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# ECOSYSTEM-BASED APPROACH AND RESTORATION OR COMPENSATION FOR ECOLOGICAL DAMAGE

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ECOSYSTEM APPROACH  
ECOLOGICAL DAMAGE  
RESTORATION  
COMPENSATION  
IN-KIND REPARATION  
METHODS OF ASSESSMENT  
DAMAGES

**ABSTRACT.** – The Law of August 8, 2016 for “the Recovery of biodiversity, nature and landscapes” introduced the principle of compensation for ecological damage into French civil liability law. The definition of ecological damage given by the Law refers to the work of the Millennium Ecosystem Assessment by distinguishing the ecosystem elements and their functions and services. The purpose of this article is to investigate whether the different ways of repairing ecological damage are in line with an ecosystem-based approach. For a very long time, legal doctrine has argued that reparation for ecological damage should be made “in kind”. But restoration to return to the *statu quo ante* is not always possible and can sometimes prove dangerous for the ecosystems concerned. It appears that the most appropriate in-kind repair often consists simply in recreating the conditions that will allow new processes and new functions to be expressed. Where reparation in kind is impossible, to what extent are the various methods of assessment currently used by the courts compatible with an ecosystem-based approach? Finally, what are the recommendations that the scientific community can make to the judicial authorities to avoid mistakes being made on this point?

## INTRODUCTION

Law n° 2016-1087 of 8 August 2016 on “the Recovery of biodiversity, nature and landscapes” (JORF, n° 0184, 9 August 2016) introduced for the first time in French Law the principle of compensation for ecological damage by providing that “Any person liable for ecological damage shall be required to make reparation for it”. Until then, the only reparable damage was that which was caused to a human person or to property belonging to a human person. In order to demonstrate that this measure was a new step in the evolution of the classical law of civil liability, the legislator decided to introduce this principle into Article 1246 of the Civil Code (Taylor 2018, Martin 2017, Neyret 2017).

Obviously, the first question raised by this law is how ecological damage is to be defined. The answer to that question is given in the subsequent article (Art. 1247), which states that ecological damage is “a non-negligible impairment of the elements or functions of ecosystems or of the collective benefits derived by man from the environment”. It should be noted that this definition refers very directly to the work of the Millennium Ecosystem Assessment (MEA 2003) by distinguishing the ecosystem elements and their functions and services (the latter being here referred to as “collective benefits derived by man from the environment”).

It should be borne in mind that, prior to the adoption of this text, the courts had already repeatedly condemned those liable for ecological damage to repair it, but they did so without a solid legal basis and, above all, prior to

the adoption of any clear definition of ecological damage (Van Lang 2008, Neyret 2010, Neyret & Martin 2012, Jegouzo 2013, Martin 2014, 2015a).

But it is one thing to define ecological damage, and quite another to determine how reparations are to be made for it. On this point again, the 2016 Act provides useful clarification. It stipulates that ecological damage must be repaired “*first and foremost in kind*”, but it also provides that if reparation in kind is impossible, for any legal or factual reason, the judge may order the person liable to pay damages, which must be “*allocated to the repair of the environment*” (Article 1249 of the Civil Code).

The purpose of this article is precisely to deal with the reparation for ecological damage, both before and after the adoption of the law, in order to investigate whether the modalities of implementation of such reparation are in line with an ecosystem-based approach.

The first question is relative to reparation “in kind”. Is reparation for ecological damage “in kind” always compatible with an ecosystem-based approach? Is there not a risk that it may open the way to manipulations that are dangerous for ecosystems?

Where reparation in kind is impossible, the text provides for the awarding of damages. In this case, an assessment of the ecological damage is required. What are the various methods of assessment currently used by the courts and to what extent are they incompatible or compatible with an ecosystem-based approach?

To conclude, what are the recommendations that the scientific community can make to the judicial authorities to avoid mistakes being made on this point?

## IN-KIND REPARATION FOR ECOLOGICAL DAMAGE AND THE ECOSYSTEM APPROACH

For a very long time, legal doctrine has argued that reparation for ecological damage should be made in kind (Prieur *et al.* 2019). The idea seemed to be that, since the damage had been caused to the natural environment, there was no better remedy than “restoring” the damaged or degraded environment. Some texts, for example European Directive 2004/35/EC of 21 April 2004, which established a system of compensation for ecological damage based on administrative policy and not on civil liability, had even excluded any compensation other than compensation in kind (Alt 1995, Martin 2015b). Fortunately, the law of 2016 was more reasonable by simply stating that compensation should be primarily – but not exclusively – in kind.

