social transmission of values* makes sustainable development not just a material business of maintaining ecosystem functions but, first and foremost, a *socially meaningful* affair—the receiving of a heritage from the past, and the passing on of this tissue of values to the generations to come. We see from this that, surely, there will be social as well as physical reasons for defining natural systems as CNC.

French communities that constitute their identity by locality, by regional appurtenance, by their territorial inheritance and their *terroir* (an untranslatable word that connotes the local spaces and soils, and also symbolic relations of goods and services production), tend to identify features of their food, cuisine, buildings and wider habitats as 'critical' patrimony in view of their symbolic as well as functional significance in defining group identity[7]. This suggests that, in order to appraise issues of sustainability or non-sustainability, we should consider perceived threats to the integrity of these patrimonial values and to the collective transmission of meanings.

### 2.3. The IFEN survey of (perceptions of) critical natural capital in France

During 1999 a research study was initiated by the IFEN which aimed at obtaining insights into the perspectives of different interest groups and individuals in French society about those features of the natural environment (*milieu naturel*) considered to be of critical importance[8]. The technique used was a mailed written questionnaire, which was sent to a wide range of persons and/or organisations concerned with sustainable development issues in French society. The questionnaire was essentially exploratory. Three neighbouring terms—*capital naturel, ressources naturelles, patrimoine naturel*—were deliberately used in proximity to each other, in an effort to let respondents choose their preferred vocabulary. One of the issues being explored was, indeed, the extent to which the concept of 'natural capital' and, more particularly of 'CNC', had currency in France and, to the extent that it did, what it was taken to connote. The questionnaire was structured in three parts, focussing respectively on:

1) points of view or judgements linked to the **specific activities of respondents**, e.g. their work within a firm or corporation in a public administration, environmental or community organisations (Part 1 of the questionnaire);
2) points of view or judgements concerning '**society as a whole**', that is, **the collectivity** (notably French society) and also '**future generations**' (Part 2 of the questionnaire);
3) points of view and judgements concerning '**sustainable development**' (Part 3 of the questionnaire).

In this short presentation we will not summarise all the questions and responses. We focus on those questions and analyses that bear directly on the 'inventory' of what is critical in the French natural patrimony.

[6] See also, on the notion of distribution of sustainability, O'Connor and Martinez-Alier (1998) and O'Connor (1997). The complexity of the norm setting process is discussed by Funtowicz et al. (1997). A cultural dimension of systems sustainability is evoked by Berkes and Folke (1992) and by Norgaard (1988).

[7] For a highlighting of this dimension of French economy and community, see de Montgolfier and Natali (1984) and Godard (1990). More recently, with particular regard to agricultural community, see e.g. Beuret (1998); DRAF de Bretagne (1999), DIREN Region Bretagne (1998), Landais (1998) and Pujol and Dron (1999).

[8] The study was reported in IFEN (2000), *Le Capital Naturel Critique: Analyse Bibliographique et Consultation d'Experts,* draft report produced by the Institut Français pour l'Environnement, Orléans, under the French Ministry for the Environment (MATE) research contract DGAD/SRAE No. 98-162, June 2000, followed by a revised definitive report (in the IFEN series Etudes et Travaux), in 2001. The report is in French; this short article can furnish only a quick overview of some key results. Where we consider that significant connotations are contained in the specific French terms employed, we place these (*entre parenthèses*) in italics.

Part 1 of the IFEN questionnaire asked respondents to respond on their basis of their own particular domain of activity (business, administration etc.).

Question 2 of Part 1 asked: "What are the natural resources or the natural capitals that appear to you as *potentially* critical in the sense that their disappearance would seriously put in question the development, or the very existence, of your activity today or in the future?" The format invited a list of up to five, in decreasing order of importance.

> The responses clearly placed **water** in the leading category, followed by **ecosystems** (linked to biodiversity) and **countryside** (*paysage*), then followed by **species** (also linked to biodiversity), and thereafter **air**, **energy resources**, **materials**, **soils** and **climate**.

Question 4 of Part 1 asked: "What are the reasons why these natural resources or these natural capitals appear to you as *potentially* critical?" Six possible reasons were listed, and respondents were asked to indicate, for each of the five 'critical' categories they had identified, whether or not each of these possible reasons was felt to apply. A table was supplied, within which respondents could place a tick (etc.).

> The reason most often affirmed was *high economic or strategic importance*; followed by *vulnerability to degradation*, *absence of substitutes* (or high cost of substitution) and *irreversibility*. Then followed *high social and cultural value* and, last, *scarcity*[9].

Question 5.1 of Part 1 then asked the respondents to reconsider their listed categories of Q.2, and to answer: "What are the natural resources or the natural capitals that appear to you as *actually today* critical for your activity today?", in the sense of being at present under threat.

> The responses again placed **water** in the leading category, followed by **species**, **soils**, **countryside** and **ecosystems**. Energy is absolutely not considered as a critical problem today, whereas air and raw materials are viewed by a significant minority as under threat today.

Question 5.2 of Part 1 asked the same thing for threats "... in the medium or long term".

> The results differ significantly compared with the profile of immediate threat. In the medium/long term, the leading categories of preoccupation are **material resources**, **energy** and **species** at risk. Then follow the ubiquitous categories of **water**, **soils**, **countryside** and **ecosystems/territory**. Open space in France is listed as under serious threat by less than half the respondents.

Part 2 of the questionnaire asked respondents to address the collective point of view in the long term. Therefore, some significant differences of emphasis are to be expected, since it is the future society rather than particular existing activities that is the focus of attention. The same set of questions, suitably modified, was posed. The significant differences are as follows.

Question 10 of Part 2 asked: "What are the natural resources or the natural capitals that appear to you as *potentially* critical for the collectivity, in the sense that their disappearance would seriously put in question the satisfaction of the needs of future generations in France?" The format again invited a list of up to five items, in decreasing order of importance.

