THE DADIA–LEFKIMI–SOUFLI FOREST NATIONAL PARK, GREECE: BIODIVERSITY, MANAGEMENT AND CONSERVATION

Edited by
Giorgos Catsadorakis and Hans Källander

Illustrations by
Paschalis Dougalis

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Editors:

Giorgos Catsadorakis,
P.O. Box 403,
Dadia,
GR-68 400 Soufli,
GREECE
doncats@otenet.gr
g.catsadorakis@wwf.gr

Hans Källander,
Villavägen 6,
SE-240 35 Harlösa,
SWEDEN

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Conservation and management issues for the Dadia–Lefkimi–Soufli Forest National Park

Giorgos Catsadorakis, Vassiliki Kati, Constantinos Liarikos, Konstantinos Poirazidis, Theodora Skartsi, Dimitris Vasilakis and Demetres Karavellas

The main threats to DNP's principal assets are habitat and landscape homogenization, large-scale fires, the over-development and unwise location of wind-farms around the park, poisoned baits and the aesthetic degradation of landscapes. Impediments to effective management are not only local, but most stem from problems relating to the general system of protected areas in Greece. They are of ecological, administrative, legislative and institutional nature, but there is also a lack of political will to find solutions for them. The principal management and conservation goals for DNP must be to preserve farmland of high ecological value, to arrest forest expansion and to increase the amount of clearings. Others are to preserve old trees and mature stands to ensure optimal nesting conditions for birds of prey and to ensure vulture food resources long-term. To reach these goals, a plan for sustainable local development needs to be developed and the existing legal framework must be amended to support it. Scientific monitoring results must inform all processes. The participation of local communities and authorities is crucial. Local forestry objectives must be revised to match biodiversity conservation needs and promotion of environment-friendly practices in agriculture must be ensured.

Keywords: Dadia, Greece, management, protected areas, conservation goals, conservation problems

Introduction

Based on the first published list of the natural assets of the Dadia–Lefkimi–Soufli Forest National Park (DNP) by Poirazidis et al. (2002), the following are considered to be the principal natural and cultural values of the area:

- The agro-silvo-pastoral landscapes and their habitat heterogeneity
- The pure and mixed mature woodlands of pine and oak and a few other rare habitats
- The endemic and/or rare species of plants and animals
- The populations and diversity of birds of prey, with emphasis on the Black Vulture and other rare and threatened species
- Various geological and cultural monuments, such as fossil sites, rock formations, isolated buildings, settlement ruins, architectural elements, ancient fortifications, etc.

Conservation and sustainable development policies for the DNP should target simultaneously the conservation of the above assets, the enhancement of the local economy and the strengthening of the social fabric. Since the DNP does not constitute a separate, discrete or self-sufficient unit either ecologically, socially or functionally, processes within it are strongly affected by regional changes. For instance, many birds of prey, which constitute the park's flagship asset, roam outside the park to feed.

Unfortunately, some of the principal assets of the area are only vaguely stated in the articles of the decree that established the National Park, and so are of limited use as a basis for management plans and decisions.

The present day landscapes and habitats of the park are, as elsewhere in Europe (Blondel and Aronson 1999, Herrando et al. 2003), the result of a random mixture of natural and anthropogenic processes. Disturbances, such as small- and large-scale fires, logging, pollarding, planting, clearing, cultivating, grazing and random field

abandonment add to natural features, such as soil properties, climate, disturbances from fires, floods, erosion, frost, drought and wind, to create present day landscapes.

In fact, perhaps the main threat to the park is that of reduced pressure from the above anthropogenic factors which allows the forest to expand, and which, as in many other areas in Europe (Zervas 1998, Covas and Blondel 1998, Blondel and Aronson 1999, Herrando et al. 2003), makes the landscape more homogeneous. This is expected to favour a few species, but adversely impact more. Human interventions were directly linked to economic activities, social patterns and available technologies of the past and past conditions cannot be revived. Therefore, efforts should focus on defining the optimal mix of interventions for achieving the set conservation goals and try to establish this mix through focused and realistic management policies. Carefully planned and scientifically based grazing, logging, pollarding and cultivation regimes (both forestry and agricultural) are some of these. Obviously, the role of the primary sector remains crucial, both for the local economy and the management necessary for the preservation of the area's natural assets.

This paper is a synthesis of the main conclusions presented in the previous articles of the book and other published data and aims to draw an updated picture of present conservation and management issues in the DNP. The first section presents an overall picture of the natural and anthropogenic context within which management and conservation policies operate. It also describes the main threats to the natural and cultural values of the park and problems connected with implementing effective management policies. This is accompanied by the authors' suggestions for coping with these problems. The main cultural, legislative and institutional framework within which the park operates is outlined in a following section to show the practicalities of implementing management and conservation measures within and outside the park. In the last section, steps needed to take management and conservation of this park forward are put in their necessary national, regional and local perspectives.

Key conservation and management issues – main threats and suggestions for remedies

Some of the assets listed above are today on a satisfactory level of conservation or use, but the maintenance of this status needs continuous management interventions and long-term policies. The situation of some others is not satisfactory and initiatives must immediately be taken towards their improvement. To achieve both an integrated conservation of the natural and cultural assets of the area and an improvement in the living conditions for the local people, a number of issues are important (Table 1). The main ones at stake are:

- Policies and measures to be adopted for areas both within and in the vicinity of the park, to ensure conservation and enhancement of the landscapes, natural resources and biodiversity within the DNP, with emphasis on the rare raptorial birds and vultures.
- Development policies for agriculture, livestock rearing and forestry, and their implementation within and outside the park and how these activities can be harmonized with biodiversity and landscape conservation goals.
- Initiatives needed to ensure long-term food self-sufficiency of the vultures, necessarily associated with specific regional plans for the support of free-grazing stock or large-scale re-introduction and management of wild ungulates, or a combination of the two.
- Revision and improvement of the eco-tourism concept and eco-tourism enterprise in the area to maximize benefits to the local people.