In fact, a first question arises as to what is meant by “reparation in kind”. First of all, one must be aware that in the case of a fairly large number of hypotheses – fortunately less and less frequent nowadays – the judge must decide, in spite of the fact that he has absolutely no expertise in the scientific and technical data of the situation presented to him; most of the time, the lawyers who plead the case as plaintiff or defendant are hardly any more competent. It has often happened – and still happens – that reparation in kind was simply assimilated to the reintroduction of a few individuals of species that had disappeared from the damaged environment, without concern for whether all the balances, processes and functions of the affected ecosystem would have remained as they were before the accident. It is extremely difficult for a magistrate to understand that reintroducing a few eels and crayfish into a river from which they had disappeared as a result of pollution, for example, is not “restoring” or even “repairing in kind”. Most of the time this results in something useless because the reintroduced species will not be able to survive and/or will prevent other balances from emerging. It is not surprising, however, that this partial species-specific approach is still sometimes used. Because it is the oldest, it is enshrined in the shared traditional environment culture; because it is the simplest, it allows for a quick solution and gives the illusion of satisfying the plaintiff. The magistrates who deliver rulings, like the lawyers who draft the claims for compensation, have, in most cases, no training in ecology, and the number of competent experts, registered on the lists of experts approved by the Courts of Appeal and who could enlighten the judges, is infinitesimal. For years now, the best-informed legal doctrine has been calling in vain for the creation of a list of accredited experts in the field of the environment and ecology (APCEF 2016).

If we therefore set aside this “false” reparation in kind, the fact remains that the expression can still be subject to various interpretations. In the minds of some authors, reparation in kind must necessarily lead to rehabilitation and

thus to the restoration of the *statu quo ante* (Prieur *et al.* 2019). This rather restrictive interpretation of reparation in kind may correspond to certain situations. There are, in fact, hypotheses in which rehabilitation is technically possible, ecologically appropriate and ethically acceptable. This was for example the case in 2004 when *génépi* pickers were caught in the core area of the French Mercantour National Park in possession of more than 6,000 strands of this plant. *Génépi* refers to Alpine plants of the genus *Artemisia* that provide the flavor and the color of an herbal liqueur popular in the Alpine regions of Europe. They had acknowledged the facts and admitted that this harvest enabled them to prepare about 150 liters of liqueur, which they would sell at a good price in Italy, where the plant pickers came from. The Mercantour National Park submitted a request for reparation in kind, explaining to the Court that the offenders had committed a breach of the regulations, but that they had nevertheless more or less respected the site and the *A. umbelliformis* plants, which had not been uprooted or degraded. It was therefore possible to collect seeds on site to ascertain the origin and genetic characteristics of the seeds, then take them to INRA (*Institut National de la Recherche Agronomique* – French National Institute of Agricultural Research) laboratory in Antibes where they were cultivated, before moving the new plants to the original site. Two monitoring visits per year for 3 consecutive years seemed necessary. According to the specialists, a quarter of the seeds collected were lost in the operation and a certain percentage of the new plants did not thrive. This had to be taken into account when trying to find the 6,000 illegally collected strands at the end of the operation. The judge agreed to charge the offenders with the restoration cost. They were condemned to pay more than 18,000 €! (Chevassus-au-Louis 2009). This was possible because it was technically feasible, and the ecosystem had not been disrupted by the harvesting.

However, it is often the case that developments carried out or observed pollution have interrupted or altered some ecosystem processes or functions, making true restoration impossible, strictly speaking. Should it then be considered that, in such a case, the damage is irreversible? No text defines what is irreversible damage. The courts themselves refrain from giving a definition. As a general rule, they consider that restoration is not possible where development, accident or pollution have caused the disappearance of the various elements, processes and functions which made the ecosystem live. From this observation, three kinds of decisions can be identified.