> The responses placed **water** in the leading category, followed by **air** and then **biodiversity** (**ecosystems** and **species**), then **countryside** (*paysage/territoires*) and **soils**. Remaining low on the list are energy resources, materials and climate.

Question 11 of Part 2 asked, again: "What are the reasons why these natural resources or these natural capitals appear to you as *potentially*

[9] The key words of the categories are here placed in italics and not bold, because they were supplied by the questionnaire and not by the respondents autonomously.

critical in the long term?'' The same six possible reasons were offered and a table was supplied to be filled in.

> The leading reason is *vulnerability to degradation* followed by *absence of substitutes* (or high cost of substitution) and then, in decreasing frequency, *high economic or strategic importance; irreversibility, high social and cultural value* and, again last, *scarcity*. The criterion of vulnerability is particularly attached to ecosystems/biodiversity and to countryside/landscapes. Difficulties with substitution applies to raw materials and also species diversity, but not so strongly to energy resources.

Question 12 of Part 2 then asked the respondents to reconsider their listed categories of Q.10, and to answer: ''What are the natural resources or the natural capitals that appear to you as *actually today* critical for the collectivity?''

> More than 90% listed **biodiversity/ecosystems** as critical for the collectivity, followed closely by **species**, **water** and **air quality**.

Question 14 of Part 2 asked: ''What indicators should be developed in order to monitor the changes in critical natural patrimony in France over the next 30 years?''

> The responses were quite varied and wide ranging. Broadly speaking they confirm the evaluations of 'criticalness' suggested by the patterns of previous questions. The most frequently stated domains are **water**, **species/ecosystem diversity**, **soils**, **countryside/landscape**, and **air**. Much less frequently mentioned are climate, energy resources and raw materials.

Question 15 of Part 2 asked respondents to specify: ''In your *own region*, what are the components of natural patrimony that appear to you as *potentially* critical for the collectivity, in the sense that their disappearance would seriously put in question the satisfaction of the needs of future generations in France?''

> The distribution of respondents between regions is uneven. Broadly speaking they confirm the evaluations of 'criticalness' suggested by the patterns of previous questions. The most frequently stated domain is **water**, followed by **ecosystem diversity**, **soils**, **countryside/landscape**, and **air**.

It is noteworthy that water, ecosystems and countryside (*paysage et territoires*), then soils and species, are persistently present in responses. Availability of 'open space' is not, in itself, a burning issue in France (compared with, for example, the much more dense populations of rural England or The Netherlands). Yet, there is a heightened sensibility to the vulnerability of the countryside and of the various elements that support, both materially and symbolically, the French wealth and way of life. High on almost every list are water, air quality, soils, and biodiversity—the components of patrimony of the productive and aesthetic countryside. Much less frequently mentioned are climate (notwithstanding international debates) and energy resources and raw materials (notwithstanding evident economic importance). If these latter are not conceived as 'critical', this is not because they are ignored. Rather, the issues of ensuring adequate supply for energy and materials are not of the same sort as the perceived vulnerability of the countryside to qualitative degradation or decay.

## 3. Maintenance and decay: the integrity of the patrimoine

### *3.1. The entropic model of societal dynamism and decay*

The science of thermodynamics tells us that purposeful production will always be accompanied by unwanted wastes and disruptive environmental effects. As development theorist Gourlay (1992) writes:

> The more we consider the industrialised world of today, and the Third World of tomorrow, the more we realise that we live in

> a world dominated by waste, a World of Waste, most of it undesirable, and that unless we do something about it, humanity may disappear under its own detritus, and the world we know with it.

The novelty and incessant innovation that is the mark of the technological society, is matched by the novelty of *uncontrolled ecological change* due to pollution and habitat disruption. Social theorist Bataille (1967) in *La Part Maudite* has suggested that driving forces of a cultural group can be understood by investigating what it does with its produced surpluses and wastes. In the French context:

- The 'agricultural surpluses' currently posing problems are not just the subsidised and unsold foodstuffs that are the (intended?) product of the European Common Agricultural Policy, but—more particularly—the nitrates and pesticide residues that stray into the air, soil and water.
- The 'energy surpluses' that currently are causing concern are not just the nuclear-electric kWh sold by Electricité de France across the border to European neighbours, they are the overly (radio)active nuclear reactor wastes in need of eventual disposal...
- The 'free gifts of nature' that have no price (because, in the reasoning of 19th century and 20th century economics, they were in surplus supply) are now the dirty air that we cannot breathe, the poisoned water that we cannot drink, the polluted sea foods that we cannot consume.

Hand in hand with this ecological innovation comes *uncontrolled social change.* Trans-nationalisation of investment, the routine transportation of commodities and manufacturing inputs between continents, and increased consumer affluence and mobility, all contribute to social fragmentation, placing stress on traditional community structures and solidarity as well as on ecosystems. French social scientist Latouche (1989), has recently observed:

> The individualist worldview is like a yeast for the decomposition of social ties. It eats away at the tissue of traditional solidarities like a cancer. The thing that renders individualism irresistible, is that to each individual it appears as a liberation. It emancipates, in effect, from constraints and opens up unlimited possibilities—but at the expense of the solidarities, which constitute the fabric of social collectivity.

In the context of our concern for *natural capital*, it is convenient to transpose this argument also onto the biophysical solidarities that, in the 'strong sustainability' perspective, are the necessary underpinning for durable economic and social well-being. In this section we review some aspects of the current French situation and outlook for natural capital maintenance, use and degradation. In a thematic way, we consider aspects of forests, primary energy, air quality, water and agricultural patrimony[10]. Through these examples we will see that while economic and strategic significance of resource stock management and supply security is plainly in view, the perceived priority issues from a sustainability point of view relate to *vulnerability* of the *terroir* or of the countryside (*paysage et territoire*) to qualitative degradation or decay. We will then offer some interpretations of this vulnerability as a social as well as ecological phenomenon, thus framing research questions about prospects for French sustainability.