It is clear that all of the above is closely linked to the crucial issues of ensuring effective management and guarding of the DNP and the coordination of local, regional and national authorities. The conservation of the park's assets clearly must not be seen as a matter of measures only within the park. As the home ranges of most large birds of prey and vultures transcend its boundaries (Vasilakis et al. 2008), local measures will have little effect (Newton 1991). Broader threats include: the use of poisoned baits (Skartsi et al. 2008), over-development and problematic location of wind-farms (WWF Greece 2008), changes in land use and land cover in the wider area of Greece and Bulgaria resulting from rural depopulation and abandonment of traditional silvicultural and stock-raising practices (Stoychev et al. 2004).

Heterogeneity, integrity and aesthetics of landscapes and habitats: local and regional threats

Landscapes in the DNP are dominated by woodland of various types containing scattered areas of irrigated and rain-fed fields, grassland, pastures, bare ground, rocky outcrops and human settlements. Many of the man made factors responsible for the creation of open

Table 1. Main threats to the values and protected features of the DNP.

- Habitat and landscape homogenization through diminishing vertical and horizontal heterogeneity, both inside and outside the DNP (slow, long-term, continuous, increasing if not managed, controllable)
- Large-scale fire (stochastic, can occur at any time, natural or anthropogenic cause, difficult to control – uncontrollable)
- Adverse impacts on population sizes and distributions of birds of prey by overly development and unwise placing of wind-farms (medium to long-term, proportional to density, anthropogenic, legal, controllable)
- ncreased mortality of birds of prey due to accidental, secondary poisoning (stochastic, can prove to be decisive, anthropogenic, illegal, uncontrollable in the short term)
- Aesthetic degradation of landscapes; by both small-scale interventions, such as dumping and building (long-term, continuous/recurring, anthropogenic, controllable), and by large-scale works (e.g. the Burgas-Alexandroupolis oil pipeline and poorly planned wind-farms).
- Lack of political will, institutional inefficiency, lack of structural, operational or administrative competence, or a combination of these, to cope with the above in an organized way.

habitats (forest fires, uncontrolled logging, extensive livestock grazing, clearing and ploughing) have been on the decline during recent decades. As a result, forest cover has increased from 46% of the DNP area in 1945, to 54% in 1973 and 72% in 2001 (Triantakonstantis et al. 2006).

In contrast to most other protected areas in Greece at similarly low altitudes, the number of scattered buildings outside settlement limits is low in the DNP. Although settlements have lost their traditional architectural features (after extensive re-building following destruction in World War II and the Civil War), from an aesthetic point of view they are small and unobtrusive. The network of forest roads, though extensive, is not visible from most places in the park, and does not visually offend its overall image. Nor does it reduce much of the visitors' feeling of "naturalness".

The importance of the agricultural zones (especially that of Dadia on both sides of the Diavolorema stream but also those of Lefkimi, Soufli and Vyrini) for visitor experience is clearly underestimated. The farmlands of Dadia and Lefkimi in particular, which are crossed by the main access roads to the park, play a major role for visitors' impression of the landscape and contribute immensely to their aesthetic satisfaction, whilst at the same time they constitute key ecological features. It must be emphasized, however, that the ongoing degradation of the agro-pastoral landscapes along both sides of the Alexandroupolis – Oresteiada national road, along which the park is accessed, will diminish visitors' experience and satisfaction. Active policies should be adopted to avert this degradation. The agricultural landscape is one of the most threatened elements of the National Park. The present re-parcelling and re-allotment schemes to promote agricultural intensification lead to homogenization, at the expense of traditional landscape characteristics and cultivation practices. At the same time, marginal agricultural holdings within the forest are abandoned (Liarikos, this volume).

In regard to landscape conservation, the DNP's establishment decree mentions: "*The present decision's goal is to protect, preserve and manage nature and landscapes, as natural heritage and valuable national natural resources, in the Dadia–Lefkimi–Soufli forest complex – which is characterized by a high biological, ecological, aesthetic, scientific, geomorphologic and educational value – through its establishment as a National Park and the operation of the correspondent Management Agency.*" To date no attention at all has been paid to landscape preservation. A concerted effort must be made to safeguard the agro-silvo-pastoral landscapes, especially in the direct sense of avoiding more scattered building and large-scale constructions and roads. It is imperative for decision makers on all levels to realize that, especially under the EU agricultural policies, agriculture is increasingly appreciated for maintaining and enhancing the aesthetic, ecological and recreational value of rural areas (Pisani 1994 in Finger-Stich and Ghimire 1997). Low-intensity agriculture is very important in Europe not only for socio-economic reasons but for nature conservation as well (Bignal 1998, Osterman 1998). In protected areas, this environmental conservation function is often valued more than agriculture's productive role.

Landscapes around the five main villages in the park and at its periphery (Dadia, Lefkimi, Giannouli, Soufli and Kornofolia) are degraded in places by the presence of abandoned buildings or infrastructure, sites with uncontrolled gravel and sand extraction, and uncontrolled landfills of domestic and demolition waste. Most of the buildings outside villages are sheepfolds and a few cottages, and are situated in the agricultural zone to the west and north of Soufli. The aesthetic value of some agricultural landscapes around Lefkimi and Giannouli could be much improved with proper intervention.