Sometimes, courts may infer that they must forego compensation in kind; they then choose to grant the claimants (often an NGO) financial compensation. This can be seen, for example, in a case decided by the Court of Appeal of Chambéry on 30 June 2011 (reported by Neyret & Martin 2012). Having acknowledged the development of a track dedicated to 4x4 vehicles in the French

Vanoise National Park with ditches encroaching on wetland and resulting in the destruction of the habitat of the protected plant *Cirsium heterophyllum* (Linnaeus) Hill, the Court of Appeal of Chambéry condemned the offenders to compensate for the damages, without ruling out a compensation in kind, which was deemed impossible.

At times, on the contrary, the judges, while recognizing the impossibility of returning to the *statu quo ante*, consider that it is necessary to adopt a broader interpretation of “reparation in kind”. They then accept that the reparation can take the form of a physical intervention aiming at trying to (1) erase what had been done illegally, and (2) either restore the degraded habitat as faithfully as possible, or endeavor to recreate the conditions for natural restoration, knowing that this might span a relatively long period of time.

With regard to work aimed at erasing what has been done illegally, the courts rarely hesitate to order it either as an additional penalty (Brunin & Timbard 2015) or as compensation. Such a decision can often be approved both in legal and ecological terms. On the legal level, it leads to erasing the consequences of an illegal act; on the ecological level, it has no negative consequences when the illegal behavior had already destroyed or very strongly degraded all the ecosystems concerned. Thus, for example, in a case decided by the Bordeaux Court of Appeal (C.A. de Bordeaux, 10 April 2009, reported by Neyret & Martin 2012), illegal dredging work had been carried out on the stream bed, which caused the removal of vegetation and the obstruction of the old watercourse, causing, according to the Court, “the disappearance of all flora and the damage to the entire living environment”. The Court approved the Criminal Court for having imposed as an additional penalty the “restoration” of the site, that is to say, in reality, the reopening of the old watercourse, which had been filled in. But this is not always the case. Sometimes there is a risk that the intention to erase the consequences of an illegal act aggravate the damage caused by the illegal act itself. Several studies have shown, for example, that the use of heavy methods to “clean” beaches or rocks soiled by oil pollution could have very negative consequences for the environment (Boudouresque *et al.* 2019). Despite this well-documented observation, it is very common for such work to be ordered or spontaneously proposed by polluters and their insurers to minimize some damage, particularly of an economic nature, and to be validated *a posteriori* by the courts.

As for the works intended to reconstitute the degraded environment, they may be approved by the judge without always-adequate examination of their suitability. Advances in ecological engineering sometimes lead applicants to present a project for the “reconstruction of living organisms”, which will claim to be able to compete with genuine restoration. Thus, for example, following damage to a *Posidonia oceanica* (Linnaeus) Delile meadow following the sinking of a ship and the attempt to tow the ship-

wreck away, consideration was given to reconstructing the meadow by “replanting” in the mat of *P. oceanica* cuttings (Martin 2020a). Such an in-kind repair project raises considerable difficulties, both ecologically and ethically. Ecologically, it is unlikely that the destroyed or degraded ecosystem can be reconstructed, since a multitude of factors that are difficult to control (currents, water temperature, occupation of the area by species that will have taken advantage of the damage caused to establish themselves, etc.) may come into play. From an ethical point of view, except the often exorbitant cost of such interventions for an uncertain result (Boudouresque *et al.* 2012), the question arises as to whether such underwater “gardening” work is compatible with the nature of a *protected* area and with the spirit that must govern its management. That is why it often seems preferable for the judge to take into account the possibilities of natural regeneration of the site and to draw the conclusion that the so-called “restoration” or “repair in kind” works are limited to attempting to reconstitute the conditions of a natural evolution of the degraded site, by organizing the monitoring of the affected environment and by agreeing to consider that part of the damage is not reparable in kind and must be the subject of financial compensation. In the case already cited, which gave rise to a decision by the Bordeaux Court of Appeal in 2009 (C.A. de Bordeaux, 10 April 2009, reported by Neyret & Martin 2012), the Court noted that “the minutes drawn up by the agents of the ‘Conseil Supérieur de la Pêche’ (Higher Council for Fisheries) indicate that the readjustment time (sic) for a return to the original profile will in any event be more than 10 years and that risks of a readjustment time of more than a hundred years are not to be ruled out. Consequently, the restoration of the site ordered as an additional penalty by the court has not removed the consequences of the offence and there remains a certain environmental damage”, which the Court makes good by awarding damages to the acting NGO calculated on a lump sum basis (on the methods of monetary evaluation of the ecological damage, see below).