### 3.2. Forest assets and woodland patrimony

Woodlands and forests are a major component of the French countryside (*paysage*) and are associated with species and ecozone diversity—the biodiversity as well as landscape qualities—featuring in the responses to the IFEN survey. The 'naturalness' of the forests could be disputed, as

[10] France's wild and agricultural biodiversity deserves a fuller treatment than can be afforded in this paper. We do indicate, in passing, some considerations in relation to forest resources, food and agriculture (and controversies surrounding GMOs in food and agriculture), and pollution threats to fisheries resources, coastal and marine ecosystems.

these are forests that have been exploited, modified, managed, replanted and reconstructed over long periods of time. The very concept of *patrimoine naturel* carries the presumption of a human influence within the ecosystems being transformed and transmitted through time.

A quantitative profile of the French forest resources has been established through the European Framework for Integrated Environmental and Economic Accounting for Forests (IEEAF)[11]. The IEEAF framework developed, tested and refined by a Eurostat Task Force since 1995, aimed to link forest balance sheets and flow accounts for land and timber, forest-related economic activities and the supply and use of wood within the economy, in a consistent way in both physical and monetary terms. A first set of ten main tables was developed covering monetary and physical balance sheets for land and standing timber, economic accounts of forestry and monetary and physical supply-use tables[12]. The four Member States covered by the pilot applications (Germany, France, Finland and Sweden) represent 70% of forested land area in the European Union.

In addition, under a contract with Eurostat, the French ENGREF in co-operation with the IFEN has experimented with the application of the IEEAF at a regional level for France. The French forests have been divided into nine regions (see map below), and changes in land use and characteristics have been estimated. In particular, changes in land use from and to forest have been established for the nine regions for the 1986–1996 period (see Steurer, 2000). Results show the different dynamics of the forests, e.g. due to agricultural land abandonment, urbanisation, etc. Some regions show a very high increase in forest area (West and Mediterranean forests), while for other regions (North East and Alps) the increase is very slow; for the 'Landes' region (one of the most productive forest areas) there is a decrease due to the pressure of agriculture and urbanisation.

Characteristics as concerns the wood supply function have also been appraised. The nine regions present very different characteristics as concerns the wood supply function—see Table 1. The volume of standing timber per hectare ranges from 221 $m^3$/ha (North East region) to 85 (Mediterranean). Total removals represent 85% of the increment in the Paris basin and 39% in the Mediterranean region. In most regions (except the south west 'Landes' region) the commercial part of the removals is much lower than total removals.

These figures suggest that French forest quantity is not under any immediate threat; wooded or forested area in France is indeed slightly increasing year by year. The apparent lack of pressure on national wood resources is, however, partly due to imports of wood and timber, e.g. from the Cameroon and other African sources[13]. In effect, France may be 'importing' its sustainability at the expense of some other regions of the world[14].

There are, however, some concerns about the 'integrity' of the resource. Immediately after the Christmas 1999 freak tempests that brought down trees in wide swathes across France and stretching into Switzerland and Germany, comments were made in numerous quarters that the damage was more serious than it might have been because of 'neglect' of the forests. This judgement was offered

[11] We are grateful to Anton Steurer from Eurostat for these results from current reports (see also Steurer, 2000).

[12] The results of the first pilot applications of the IEEAF have been published as 'The European Framework for Integrated Environmental and Economic Accounting for Forests: results of pilot applications' (European Commission, 1999, Series 2D, Eurostat catalogue number CA-22-99-329-EN-C). The handbook 'The European Framework for Integrated Environmental and Economic Accounting for Forests' has also been published in 1999.

[13] For example, as documented by Lescuyer (2000), there is a significant presence of large forestry exploitation companies with major French ownership, in several African countries including the Cameroon. Much of the cut logs are destined for export, including to Europe. This is one way for France to reduce pressure on its own forest reserves...

[14] This corresponds to a type of international 'environmental load displacement' as analysed and discussed by Muradian and O'Connor (2001) and Muradian et al. (2002).

Table 1
France's forests—standing volume, increment and removals

| Region | Standing volume $m^3$/ha | Increment $m^3$/ha per year | Commercial harvest in % of increment (%) | Total removals in % of increment (%) |
|---|---|---|---|---|
| Paris Basin | 168.4 | 7.5 | 48.1 | 86.6 |
| West | 136.3 | 7.0 | 46.4 | 68.2 |
| Centre | 144.9 | 6.7 | 34.5 | 58.0 |
| North East | 221.2 | 8.8 | 48.2 | 79.4 |
| Landes | 164.9 | 8.5 | 68.0 | 74.8 |
| Centre West | 146.7 | 7.3 | 46.8 | 58.6 |
| Centre East | 201.8 | 8.6 | 27.7 | 57.2 |
| Pyrenean | 127.9 | 5.2 | 29.9 | 55.6 |
| Mediterranean | 85.5 | 3.4 | 22.4 | 39.2 |
| France | 154.0 | 7.0 | 41.4 | 65.4 |

as much towards woodlands managed as non-commercial patrimony (private domains, and regional parks under state management) as towards forests oriented to commercial production. In effect, the question was posed of a possible loss of integrity of the social–cultural–territorial space.

It is not easy to make an objective appraisal of the basis (or not) of this perception[15]. Forest scientist de Montgolfier (2000) offered an interesting commentary on the losses occasioned by the tempests. In quantity terms, around 120 million $m^3$ of standing timber was uprooted or broken, which can be compared with the total volume of some 2000 million $m^3$, the annual regeneration of about 70 million $m^3$, and the average harvest of slightly over 50 million $m^3$. The damage was often more severe in plantations established and managed with a preoccupation for low costs and high 'productivity' reasons—namely, areas of trees having all the same age, and plantations of certain fast-growing or high value tree species in conditions far removed from their 'natural' conditions. So, the hint is that the 'commodification' of the forest resource may be associated with a reduction in robustness of the patrimony.