In addition, the future Burgas – Alexandroupolis oil pipeline is planned to cross the DNP longitudinally at its north-eastern borders, in Zones B1, B2a and B2b (Fig. 8 in Introduction), but its aesthetic and other im-

pacts upon the park's landscapes are still difficult to estimate. Care must be taken so that the pipeline leaves the beautiful agro-pastoral landscapes south of Soufli intact. It is therefore imperative that, south of this point, the pipeline is constructed outside the park's borders and to the east of the Alexandroupolis–Oresteiada national road.

The army is another factor of landscape degradation and disturbance. There are used or abandoned military infrastructure, camps and installations in many places in the park. A number of training fields for personnel, artillery and tanks also exist, while manoeuvres and drills may take place anywhere. Dykes are frequently constructed and abandoned without any attention being paid to landscape aesthetics. Negotiations with the army will certainly need to be made to change its activities in the DNP so that these cease to be factors of environmental degradation (see also European Commission 2005).

In practice, any kind of management aimed to maintain and enhance landscape and habitat heterogeneity in the park necessarily involves long-term, large-scale policies for the forestry, agriculture and livestock-rearing sectors.

Forest management: mature woodlands and other valuable habitats

Among the nine main habitat types recognized in the area by Korakis and Gerasimidis (this volume), three are of conservation priority in the EU: (1) Pseudo-steppe with grasses and annuals of the *Thero-Brachypodietea*, (2) (Sub-)Mediterranean pine forests with endemic Black Pine *Pinus nigra* and (3) Alluvial forests with *Alnus glutinosa.* The first habitat type is the most abundant and widespread grassland and covers approximately 2.5 % of the NP area. The pure stands of Black Pine are scarce in the DNP, while the *Alnus glutinosa* alluvial galleries are found along many streams across the park.

Old, mature deciduous forest is important for woodpeckers, owls and other hole-nesters, while mature pine forest is crucial for nesting raptors, especially the larger ones (Adamakopoulos et al. 1995, Poirazidis et al. 1996, Poirazidis et al. 2007). Despite their importance, there is no special mention of the value of mature stands or the need for their conservation in the DNP establishing articles. It is apparently implied that this is covered by the establishment of the two core zones of absolute protection, but this is insufficient, as large trees definitely must be preserved all over the park.

Forests are a basic element of the landscapes of the park and an invaluable habitat *per se* for a plethora of organisms. However, although the forest's future is threatened only by large scale fires, the decline of certain human activities allows the forest to expand over open spaces thus reducing landscape and habitat heterogeneity, both crucial for a high biodiversity. There are three management tools to arrest forest expansion and densification: prescribed burning, grazing and specific silvicultural interventions. The first, which could possibly replace the role of small-scale fires lit by shepherds for centuries, is not allowed by the national forestry legislation, so it is not applicable. On the other hand, stock rearing is on the decline (Skartsi and Poirazidis 2002) as it is considered an arduous job with low social prestige and mediocre financial earnings. Under conditions defined by the specific management studies, silvicultural interventions must be intensified in both protection zones. Of course, creating clearings by logging is only a short-term solution if not coupled to grazing (Zervas 1998). For this reason, the park managers must offer stock keepers specific incentives in order to attract more herds to the area and so increase the number of animals. Similar incentives must be offered to loggers' cooperatives, which are also on the decline due to the hardships of the profession and small returns.

Acknowledging that the landscapes one seeks to preserve are the result of the residents' work and culture (Beede 1992 in Finger-Stich and Ghimire 1997), subsidizing farmers, stock keepers and loggers is a very widespread practice in many national parks in Europe. One should also note that, apart from its often detrimental effects on the preservation of the landscape mosaic, reduced grazing also leads to the accumulation of dry plant biomass as well as woodland expansion, which increases the risk for wildfires. Wildfires constitute one of the most important threats to the viability of the area, in the sense that a single fire escaping immediate control could decimate a large part of the forest.

Forestry management must be multi-purpose: conservation of raptors and biodiversity combined with as high as possible timber yields and optimal grazing. Forest management should target the conservation of all stands and individuals of mature trees, whether conifers or broad-leaved trees, not only in the core zones of the park but also in the peripheral ones. Strategically chosen whole stands and specific trees should also be left to mature so as to serve as nest sites for birds of prey in the future (Poirazidis et al., this volume, Gatzogiannis and Poirazidis, this volume). Planting former arable land with *Robinia pseudoacacia* trees as an agro-environment

measure is undoubtedly an undesirable practice which counteracts the principal conservation goal of maintaining open spaces (Georgiadis 2003).

Specific revisions of the forest management plans and silvicultural interventions will also permit the forest to develop a horizontal structure with more fire-resisting species, as the accumulation of combustible plant material increases the risk of large fires, which could have catastrophic results for biodiversity and landscape heterogeneity (Herrando et al. 2003). It is also necessary that all forestry operations should continue to be planned in ways that avoid any kind of disruption to species' nesting activities. Small areas, strategically scattered all over the park, should be left unmanaged (and with access restricted) as a kind of natural repository, to be used as a control and reference to forest succession. All old oak woodlands in the region should be strictly protected (Gatzogiannis and Poirazidis, this volume). On a national level, Stamou et al. (1998) and Gatzogiannis and Poirazidis (this volume) propose a radical re-orientation of the institutional framework of forest management in a much more sustainable-forestry direction which is currently lacking.