At this point, it is possible to draw some partial conclusions: firstly, that the expression “in-kind repair” covers very diverse realities; secondly, that restoration and attempts to return to the *statu quo ante* are only possible in fairly rare cases and can sometimes may have additional negative effects on the ecosystem concerned; and finally, that the most appropriate in-kind repair often consists simply in recreating the conditions that will allow new balances to be established, and new processes and functions to be expressed.

These conclusions overlap with those that can be drawn after examining the other alternative. Where the judge finds that in-kind compensation is not possible for legal or factual reasons, he may decide to award financial damage compensation to the plaintiff, although the law specifies that these amounts must be “allocated to the repair of

the environment". This option obviously raises the very difficult question of how to assess ecological damage.

### FINANCIAL COMPENSATION FOR ECOLOGICAL DAMAGE AND THE ECOSYSTEM APPROACH

It is obvious that financial compensation does not raise any difficulty when the damage is a traditional, material kind of damage, for example, damage to private property or to an economic activity. For a very long time, judges have found and developed methods to assess the personal injury and physical suffering suffered by a person, depending on his or her age, sex, occupation, hobbies, etc., in order to determine the amount of compensation to be awarded. There are even more or less official scales, which make it possible to assess such injuries accurately. It is already more difficult to assess moral damages, but for decades the courts have been willing to repair – and therefore assess – the pain and grief caused by the loss of a loved one, whether a person or an animal, or the harm felt by a person whose honor and reputation have been damaged. The assessment of harm, on the other hand, becomes very delicate when it concerns living and inter-related beings and (eco)systems, which are as far away as possible from the commercial and even emotional universe, at least as it is perceived by humans in occidental culture.

The following discussion examines how the courts are attempting to respond to this challenge, asking whether the valuation methods they use are compatible with an ecosystem-based approach.


If one accepts this schema, five different approaches can be distinguished in case law, noting that these methods are not mutually exclusive and can sometimes be combined.

It is the flat-rate assessment that was used first and which, unfortunately, is still quite often applied: the ecological damage is assessed through an element (*e.g.*, the individuals in a population of animals, one cubic meter of water, one hectare of forest) to which a flat-rate value is given and which is multiplied by the number of units affected by the damaging phenomenon. An illustration of this can be given through the case known as “*the Montedison red mud*” that this company was dumping at sea off Cap Corse (Corsica). As the Bastia fishermen’s guild (*La Prudhomies des Pêcheurs*) had acted to seek compensation for the damage caused to the environment, the *Tribunal de Grande Instance* of Bastia (judgment of 8 December 1976), confirmed by the Court of Appeal of Bastia (judgment of 28 February 1977), proceeded to the following reasoning (on the whole case, see Kiss 1975, Remond-Gouilloud 1979, Huglo 1992): taking into account the tonnage of fish exploited in the waters by the fishermen in that area, the court deduces an average “value” of the

m<sup>3</sup> of sea water and, taking into account the extent of the pollution, it multiplies this value by the number of m<sup>3</sup> of polluted water. This way of proceeding combines a plethora of approximations and can be criticized for a variety of reasons. On the one hand, it only takes into account the economic damage as the damage to the environment – and only on a very rough basis; on the other hand, it does so on a flat-rate basis by giving a value per m<sup>3</sup> of water deduced from the supposed average presence of a certain quantity of fish that can be caught; finally, it completely ignores ecosystems that are never mentioned.

This flat-rate method has also been encouraged by the practice of the French *Office National de la Chasse et de la Faune Sauvage* (National Hunting and Wildlife Board) of publishing, at least until 2012, scales determining the “value” of an individual belonging to certain game species (Fig. 1).