### 3.3. Post 'oil-crisis' energy policy and the liberation of uncontrolled energies

France's current primary energy supply is composed in part of transportable raw materials (coal, oil, gas, uranium) and in part of fixed exploitation sites (hydro, wind…) which can feed a grid distribution system. The country has relatively small domestic reserves—less than 0.1% of the planet's energy stocks, and only 1.2% of the world's energy production (to be compared with having 2.5% of the world's consumption). So energy supply is a vulnerable point for French economic sustainability.

Half of the coal consumed in France is imported. French coal stocks are officially estimated at about 200 million tonnes; by comparison the United Kingdom's stocks represent 5000 million tonnes compared with more than 20 000 million tonnes for former West Germany.

Almost every oil product is imported. The relatively poor French oil endowment is illustrated by recent Eurostat compiled statistics for selected European countries (see Table below; the French profile for gas is similar to oil). Extraction companies do not prove more than needed for maintaining their activity during a limited number of years, typically 5–10 years. So the indicator of

[15] A good spectrum of 'opinion' and information is to be found on website: http://www.ac-grenoble.fr/CARMI-Pedagogieitindex.htm.

proven reserves after decades of intensive extraction is often higher than at the beginning of the recording period. However, the relative country endowments contrast greatly—France's proven reserves are relatively quite small.

Oil reserves (million tonnes; source: Eurostat)

| | Initial year | Initial reserves | Final year | Final reserves | Total extraction |
|---|---|---|---|---|---|
| Norway | 1984 | 1677 | 1997 | 4113 | 1282 |
| United Kingdom | 1977 | 1915 | 1997 | 1134 | 2159 |
| France | 1980 | 14 | 1995 | 16 | 41 |
| Austria | 1975 | 23 | 1997 | 15 | 25 |

French energy policy pursued in the wake of the 1973 oil-crisis had three main aspects: domestic energy production to be provided by the electro-nuclear programme; the diversification of foreign supplies; energy savings and research into new energy sources. By the early 1990s a new profile of energy supply had been stabilised. Generation of nuclear electricity increased from 2% in 1973 to 34% of total energy production in 1992 (about 70% of French electricity production)[16], while hydroelectricity remained stable at about 7%. The share of coal has greatly diminished, whereas use of natural gas is increased. France has substantial stocks of uranium, disposing of 3% of proven world stocks (order of 100 000 tons) and has been, over recent years, the leading producer of Western Europe (even though partly for price reasons and partly for strategic reasons France chooses to import from overseas much of the uranium used in its commercial reactors).

It is the 'downstream' issues associated with energy use energy production and use—the localised and dispersed side-effects impacts relating to the environment's roles as life-support, scene, site and sink—that look currently to be the most problematical. We will consider three aspects: nuclear waste disposal, atmospheric pollution from fossil fuels, and marine oil spills.

*3.3.1. Radioactive waste production and disposal*

In the 1970s nuclear waste disposal was not an urgent problem. By the mid-1980s, there was an increasing amount of radioactive waste to be stored, and environmental organisations were becoming more vociferous about the long term consequences. French policymakers will need to make major decisions about replacement of the first reactors built in the 1970s and their dismantling (decommissioning) between 2005 and 2015. Among international experts, a convergence had been taking place towards geological disposal as the reference solution. In the late 1980s the French National Agency for Radioactive Waste Management (*ANDRA*) began design studies for underground laboratories. This awoke mistrust and opposition from local populations as well as from concerned environmental groups. This was the context for the French *Loi* Bataille (1967) which established a *Commission Nationale d'Evaluation* and sought a new process for evaluating options for management/disposal of high-level radioactive waste involving all stakeholders. It is required to draw conclusions by about 2006. A policy decision has been made that waste stocking/disposal should be within the metropolitan French territory. This makes the national territory into a CNC, where the question is to establish the territory's capacity as a site to receive and to store various qualities and quantities of radioactive wastes that will be active for tens, hundreds or thousands of years!

So far, there is no sign yet of an 'agreed' solution (see for example, Barthe, 1998; Hériard Dubreuil, 1998; Hériard-Dubreuil et al., 1998; Schieber and Schneider, 1998). Despite careful technical and geological work on underground rock storage concepts, the ANDRA and other organisations has not yet found a clear willingness on the part of any local community in France to accept to host the wastes. On the contrary, promising initial discussions have several times collapsed. The question thus arises, why are the reservations so strong, whereas the French public had relatively readily accepted the nuclear produc-

[16] The electricity generation capacity now outreaches domestic demand, and exports of electricity to neighbouring European countries have become a significant item, increasing from 25 TWh in 1986 to 45 TWh in 1990 and remaining high since. For an overview of these trends, see Méral et al. (1994).

tion choice over the past 30 years? There is not yet a clear explanation[17]. One hypothesis is that the unwillingness to host the underground wastes (which would not at all be a visual or traffic nuisance) may be related to a diffuse sense that such an installation causes a dirtying, or degradation or 'violation' of the integrity of the French space—once again the *terroir*? Such hypotheses need to be explored in future sociological work for hopes of a robust waste management policy.

### 3.3.2. Climate change and air quality

Atmospheric pollution in France has, for reasons of historically lower intensity of heavy industry in urban areas and also climatic factors, been less a preoccupation than, by comparison, Germany and England. At present, however, it is admitted that there are significant health costs of current urban pollution[18]. Many emissions from combustion processes are sources not only of local air quality degradation but also of long-range pollution. This is notably the case for acid rain precursors (principally sulphur dioxide and nitrogen oxides), for emissions of greenhouse gases (carbon dioxide and, in the case of natural gas leaks, also methane), and for chloro-fluoro-carbons (CFCs) and other molecules that contribute to the degradation of stratospheric ozone. All of these pollution categories have been the object of international agreements and negotiations. In effect, the key questions being posed in each case are: (1) how urgent is the reduction of the pollutants world wide? (2) What is the appropriate contribution of France to this reduction? (3) What will be the cost and/or inconvenience to the French economy and to specific sectoral interests within the economy?