Agriculture and livestock rearing

Income from agriculture is second in importance for the local economy after services, and although occupation in agriculture has declined during recent decades, it remains the most socially important activity for the local population (Liarikos, this volume). Agriculture deserves a very special place among management considerations for the DNP: agricultural holdings consume space and contribute to the valuable landscape features of the area. Farming practices are crucial determinants of environmental quality, while farming acts to maintain cultural and social traits as well as the local social fabric. The latter is of specific importance.

Broadly speaking, the agricultural zones of interest for the management of the DNP can be classified into three groups: The first includes lands around the main settlements and along highways, which are more or less intensively cultivated with annual crops and alfalfa but also contain some vineyards. The second is the smaller, isolated holdings of marginal productivity within the forest where rain-fed cereals are almost exclusively grown. The third category includes agricultural areas surrounding the DNP, which are of crucial importance for biodiversity within the park. Although conditions and practices within these three groups differ, they are all faced with different aspects of the same two principal management challenges: (a) landscape preservation versus intensified production on highly productive lands and the abandonment of low-productivity ones, and (b) the impact containment of cultivation practices, especially the use of agrochemicals. The available policy tools provided by the Common Agricultural Policy towards meeting these challenges have not been utilized to date. These tools, which constitute the backbone of the new EU approach to agriculture, include a series of regulative stipulations, prominent among which is "Cross Compliance", and a series of important funding opportunities. Within the latter, of particular importance to the DNP are provisions for the decoupling of production volume and subsidies, relative requirements for the maintenance of set-aside land in good condition and, of course, agri-environmental funding schemes. Opportunities for funding environmentally friendly agricultural practices through other funding initiatives (such as the LIFE or the INTERREG programmes) as well as locally specific initiatives for the labelling and marketing of DNP products, have also not been explored.

Cross Compliance and Commission Regulations 1782/2003 and 796/2004 are policy tools that must be used extensively in the area to (a) reduce adverse environmental effects arising from irrigated intensive agriculture in specific places, particularly those close to settlements and (b) to prevent agricultural marginalization in scattered cultivated dry-land areas far away from villages, so as to avert their abandonment and subsequent forestation. The latter are of the utmost importance for landscape aesthetics and for the preservation of crucial ecological features of the DNP. According to Reg. 1782/2003, farmers who receive direct payments are obliged to maintain their land in Good Agricultural and Environmental Condition (GAEC). This sets a framework of standards additional to the Cross Compliance, which provides EU member states with a general framework of environmentally sustainable agricultural practices and focuses on soil and, of much interest for DNP, defines the minimum maintenance of agro-ecosystems to qualify for subsidies. Four standards of high relevance to the DNP needs are listed: minimum livestock stocking rates and/or appropriate regimes; protection of permanent pasture; retention of landscape features; and avoidance of unwanted vegetation encroaching on agricultural land (Swales 2007). In most member states the official Cross Compliance literature is detailed and clear. In Greece, however, farmers claim that the information offered to them by the services is not comprehensive enough and believe that less than 20% of Greek farmers understand the new requirements (Dimopoulos et al. 2006).

As far as livestock is concerned, the park hosts only extensive units of beef cattle, sheep and goats without transhumance (see classification in Zervas 1996). Between 1964 and 2008 the livestock capital within the DNP and at its margins declined by 60%, while labour animals practically disappeared. At present, livestock number c. 6000–6500 stock unit equivalents of which c.700 are cattle and the rest sheep and goats. Efficient veterinary care keeps average annual mortality of livestock ranging between 2% (cattle) and 5% (sheep and goats) (Skartsi and Poirazidis 2002). From an ecological point of view, assuming that there are no major spatial shifts in grazing areas and given that these animals graze freely all over most of the park, the above numbers mean (a) limited grazing pressure on the grassland, scrubland and woodland of the park and (b) few livestock corpses. As a result, wooded areas are allowed to expand over open ones and, in combination with compulsory hygienic measures, very few stock corpses are available to vultures. Furthermore, the large decrease of free grazing stock may also result in limited transportation of biomass in the form of dung from more densely vegetated to less vegetated areas. This may be directly connected to declines in some insect populations (Fuller and Gough 1999) and consequently to declines in reptile populations. In addition, as in the case of agriculture, the novel EU approach to the CAP has not been adequately explored and used with respect to livestock rearing.

Tourism, environmental interpretation and education

Until the end of the 1980s, very few people visited the Dadia Forest, despite the fact that Soufli, at the margins of the present-day DNP, had already developed a small but constant visitor flow based upon local silk-garments and the history of the silk industry. At that time, visitors comprised a few birdwatchers (during spring and summer) and hunters (during winter). During the 1990s, however, much attention was paid to promote the area as an eco-tourism destination, with the establishment of a variety of infrastructures and the organization of a small set of visitor services (Hovardas 1999, WWF Greece 2000, Stergioti 2001, 2003, Svoronou and Holden 2005, Symvoulidou 2006).