The organization claimed, without demonstrating it, that this value represented on average the cost of reintroducing and monitoring an individual of the same species. In any event, a lawyer who presented the judge with the



Office National  
de la Chasse  
et de la Faune Sauvage

CONSEIL D'ADMINISTRATION  
Séance du 19 juin 2012  
Décision n° 12/17

VU L'article L. 421.1 du Code de l'environnement portant création de l'Office national de la chasse et de la faune sauvage,

VU L'article R 421-13 du Code de l'environnement relatif au Conseil d'administration de l'Office national de la chasse et de la faune sauvage,

VU Le règlement intérieur du Conseil d'administration,

VU L'avis de la Commission des finances du 12 juin 2012

Sur le rapport du Directeur général de l'Office national de la chasse et de la faune sauvage, le Conseil d'administration décide de fixer comme suit les valeurs de référence devant les tribunaux des principales espèces de gibier qui peuvent être chassées :

**GRAND GIBIER**

Cerf élaphe.....	1 700 €
Biche.....	1 200 €
Faon.....	900 €
Cerf de Corse.....	3 200 €
Cerf, biche, sika.....	300 €
Mouflon continental.....	1 000 €
Mouflon en Corse.....	5 000 €
Daim.....	300 €
Chamois.....	1 200 €
Isard.....	1 800 €
Chevreuil brocard.....	950 €
Chevrette.....	950 €
Sanglier.....	500 €

1/2

Fig. 1. – The flat-rate method of the French ‘*Office National de la Chasse et de la Faune Sauvage*’: ‘value’ of an individual belonging to certain game species. *Cerf élaphe*: red deer; *biche*: doe; *cerf de Corse*: Corsican deer; *cerf, biche, sika*: sika deer (males and females); *mouflon continental*: continental mouflon; *daim*: fallow deer; *chamois*: Alpine chamois; *isard*: Pyrenean chamois; *chevreuil brocard*: roe deer (male); *chevrette*: roe deer (female); *sanglier*: wild boar.



fee schedule from a specialized public institution was very likely to be followed and could perhaps even see in the judge's eyes a certain glimmer of gratitude for having made his work so much easier! However, the assessment is typically based on a species approach and does not even consider the population density in a given place. For example, the Alpine chamois (*Rupicapra rupicapra*) was "worth" 1,200€ in the entire Alpine region, whether it was shot within a National Park or outside its boundaries, and whether it belonged to a dense or sparse population. The destruction of an entire population was therefore not subject to any coefficient to re-evaluate the damage.

Finally, in the most recent period, it can still be seen that some magistrates continue to assess ecological damage on a flat-rate basis. For example, the sum of two million Euros for the significant damage caused to the Reunion National Park as a result of arson is not considered "excessive" by a Court of Assizes, if we relate it to the number of inhabitants of France (judgment of the Court of Assizes of Reunion ruling on civil interests of 2 March 2018, reported by Martin 2020b). Similarly, with regard to the harmful consequences of a prohibited fishing action, the Criminal Court of Toulon (date not communicated, reported by Martin 2020b) recently considered that "*in view of the fundamental role of Posidonia oceanica in the coastal ecosystem, the uprooting of P. oceanica by Mr B.'s vessel during its fishing activities in an illegal zone necessarily led to the partial destruction of the surrounding ecosystem in the zone, which is characteristic of certain material damage; that damage should be compensated by the allocation of a lump sum, which should be fixed in the amount of € 2,000*". In this hypothesis, the Tribunal does refer to the "coastal ecosystem" and the "ambient ecosystem", but it concludes that a lump sum should be awarded, the amount of which is at no time justified. The difficulty in assessing harm cannot be a justification for such 'rule of thumb' approaches. The latter seriously undermine the educational mission of legal action and do nothing to enlighten the person responsible and public opinion on the value of destroyed or degraded environments. "*Moreover, they are experienced by the responsible party only as an additional "fine" and not as compensation for the value of destroyed natural "capital", which must, as far as possible, be restored*" (Martin 2020b).

Another much more satisfactory way of assessing damage is to do so by reference to the cost of rehabilitation, even if such rehabilitation cannot be implemented for technical and/or ethical reasons. As pointed out above, there are cases where it does not seem possible or desirable to carry out reconstruction of living organisms. Nevertheless, it may be interesting to assess what such an operation would cost, in order to give the judge an evaluation of the prejudice by reference to such a cost and thus avoid underestimating the prejudice.