Concerning acid rain, there is little current discussion in France. The air is the vector of damaging forces rather than itself being the sink; the water/soil is the CNC at risk. But, by comparison with more northern European neighbours, the French situation is not acute. Wind patterns, nuclear energy and the phasing down of coal some years back, mean that acid deposition loads are sub-critical on most of the French territory. Despite being embroiled in some technology controversies (notably the *pot catalytique*) the French are essentially followers rather than initiators of international policies (Faucheux and Noël, 1990; Hourcade et al., 1992).

Concerning CFCs and the upper atmosphere ozone layer, France is not exposed to immediate noticeable effects of the thinning of the ozone layer (there is not yet a rise in sunburn and skin cancer such as in fair skinned populations in southern hemisphere countries like Australia and New Zealand). The preoccupation in France with negotiations to phase out the production and use of CFCs was at the level of industrial strategy: several major French companies had stakes in CFC manufacturing and in the wake of international protocols in the 1980s were forced to adjust (Faucheux and Noël, 1990; Mégie, 1989).

Concerning greenhouse gas emissions and climate change, the problem is defined as global rather than national in scale. Since the 1980s it has been widely asserted that, through its choice to invest heavily in nuclear electric capacity, France has already contributed substantially to reduction in GHG emissions (and acid rain precursors). Within the Kyoto agreements dating from 1997 and whose application is currently uncertain, France's part is to assure a 0% increase in GHG emissions for 2010 (that is, emissions of a weighted basket of gases including $CO_2$, $CH_4$ and $N_2O$, averaged over the window 2008–2012) compared with the 1990 baseline levels. Given the high dependence in France on oil products for car and truck

[17] There is a scattered, and mostly unpublished, literature on this subject. Some overviews of the French situation in a comparative international perspective, are brought together in documents of the Forum on Stakeholder Confidence of the OECD's Nuclear Energy Agency, Paris (see http://www.nea.fr).

[18] Useful information sources in this regard are: http://www.airparif and http://www.ademe.fr. An example of the state of the art, which more constitutes monitoring and diagnosis than, as yet, concerted action for change, was the conference PRIMEQUAL-PREDIT held at Toulouse on 29–30 November 2000, sponsored by the French Ministry for the environment and the ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie); see http://www.predit.prd.fr.

mobility, achievement of this target of short-term GHG emissions stability will not be easy (see van den Hove, 1998; O'Connor et al., 1998; Schembri, 1999). There is currently an undercurrent of controversy, about whether or in what sense GHG emissions should be a consideration for renewal, or not, of the French nuclear electricity capacity.

Since 1998 and notably again in early 2001, there have been flurries of debate within French society, as to whether 'unseasonably' warm and wet winters, high-humidity summers, freak tempests (e.g. December 1999), and region-wide floods, can be attributed to *changement climatique*. The heavy consequences of changes in (or unpredictable variability of) precipitation patterns for agricultural production and for the integrity of the build environment (waterlogged buildings, etc.) are becoming, in a confused way, a public and scientific preoccupation.

### 3.3.3. Marine oil pollution

France has a privileged geographical position for observing marine oil spill disasters. The first big supertanker disaster was that of the *Torrey Canyon* in 1967, liberating 117 000 tonnes of crude in the English channel (north of France) in a black tide that made headlines world-wide. In 1978 *the Amoco Cadiz* foundered on the Brittany coast, pouring more than 200 000 tonnes of light crude into the sea, the worst disaster of this kind in volume terms. Direct clean-up costs exceeded 600 million francs (about US$100 million), with uncompensated adverse impacts on the regional tourist industry, and difficult-to-quantify damage to marine and coastal ecosystems[19]. In December 1999, again off the coast of Brittany, the *Erika* foundered and broke in two parts, releasing a large part of its more than 30 000 tonnes of heavy fuel oils. There was again an outcry about the absence of adequate regulations in the European Union zone providing for legal liability in the case of accidental oil spills.

It was subsequently revealed that the *Erika* was in a lamentable state of non-maintenance, and that the crew members seemed to have little relevant expertise, and so the whole process of ship licensing (flags of convenience and so on) became once again a talking point. Questions were posed about the true character of the cargo, notably the suggestion that it contained, at least in part, not just heavy fuels but also waste by-products of refinery processes having a highly toxic (carcinogenic) nature. A legal judgement during in late 2000 asserted that the cargo transported in the *Erika* was within the specifications for heavy fuel. But, this legal decision has not much reduced the widespread attitude that the whole affair has come about due to an excessive preoccupation with commercial advantage and low costs at the expense of public interest, ship maintenance and environmental security…[20] Nor were matters helped when, within a few months, other major oil spills in high seas took place including one just off the Galapagos Islands which is one of the ecological treasures of the world.

## 3.4. The violation of water and food integrity

The rusty *Erika* and its oil slick arrived like an inopportune symbol of a deepening sentiment, felt by many members of the French public, that one is witness to a veritable *marée noire*—a generalised black tide—of degradation of their physical environment and quality of life.

[19] In 1989, the wreck of the *Exxon-Valdez* on the coast of Alaska liberated 38 000 tonnes of crude. The *Amoco Cadiz* and *Exxon-Valdez* spills have been decisive events in the evolution of compensation law and also the application of economic valuation methods in litigation and jurisprudence (see Bonnieux and Rainelli, 1991).

[20] A variety of websites permit an appreciation of the debates, including: http://www.ac-grenoble.fr/CARMI-Pedagogie/itindex.htm; http://www.defense.gouv.fr/marine/actu/erika; http://www.mareenoire.com; http://www.mareenoire.org; http://belle-ile-en-mer.org. Not everybody was reassured when it was learned that the French government had made an agreement with TotalFinaElf (the shippers of the Erika's cargo) that put the latter in charge of communications concerning the operations of attempted salvage of the thousands of tonnes of heavy oil still within the hold of the sunken ship (see http://www.totalfinaelf.com/erika/index.htm).