The overall tourism system was structured around the single spectacle of the vulture feeding site which, although never conceived as such, was utilized to attract visitors who were offered the opportunity to be led to a hide to watch vultures feed on carcasses. The initial development of a tourism scheme was partly conceived as compensation to the local population for restrictions following the establishment of the forest reserve. Although the Dadia Forest has since been utilized as a flagship area for the promotion and development of tourism in the Evros Prefecture along with the Evros Delta (K. Pistolas pers. comm., Evros Development Company 2003), and despite the fact that it has long been used as a national example of eco-tourism development, very little has been done to actually improve the "product" offered to tourists, to promote economic development based upon it and to fully embed its operation within the local society. Options offered to visitors remain very restricted (and confined to the vulture feeding site and a couple of trekking paths). Outdoor recreation facilities are few, other ecological characteristics of the area are not promoted, and visitor services are rather poor. At the same time private tourism investments do not exploit the high visitor influx. Hunting is allowed in certain parts of the DNP and attracts a few hundreds of hunters annually, but control of poaching – and other illegal hunting – remains pending.

The above also reflects the development of visitor rates to the area, and their qualitative characteristics (Liarikos, this volume). While visitor numbers rose from 1800 in 1994 to more than 50,000 in 2003 (Fig. 1), the area was transformed from being a nature-lovers' destination to one of environmental mass-tourism, characterized by short visits, mainly within the framework of organized tours in Thrace, with very few overnight stays and, consequently, little income generated for locals. This change has also gradually led to a near 20% decline in visitor numbers after 2003 (Data source: WWF Greece and DNP Management Agency). Unless measures are immediately adopted, "high-value" visitors will be all the more discouraged from visiting the area and uncertainty among local entrepreneurs will grow.

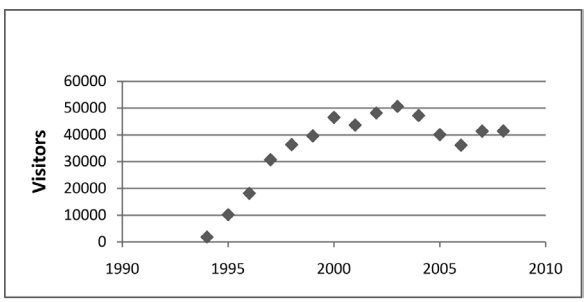

Fig. 1. Annual number of visitors to the Dadia visitor centre during 1994 to 2008 (Source: WWF Greece and DNP Management Agency).

The immense potential of the DNP for education is not yet satisfactorily used in a systematic way. Organized visits by students from some universities occur, and WWF Greece has used its long experience of the area for education purposes. It has organized a number of seminars and education sessions on conservation and management using examples from its local involvement.

The environmental interpretation scheme for visitors has remained the same since its initial launching by WWF Greece in the early 1990s. This had focused on the outstanding natural diversity of the area with an emphasis on raptorial birds. The scheme is now outdated and in need of revision. Without losing sight of the flagship issue (raptors), one should focus on landscape management issues and demonstrate the complex interrelationships between the present management and conservation issues and past practices, as well as present links to the geological, topographical and cultural history of the region.

The area's cultural history is manifested in, e.g., a high number of sites of cultural and archaeological importance scattered over the DNP, such as village ruins, stone-bridges, houses and churches, various remains of ancient fortifications, mainly Iron Age but also early Byzantine, remnants of ancient settlements and many other historical sites (Gouridis 2006). Many of these are situated inside the DNP and in its immediate vicinity. Most have not been excavated, but there is still much to be seen and enjoyed by the interested visitor. These sites could also become part of an integrated and coherent environmental interpretation story for the area which is currently lacking. The historical monuments are not covered by any specific legislation other than the general one regarding antiquities, and they are not officially considered as an asset of the park, nor are they mentioned at all in the park's establishment articles.

Special mention must be made of the very well preserved parts of fossilized trees, which comprised part of a huge forest ecosystem c.20–25 million years ago. It is considered to be the oldest petrified forest found on Greek territory (Velitzelos 1998, 2000). This important geological heritage extends today mainly over the low-lying, flat areas along the River Evros and only a small part reaches into the park.

The birds of prey

The DNP still hosts a highly diverse fauna of raptorial birds with 36 out of the 38 European species recorded in this area (Hallmann 1979, Dennis 1989, Poirazidis et al., this volume). The assemblage of birds of prey remains almost as diverse as described 30 years ago. From 2001 to 2005, 19–20 species bred in the area and many populations have remained stable since the 1970s (Poirazidis et al., this volume), a fact attributed to protection and conservation measures implemented during the last 15 years.

Initially, the Dadia Reserve and later the DNP were established basically to ensure the conservation of birds of prey while DNP's establishment law mentions that: "*…the protection and conservation of the natural features of the protected habitat types and the protected species of flora and fauna met in the area and particularly their preservation as birds of prey habitats, is specifically sought.*" Thus, it is at least clear that the park's main objective is the conservation of all species of plants and animals listed as "protected" (though these are not specified), but the priority is on raptor conservation. Indeed, habitat management practices focusing on the conservation of top predators, and especially raptors, can be ecologically justified because they deliver broader biodiversity benefits (Sergio et al. 2005, Sergio et al. 2006), although on this there is no unequivocal consent (Cabeza et al. 2007). A potential interpretation of the law could be that in case of a conflict of interest between specific management practices, birds of prey would have priority.

During the past two decades, especially with the successful intervention of WWF Greece, a number of management measures have been implemented through various initiatives, aiming at safeguarding the nesting conditions of the birds of prey and vultures: the exclusion from management of certain forest zones crucial for nesting, restriction of forestry operations in certain areas to months outside the nesting season, restrictions on logging around nests of Black Vulture when nests are outside Zone A, restrictions on access to certain sensitive areas and, of course, the supplementary feeding scheme for vultures. All these have greatly assisted in keeping most raptor populations steady or even increasing (Poirazidis et al., this volume, Skartsi et al., this volume).