A third way of proceeding is to assess the damage by reference to the budgets spent in pure loss as a result of the occurrence of the harm. A National Park spends a specified budget to manage a species present in its territory and its habitat or a particular ecosystem. Poaching, pollution and accidents have rendered this expenditure useless and it will take several years to return to the initial situation: the damage is equal to the annual invested budget multiplied by this number of years. At first reading, such an accounting and financial evaluation can be considered as having little to do with the environment in general and with degraded ecosystems. This initial reaction must undoubtedly be overcome, especially when the damage has been caused on the territory of a protected area. Indeed, in this hypothesis, taking into account the budget spent in pure loss, multiplied by the number of years necessary for the restoration of habitats and degraded ecosystems or the reappearance of new biological balances, gives an evaluation of the damage that takes into account the management method. If it is based on an ecosystem-based approach, the assessment reflects this reality.

A fourth method of assessing ecological damage is to assess ecological harm by reference to the value of ecosystem services that have been lost as a result of the damage (Doussan 2009, Mongruel *et al.* 2016, Doussan 2017). As is well known, a *Posidonia oceanica* meadow provides several ecosystem services (Boudouresque *et al.* 2016). The value of these services can be assessed by reference to the costs that would have to be incurred to obtain them. If it takes 20 years for the meadow to gradually recover, it is possible to calculate the loss incurred during that time. In the case already mentioned of damage to *P. oceanica* meadows caused by a stranded wreck, where the attempts at towing further aggravated the damage, it was the ecosystem services of *P. oceanica* that were identified and then evaluated by reference to work published in the scientific literature (*e.g.*, Blasi 2009). The National Park chose a bottom-line value of 172 €/m<sup>2</sup>/year, which is considered to be seriously underestimated. Considering the average rate of recovery of 5 cm/year, from the margins of a living herbarium, the National Park proposes a table establishing the "shortfall" in ecosystem services over 20 years and arrives at the figure of 722,400 € (Martin 2020b).

Finally, the last method, which is often associated with the previous one, adds to the evaluation the investments made necessary to accompany the natural restoration of the environment. The idea here is that it is preferable to accompany a natural restoration, which obviously involves costs of follow-up, monitoring, sometimes development (for example, the installation of substitute moorings, setting up surveillance of the area, etc.). It is in this spirit, for example, that the Port-Cros National Park has attempted to assess the ecological cost resulting from the damage caused to the *Pinna nobilis* by the wreck of a ship and the attempt to refloat and tow it. *Pinna nobilis* is an

emblematic and threatened species (Rouanet *et al.* 2015). As the findings established that at least 3 individuals of this shell had been destroyed, the National Park refers to the cost of the moorings it has installed to compensate for the ban on anchoring in certain areas, which are intended to protect the *P. nobilis* present. Given the average density of *P. nobilis* in the areas concerned, the cost is 2,347 € per protected individual. It is deduced from this that expenditure of the same nature and amount will have to be incurred to protect and make possible (although it is not certain that this can be achieved) the recolonization of the degraded area with an equivalent number of individuals belonging to this species. As this case has not yet been tried, it is not possible to know whether this request will be granted by the court.

In any case, the evolution of Court judgments here described – which is obviously not linear and is still in its infancy – is largely driven by the dialogue between lawyers and ecologists: some assessments were – and still are – carried out in a totally arbitrary manner; then came the time when progress in ecological engineering suggested that the relevant reference could be found in active reconstruction and rehabilitation; while today the pendulum is swinging towards taking into account the ecosystem services lost and the cost of the support needed for the natural restoration of degraded sites. This movement follows the gradual emergence of ideas on the need to proceed, as far as possible, to the ecosystem-based management of environments and testifies – which is good news – that the law is not insensitive to it (Martin 2020a).

In conclusion, it remains to call on the entire scientific community to share its knowledge developments and analyses in order to help operational jurists (lawyers, magistrates) to apply the texts of the Civil Code in an appropriate and effective way as possible. It seems that three recommendations inspired by an ecosystem-based approach could be proposed:

- To call on the expertise of academics or researchers working in these fields whenever necessary;
- To order rehabilitation and a return to the *statu quo ante* only after such experts have assessed the suitability and possible counterproductive effects of such intervention;
- To give preference, whenever possible, in the assessment of ecological damage, to direct or indirect reference to the loss of ecosystem services and to the expenditure necessary to accompany and monitor the natural restoration of degraded ecosystems.

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