In 1999 it was discovered that some chickens and also eggs produced in certain Belgian poultry farms (which are really factories) contained easily measurable traces of dioxins, a family of highly toxic chemicals that are by-products of various manufacturing and combustion processes. The subsequent inspections revealed that, to varying degrees, dirty waste water and sump oil were 'inputs' into the poultry production processes. The dioxin component was unintended, but the recycling of dirty water (etc.) was intentional. Belgian chickens (and eggs) became highly suspect—another reason for the French to make jokes about the Belgians. In the ensuing months, a great part of egg production in France and in Belgium miraculously became 'organic' (*les œufs biologiques*). Several major cases of fraud were subsequently brought to light, concerning supposedly 'organic' poultry feeds or supposedly eggs labelled 'organic' that were not. The French satirical newspaper, in July 2000, introduced its thematic *Dossier du Canard No. 76*, with the following declamation[21]:

> When it comes to food, there is no risk of lack of imagination. From chickens with sump oil to camembert cheese made with oxygenated water, current events show us each week that the inconceivable can become reality.

The dioxin in the Belgian chickens is also a metaphor. It stands for scandals that are intruding like a kind of pestilence into the images (some would now say the illusions) that producers, retailers and, on the other side of the counter, French people as consumers, have sought to maintain concerning the quality of French food with its rural economy and countryside connotations. Three grave issues now combine with the many minor stories of food fraud and farce, to plunge the whole agro-alimentation industry (and the consuming public) into a deep state of unease. These are:

1) chemical contamination of drinking water, notably with nitrates from fertilisers and animal wastes, with pesticides from farm and other uses, but also with many other items including—an old unintended effect—lead (Pb) contamination due to the use, up until 1995, of lead metal in the piping of water distribution networks.
2) The confirmed presence of 'mad cow disease'—in French *la vache folle*—in herds of several European countries including France (and fears of possibly widespread presence in countries where screening has not yet taken place)[22].
3) Controversy over the introduction of genetically modified organisms (GMOs, in French *organismes génétiquement modifiés, les OGM*) into agriculture and, more generally, into processes of food production.

### 3.4.1. Fresh water resources

Water, in the IFEN survey, is at the top of the heap of perceived 'criticalness' of French natural patrimony needing to be husbanded. With the spread of large scale irrigation practices, industrial uses and generally rising per capita domestic consumption, quantitative limits to France's water assets are now a major object of management concern[23]. Yet it is undoubtedly the degradation of water quality rather than quantitative scarcity that

[21] CANARD ENCHAÎNE (2000), *Qu'est-ce qu'on Mange Encore? Nouvelle enquête au fond de nos assiettes*, Les Dossiers du Canard Enchaîné No. 76 (July 2000), p. 5. In fact, the Canard Enchaîné had published a similar Dossier two years previously (CANARD ENCHAÎNE (1998), *Qu'est-ce qu'on Mange?* Les Dossiers du Canard Enchaîné No. 68, Paris, July 1998. The catalogue of bizarre contaminations, suspect food processing and doubtful marketing practices is, sadly, based carefully on established facts.

[22] At the time of drafting this article (March 2001), there was also a major outbreak of the more classical 'foot-and-mouth disease' amongst sheep in the United Kingdom, with risks of spread to other parts of Europe.

[23] France has been one of the pioneers in Europe for the testing of concepts and empirical procedures for systematic accounting for water. For some years the Eurostat Task Force on Water Satellite Accounting has worked on consolidating a framework and sets of tables for Water Satellite Accounting, taking into account results from pilot studies by Member States, notably France.

is the dominant preoccupation. In many farming regions, great increases in productivity have been achieved through mechanisation of farming and intensive use of inputs from the outside (fossil energy and, more especially, chemical fertilisers and herbicides), and irrigation practices. This has resulted in the now characteristic profile of chemical contamination of groundwater and surface water, and of foodstuffs themselves. Although progress is often cited in the mastery of specified categories or regions of water pollution, there are new announcements almost weekly of contamination thresholds being transgressed—notably for town drinking water supplies, implying the closure of extraction points and/or the need to take remedial action[24].

### 3.4.2. The mad cow disease

The *vache folle* crisis, by the end of 2000, had taken on major economic and political proportions in France and across the European Union. Revelations of infection, and of possible pathways of infection via transports—more or less illicit—of cattle feed made with suspect animal inputs (etc.) and non-observation or non-quarantining of infected animals (etc.), have continued to persist through 2001 at (at the time of final revisions) 2002. The financial and societal repercussions for the farming sector are already very far-reaching, even while knowledge of the extent of infections and of the transmissibility of the disease remains very incomplete. Apart from immediate economic costs:

> First, it is agreed that, whatever the other factors playing their part, a major cause of the fiasco (in Great Britain first of all and then, once the UK situation became publicised in the mid-1990s, in France and other European countries since) has been the tendency, despite risks, to seek low costs for beef production and low disruption of the sector—the perverse result being very high costs and very high disruption (not confined only to the beef producing sector).
> Second, an illustration is given of the complexity of biological processes and ecological systems—including pathways of infection and of transmission from one species to another of a cause of sickness—and of the irreversibility of the 'unintended' innovations introduced by human agency.
> Third, a striking sensation is conveyed of the loss of integrity of basic foods and, beyond and beneath that, of biological and environmental life-support conditions.