However, no progress has been made in securing the long-term food self-sufficiency of vultures, an unresolved issue of great importance. Some kind of supplementary feeding of vultures should be continued at least until their natural food resources have been restored and the illegal poisoning radically restricted (Vasilakis et al. 2008, Skartsi et al, this volume). The time has come for the Management Agency of the park to instigate a dialogue between the scientific community, the local people and authorities that will eventually lead to the adoption of specific policies for the restoration of natural food re-

sources for the vultures. The options are either enhancement of wild ungulate populations (e.g. Roe Deer – or, if necessary, re-introduction of Red Deer and/or Fallow Deer) or boosting free-grazing livestock, or a combination of the two (Vasilakis et al. 2008). All are indeed quite demanding and long-term enterprises. However, to the extent that the supplementary feeding is coupled to tourism built around watching feeding vultures, any effort aimed at changing the pattern of supplementary feeding should be preceded by a long and tedious preparatory period to change the perceptions of local people about the issue (see also Piper 2006).

The only visible solution towards establishing a more "natural" food provisioning and decoupling the supplementary feeding of vultures from nature tourism as we know it so far, is to re-design the tourism model for the park, so that it works as an alternative to vulture watching. The new model should move the epicentre away from vulture watching and emphasize other elements of the park worth seeing, so far totally unexploited. Such elements could be specific landscapes and geological sites (many very important), places of historical, cultural and architectural interest, other rare and interesting wildlife, local folk, etc. Vulture watching may still be one of the highlights of the park but not the only one. This shift to a new model will render possible the disengagement from very frequent provisioning of the vultures, which may then become more random and unpredictable in space and time and thus resemble more natural conditions. WWF Greece already operates a second feeding station along these lines, supplied with food according to a random scheme and entirely disengaged from tourism (Liarikos 2006b).

A large part of the Evros and Rhodopi prefectures has been characterized as a Priority Area for Wind Power (PAWP 1) by the Special Spatial Planning Framework for Sustainable Development and Renewable Energy Resources (SSPFSD-RER). According to the relevant study, the wind potential of Thrace is exploitable and the carrying capacity of the PAWP 1 was estimated to be 480 typical wind turbines, i.e. c. 960 MWe. At present, eight wind farms of 132 turbines and of 157 MW total power are already established within the PAWP 1 and 31 turbines of 40.3 MW power outside it (WWF Greece 2008). To date, more than 45 applications for permits to erect wind farms of more than 1000 MW power within the PAWP 1 have been submitted to the relevant state authority, and more than 35 such applications for more than 800 MW have been submitted for the area around it (WWF Greece 2008). So, if a large portion of these applications is approved, a concentration of infrastructure related to wind power will be constructed. The endangered Black Vultures use the PAWP 1 intensively (Vasilakis et al. 2008). In most cases vultures fly within the area swept by rotors of the wind turbine models used in the region, which strongly increases the risk of collision (Vasilakis 2009). The other two vulture species that inhabit the area, namely Griffon Vulture and Egyptian Vulture, also intensively use the PAWP 1, which holds a large proportion of the Balkan populations of these species (Skartsi et al., this volume, Sidiropoulos and Tsiakiris 2009). All of this area is part of a wider one characterised by the highest diversity and density of nesting and migrating birds of prey in Greece and overlaps by c. 50% a number of SPAs (protected areas according to EU Directive 79/409 for the protection of birds and their habitats). The maximum harnessing of wind power for energy production is more than crucial to the country. However, the cumulative effects of erecting multiple wind farms in a region intensively frequented by rare and protected resident and migratory raptorial birds prone to collide with the turbines' rotors, is a serious problem (Barrios and Rodriguez 2004, de Lucas et al. 2008). Much attention must be paid to (a) making sure the density of wind farms does not exceed the ecological carrying capacity of the area; (b) ensuring, through careful pre-construction studies, that the best possible locations for wind farms and individual turbines are chosen in order to minimize any adverse effects on the avifauna; (c) implementing efficient post-construction monitoring, to enable timely and effective mitigation measures in case of adverse effects (Drewitt and Langston 2006); and (d) minimize negative effects on park visitors' feeling of naturalness. WWF Greece believes that Greece must actively participate not only in the interception of climate change but also in halting the ongoing loss of biodiversity. To that end the organization has prepared and distributed a focused, relevant study for Thrace (WWF Greece 2008).

The rare and endemic plants

The flora of the DNP consists of more than 354 plant taxa (Korakis et al., this volume). Local endemics are *Minuartia greuteriana* (Caryophyllaceae), *Onosma kittanae* (Boraginaceae), and the geographically restricted *Salix xanthicola* (Salicaceae) (Korakis et al., this volume). The first grows on rocky outcrops and degraded woodland, habitats not generally threatened by further degradation or alteration. While threats, if any, to the small populations of *Salix xanthicola* are not known, according to local people the species has recently shown

a declining trend (Korakis et al., this volume). *Onosma kittanae* grows on serpentine soils, has a restricted range in the park but it does not seem to be threatened. Korakis et al. (this volume) argue that rare and protected plants just need to have their distributions mapped and populations monitored, which would make it possible to take their requirements into account in development and management works, including those designed to improve other valuable features of the park.

Animals other than raptors

As far as invertebrates are concerned, among the 75 species of butterflies (Lepidoptera) recorded in the DNP (Grill and Cleary 2003), *Lycaena ottomana* and *Euphydryas aurinia* are the most important from a conservation point of view. The Orthoptera are well known faunistically (Kati and Willemse 2001, Kati et al. 2004a, Kati et al. 2004c, Grill et al., this volume). There are at least 39–44 species in the area, the rarest being *Paranocarodes chopardi.* In general, more habitats of high insect diversity are found in the buffer zone (Zone B), showing that its importance for the conservation of the park's overall biodiversity is equal to, or greater than that of Zone A, the main importance of which is for the nesting birds of prey and vultures. Besides the need to systematically monitor the most rare and threatened invertebrate populations, the basic management goal for invertebrate conservation is to preserve as much as possible of the traditional, open agro-silvo-pastoral character of the zone B landscape, a policy that will also benefit a number of other rare species (Grill et al., this volume.)

The fish fauna of the park is poorly known even though the ecological role of fish populations might be important, especially in the largest streams (Diavolorema, Lyra, Megalo Rema, Kamilopotamos, etc.). The Evros river system is known to support 40–47 species of fish strictly inhabiting freshwater (Economou et al. 2007), of which at least 17 have been recorded from the streams (Zogaris et al., this volume). Besides their intrinsic value, fish are also very important to the functioning of the park's water ecosystems. They are also prey for a number of rare birds and the Otter. Fish will be directly affected by increased temperatures and decreased water availability resulting from the ongoing climate change. Fish populations therefore should be censused and monitored and specific provisions for them taken in the planning and construction of all hydrological works. As a number of medium-sized weirs and dams are planned, in addition to those already constructed by the Evros Forest Service at the periphery of the DNP, great care should be taken towards the conservation of fishes. The necessity of dams must be carefully assessed, and where judged necessary, fish ladders should be constructed to allow for free fish movement.

The 13 species of amphibians in the park (Adamakopoulos et al. 1995, Kati et al. 2007) are critically dependent upon the availability and physico-chemical properties of permanent or temporary water bodies. Amphibians are one of the animal groups for which there is ample evidence worldwide to show that they have been adversely affected by climate change during the last 15 years (Pounds et al. 1999, Carey and Alexander 2003). The reptiles of the park are not only a highly diversified group of 29 species (Adamakopoulos et al. 1995, Kati et al. 2007, Bakaloudis, this volume) but their distribution and densities are among the main factors supporting the high diversity and densities of birds of prey, as they are important prey for many of them (Adamakopoulos et al. 1995, Bakaloudis, this volume). Terrestrial reptiles are favoured by a mosaic of semi-open habitats (open oakwoods, heaths); these are located in the buffer zone rather than in the densely forested Zone A (Kati et al. 2007). The monitoring programme of the DNP should emphasize the conservation status and trends of the five protected species, i.e. *Bombina variegata*, *Emys orbicularis*, *Mauremys rivulata*, *Testudo graeca* and *T. hermanni*.

The park hosts 120 species of landbirds, including 39 species with an unfavourable conservation status in Europe (SPEC 2 and 3). Kati and Sekercioglou (2006) and Kati and Kakalis (this volume) have shown that rural mosaics, hedgerows, and forest clearings are crucial for small landbird conservation in the area. They also provide evidence in support of maintaining horizontal heterogeneity at a local scale.

The estimated total number of mammals in the DNP, including bats, is 62–65 (Adamakopoulos et al. 1995, Papadatou, this volume, Catsadorakis and Bousbouras, this volume). As for other vertebrate and invertebrate groups (Kati 2001, Kati et al. 2004b), areas with the highest densities of small mammals are those where an intricate mosaic exists, with woodland stands, open grasslands, natural hedges, cultivated fields, brush thickets and rocky areas, i.e. habitats mainly found in Zone B. Large-sized species are threatened by poaching and poisoning, and by high road mortality. The Otter, the most endangered species, is probably threatened by increasing habitat disturbance and declines in upstream fish populations, which may result from obstructions to fish movement by dams and by changes brought about by climate change. The six most threatened of the 24 species of bats found in the area depend strongly

on caves (Papadatou, this volume). The area's three disused mines should therefore be maintained and their entrances stabilized. Another 13 species regularly use the artificial pools constructed to supply water for fire-engines, for drinking and foraging. Summer is a crucial period in the DNP for bats nursing young as water sources are limited. Thus, every kind of water body should be maintained to ensure the survival of these animals (Papadatou, this volume).

The organizational and institutional management framework

However clear the management and conservation goals might be in the DNP, the current management level of this and of all other protected areas in Greece is highly problematic (WWF Greece 2004). A variety of decade-old problems remain unresolved, while at the same time the recent establishment of ineffective management agencies further increases negative attitudes of the local people. Prospects for countering these problems are rather dim. The government's rhetoric about the status of protected areas remains positive, but actual policy measures are rarely implemented (Liarikos 2006a, Papageorgiou and Vogiatzakis 2006, Apostolopoulou and Pantis 2009).

The majority of protected areas in Greece (national parks, eco-development areas, etc.) are included in the NATURA 2000 Network, which covers >19% of the country's area and consists of 239 SCIs (Sites of Community Interest, according to the Habitats Directive -92/43/EEC) and 151 SPAs (Special Protection Areas, according to the Birds Directive -79/409/EEC). Hence, EU regulations and their national transpositions and applications today constitute the back-bone of nature protection in the country. Although the NATURA 2000 Network is a relatively coherent policy framework for environmental protection, its institution and operation are less than inadequate in Greece, and its provisions are not embedded in the administrative system. Some of the reasons for these inadequacies should be sought in the lack of vertical and horizontal coordination among state services, the huge overlaps and gaps of responsibilities, the perplexed legal system, the lame spatial planning system and, ultimately, the almost complete absence of political commitment to conservation (Liarikos 2006a, Papageorgiou and Vogiatzakis 2006, Apostolopoulou and Pantis 2009).