### 3.4.3. Genetically modified organisms (GMOs) in food and agriculture

The years up to 1996 in France were marked by an substantially pro-GMO policy outlook. During 1997–1998, government policy on agricultural GMOs began to oscillate, in response to demands for a more precautionary approach to environmental and health risks and for more transparent and participative decision-making procedures. In December 1998 the French high court (*Conseil d'Etat*) repealed the authorisation for cultivation given for the transgenic maize, arguing that the government had not taken sufficient account of the precautionary principle. By the end of 1998, transgenic crops had become a focal point for broader controversies about science, technology, and environmental risks in France. In June 1999, the French government called for (and in effect obtained) a moratorium, at the level of the European Union (EU), on any further authorisations for the commercialisation of GMOs[25]. In short, in June 1996 France was, within the EU, the Member State with the most supportive policy toward the introduction of GM crops and food

[24] A case study analysis of water pollution due to agricultural production, and an appreciation of the water–soil matrix as a vulnerable natural capital for the Bretagne (Brittany) region, is found in Schembri and Douguet (2000); see also Douguet et al. (2000), Bretagne Eau Pure (1998), IFEN (1998), Giovanni (1998) and Sebillotte (1999).

[25] This summary is based on the documentation by Marris (2000), in work carried out at the C3ED in the project Public Perceptions of Agricultural Biotechnologies in Europe (PABE), funded by the European Commission (contract FAIR-CT98-3844) during 1998–2000, co-ordinated by the CSEC at Lancaster University, UK. See Marris (2002).

onto the market; by June 1999 France had become one of the most reticent of EU Member States[26].

The Centre-Left-Green coalition government (Prime Minister Jospin) that came to power in late 1997, had oscillated on permits for GMO cultivation, and announced various measures aimed to improve transparency for the public, notably the intention to launch a broad public debate on GMOs. In 1998 a Consensus Conference was organised (following the model of Danish Consensus Conferences), whose recommendations addressed issues of better information (including separation of risk evaluation from commercial interests) and prudence in the face of uncertainty (see http://www.senat.fr/opecst). Questions of food security and GMOs had become the object of numerous discussions involving scientists, agricultural sector organisations and individuals, public authorities, NGOs and the general public[27]. On the 5 June 1999 a group of more than 50 persons including leaders of the *Confédération paysanne* (notably José Bové and René Riesel) and several dozen Indian farmers, forced entry into a CIRAD research establishment at Montpellier and destroyed several thousand plants of a genetically modified rice[28]. At a French cabinet meeting on 23 June 1999 the Jospin Government decided that it would call for an EU level suspension of further authorisations for the commercial release of GMOs at the European Council of Ministers to take place on 24–25 June 1999. Four countries supported the French position, sufficient to create a de facto moratorium. Seven other countries signed a separate declaration, which also urged for caution with regard to the commercialisation of GMOs. This meant that no more authorisations for the commercial release of GM crops and foods would be issued in the EU[29]. At the time of final writing, the French public remains deeply sceptical about GMOs, which are widely associated with 'globalisation' and the 'fragilisation' of the local economy and ways of life.

## 4. Sustaining traditional forms of life

Once the 'reverse side of progress' is admitted as an inherent by-product of the historical choice of modernity, what can we say about the ways that different socio-cultural frameworks enhance or inhibit capacities for response? French society, along with many others, is entering the phase of a general *paradox*, which involves the invention of policies and governance practices that seek self-consciously to manage these hitherto 'unintended' (and so often negative) dimensions of social, technological and environmental change.

We may say, using Wittgenstein (1978) language, that environmental awareness is not just a matter of opinions, but rather a matter of people displaying, individually and collectively, *different forms of life*. This paper has sought to combine the 'generic' concept of environmental functions (coming from contemporary ecological economics), with an attention to specific cultural forms of the French relation to their *patrimoine naturel*, in order to present an interpretative analysis of preoccupations within French society for the maintenance of CNC.

[26] At the European Council of Ministers on 25 June 1996, France was the only government to support the application by Novartis for the authorisation to commercialise a GM maize (Bt176), whereas at the meeting of this same Council on 25 June 1999, the French government, (with Greece) led a call for the suspension of all further authorisations for the commercial release of GMOs.

[27] An example is the Forum-Débat on "Sécurité Alimentaire et Santé du Consommateur" held on 17 May 2000 at the Ecole Normale Supérieure Sciences in Lyon; see Agro Projets Etudes (2000).

[28] The CIRAD is the Centre de Coopération Internationale en Recherche Agronomique pour le Développement. Its work in the GMOs field has become controversial partly because of accusations of a heavy influence of GMO companies on the research orientations (meaning that, rather than the companies subsidising public good research, the public purse is allegedly financing private commercially oriented research...). The persons arrested on charges of wilful damage (etc.) are—as of early 2001—yet to be tried.

[29] In May 2000, it was reported in major French papers that fields had nonetheless been planted in several EU countries (including France, the UK and Sweden) of an insecticide-resistant genetically modified rape seed (colza). The seeds of the genetically modified variety had supposedly been mixed 'by error' with those of non-modified varieties.

It has been shown that French people express, in a variety of ways, a strong preoccupation with maintaining integrity of their environmental space and ecosystems, where this is to be understood in the sense of the *terroir*, as the quality of food, as the identity and integrity of an organism, or the relation of oneself to one's origins and symbolic space. For example, our discussion highlights the compatibility of the doubts expressed over possible risks associated with GMOs in agriculture and food technologies, with wider French concerns with the integrity of their *terroir* (products of the land) and patrimoine (both cultural and physical environment heritage). One can thus discern deep socio-cultural reasons for the emergence of suspicion about the GMOs and, more widely, for the economic and technological forces that they have come to represent. The same reasons are at work in the French society's reactions to the *vache folle* and other food quality and health security scandals, as we have seen[30].

To conclude the paper, we wish to situate these cultural forms in relation to certain other features of the French political culture, in order to orient reflection on prospects for a successful sustainable development strategy in France. French society is characterised by a strong polarity between, on the one hand, the managing elites who affirm for themselves (and according to the public are supposed to have) a technical and managerial competency and, on the other hand, the public themselves who affirm a somewhat fatalistic 'irresponsibility' about the overall trends of society. The particular ways that doubts and mistrust are expressed over the *marée noire* of eventual environmental defilement and decay, are strongly interdependent with, or coloured by, this dualistic 'political culture'.

Jolivet (2001) has suggested a sociological schema that locates the middle class French citizen as an intermediary between, on the one hand, a patrimonial tradition and, on the other hand, an elite universe of public decision-making and technical expertise. Through an empirical study of suburban Paris householders' attitudes concerning domestic waste, recycling and rubbish disposal, he has highlighted the notion of a 'partnership' that, according to the views expressed by the householders, should exist between the 'Technical Universe' (represented in this case by the municipal authorities, etc.) and the 'Domestic World' (populated by the households). The inhabitants of the Domestic World affirm their commitment to the maintenance of a clean and proper domestic living space, their local environment, as members of community in a prolongation of patrimonial tradition. They affirm, as a complement to this, that it is the responsibility of the public authorities to ensure the operation of an effective waste-disappearance system. In effect, the householders construct a sense and a practice of civic duty that makes an articulation between the two worlds—the Domestic and the Technical Universes. This civic duty is epitomised by the act of appropriately transporting the rubbish-filled plastic bags (often being precisely the supermarket sacs which come in filled to overflowing with useless packaging...) out the door and into the storage room or the bin in the street. Responsibility in matters of separation of rubbish (*tri*) and recycling manifest the same schema. If the system put in place by the Technical Universe is easily comprehended and accessible, the household members will sort their waste as a gesture of their self-respect, affirming their status in a civil society[31].

But (the householders ask somewhat rhetorically), is there really a process of waste management and recycling—and, by extension, of management and governance of water pollution, radioactive wastes, toxic contaminations in chick-

[30] C.f. Benoit Browaeys (1999), Apoteker (1999), ECOROPA (1997) and Marris and Joly (1999). Further examples could be cited, such as the concentrations of a variety of toxic 'heavy metals' in the sludge that is extracted from sewage treatment plants and that has, 'traditionally', been spread onto farmland as a source of nutrients. There was a long interval between some knowledge that this contamination was probably the case, and a public admission of the problem.

[31] This work by Patrick Jolivet has been carried out in doctoral studies at the C3ED, Université de Versailles St-Quentin-en-Yvelines. On domestic waste and refuse, see also Ademe (1996) and Maresca and Poquet (1994).

ens and recycled sewage sludge, etc.—going on out there, that assures the 'scaling up' of the individual civic responsibility to the fulfilment of a societal duty towards future generations? Here they have doubts, and for good reason. Recent years have seen many breakdowns of regulatory competency or effectiveness—the current *vache folle* crisis, but also (among others) the widespread use of asbestos in schools and other public buildings many years after carcinogenic dangers were well known; the distribution of blood known to be at risk of AIDS contamination; the failure of the French state to provide protection against or compensation for marine oil spills, etc., etc. These are the sorts of events that, one observes, justify the ordinary French public to adopt an exasperated view of the silliness and myopic self-interest of many members of the governing classes and the Technical Elites.

Yet, this exasperation is largely fatalistic: it is not strongly converted into social or political commitment towards reform[32].

In the French culture, sustainability would have much to do with holding, renewing, maintaining a 'patrimonial' tradition, that is, the integrity of the Domestic World and of the *patrimoine naturel* at local and regional scales. Despite a certain fascination with technological sophistication, the mainstream of French society is deeply change-resistant. Our interpretation is that the ordinary members of French society, through their affirmations of responsibilities (albeit limited) as citizens, reach out from their Domestic World(s) and extend the *hope* that the elites of the Technical Universe will indeed play their part to assure the maintenance of the integrity of the *patrimoine*. But (as they know) nothing is less sure. This is a public who readily admit that indeed they will live (or die) with the outcomes of whatever decisions that might be taken—or, in the case of breakdowns in competent regulation, not taken—by the powers-that-be of the Technical Universe.

In the case of risks associated with genetic engineering, many French people are aware of possibilities of ecological ramifications and, more particularly, modifications to 'human nature' itself. During discussion groups that took place within the project *Public Perceptions of Agricultural Biotechnologies in Europe* (see Marris, 2000), some participants asked, "What does a sheep become when you put human genes into it?"—and conversely, when does a human become no longer human? The very categories of 'Being' become blurred. What is the meaning of 'integrity' then? In the case of nuclear safety issues, the French public was willing to accord confidence in the past concerning reactor security in the production of electricity. But they do not seem so easily able to live with the symbolic charge of stocking long-life radioactive wastes like barrels of wine in an underground cave[33]. In the case of dioxin in the chickens and of nitrates and pesticides in the drinking water, the integrity of the *terroir* at the heart of cultural identity is betrayed.

Whether, or not, these distinctive notions of integrity and civic responsibility can be mobilised as positive forces for sustainability as a creative *projet de société*, is deeply uncertain and remains to be seen. The visible political dualism combined with the sometimes fatalistic character of the French people, would favour the speculation that the present and future signs of environmental degradation and the fracturing of traditional social ways, will be acknowledged with resignation rather than protest and revolt. Yet, the under-

[32] This paper was drafted nearly a year before the French Presidential elections of May 2002 in which the 'National front' candidate Jean-Marie Le Pen obtained the second-highest score in the first round of voting (and, hence, a run-off in the second round against Jacques Chirac). It has widely been signalled during the discussions in the weeks following the election, that a major part of Le Pen's popularity is due to the sentiment that he speaks for the concerns of ordinary French people, particularly in rural areas and smaller towns, whose economic livelihoods and social fabric is disintegrating and whose interests and fears are being neglected by the 'technocratic' orientations of the mainstream parties on the 'Left' and 'Right'.

[33] Responses in the 2002 Eurobarometer survey have highlighted that the French (and the public of European nations generally) express significantly higher degrees of concern and more lack of confidence about the management of radioactive waste than about nuclear electricity generation plants themselves. The questionnaire style of the Eurobarometer does not, however, permit to explore the character of this mistrust.

currents of dissatisfaction with the trends of 'globalisation' together with disenchantment with the established Left/Right political regimes, creates a volatile social landscape in which 'punctuated evolutions' are not to be ruled out.

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