In 2003, partly in response to these problems, and to a large extent due to pressures from EU and NGOs, special entities for the management of protected areas were established, called Management Agencies, theoretically semi-autonomous and accountable to the Minister of Environment. Unfortunately, until now these agencies have failed to deliver according to their role. A series of problematic issues are relevant for explaining this. On the institutional level, immense bureaucratic barriers and delays, along with problems of intra- and inter-service cooperation, hinder the effective assumption of a clear administrative role by these agencies (Apostolopoulou and Pantis 2009). On the financial level, the irregular flow of funds makes them totally dependent on project-based funding, which essentially dilutes their capacity to maintain a baseline management effort and limits the scope of their operation (WWF Greece 2004). Finally, on the political level, the overall lack of political support for the management agencies' work and their gradual transformation into arenas of local politics are a serious obstacle to decision making on crucial issues and undermine their administrative status and capacity. Last but not least, due to their legislative and statutory properties, management agencies for protected areas cannot meet their mission without the continuous, consistent and close support and guidance by the central or regional government, something which the management agency of DNP and all other similar agencies in Greece lack completely (WWF Greece 2004, Apostolopoulou and Pantis 2009).

In theory, local and/or regional administrative authorities of inhabited, protected areas in which substantial human activities take place, should be able to develop alternative strategies and plans to harmonize economic and social development with the conservation of the areas' natural values. In fact, what has happened so far is that in the absence of such plans and mechanisms to supervise and enforce their implementation, all stakeholders plan and act in an uncoordinated way, so no common objectives are set and pursued. Thus, even if they have the best intentions, management agencies, whose main role is to promote dialogue and negotiations aiming at consensus or compromises, are unable to carry out their task.

The management agency of the DNP is very far from even fulfilling its basic role. It has not a core funding sufficient to cover minimum day to day operation, fund flow is irregular and its staff ranges from no more than one to three persons. A basic institutional problem is that because of the establishment rules for the park, the Municipality of Tychero, to which 34.8% of the DNP belong, does not have a seat on the board, thus it is hardly represented and takes no part in deci-

sion making. Besides the above, the main problem, as with other similar bodies in Greece, is that in practice few persons on the board really understand what a protected area is or should be, most have little or no knowledge of the relevant laws, in general have no experience of the operation needs of a protected area and, finally, possess little or no understanding of their role on the board. The antagonism between political parties prevails even within the management agencies and many decisions are not taken to satisfy real conservation and management needs but rather to serve political expediencies.

One of the key problems of the protected areas in Greece is the lack of a specific body of wardens. Responsibilities are shared between guards of the Forest Service (with duties on matters of forest legislation), hunters' federations' private game guards (with duties on matters of game and hunting regulations) and the lately re-established body of "rural/agricultural police" (with a broad spectrum of duties but with a rather vague mandate). The supervision of a few more matters remains a duty of the police. All this results in fragmentation and/or overlap of duties. This creates gaps in the control and reporting of environmental infringements. During the last few years, the situation for the DNP is that six forest guards and two game guards are employed to supervise more than 1000 km^2 of forest, while recently two "agro-policemen" were also employed. All these men are under-equipped, they act in a totally un-coordinated way and they have no contact at all with the management agency of the park.

Core suggestions from a national, regional and local perspective

As may have become clear, most of the management and conservation problems in DNP do not relate specifically to this park but are connected to weaknesses and inadequacies of the environmental conservation policies in Greece. In fact, for this reason there can be few DNP-specific suggestions of an operational nature targeted specifically to resolve its conservation problems. Science has long clearly identified the problems. What is missing is political will to improve environmental conservation and create a decent national system for the protected areas, capable of coping with site-specific issues. However, both WWF Greece and various independent researchers have been working in the park for a long time and are able to suggest a number of interconnected priority issues at national, regional and local levels. In most cases these necessitate a "horizontal-type" arrangement, the resolution of which will create the necessary framework for a satisfactory conservation of the DNP (Table 2).

Table 2. Main management and conservation goals, means and limitations.

Principal management and conservation goals
- Preserve mosaic and landscape heterogeneity to better serve biodiversity needs
- Enhance farmland areas of high natural value
- Arrest forest expansion and densification and increase the amount of open area (rangeland and cultivated fields).
- Preserve agro-silvo-pastoral landscapes
- Preserve old trees and mature stands and increase their numbers
- Preserve rare and endemic species of plants and animals
- Ensure optimal nesting conditions for all species of birds of prey
- Ensure self-sufficiency of vultures in terms of food resources

Necessary (potential or existing) means to reach the above goals
- Clear, comprehensive and quantitative list of assets to be protected
- Amendment of existing legal framework
- Local sustainable development strategy
- Scientific monitoring results to inform all processes
- Participation and collaboration of local communities and authorities
- Revision of local forestry objectives to become fully compatible with biodiversity conservation needs
- Large scale reintroduction of wild ungulates and/or support of traditional stock rearing
- Further promotion of environment-friendly practices in agriculture

Existing or potential limitations and restrictions
- Lack of clear local and regional policies for sustainable development
- Present local mode of tourism development
- Level of trans-border cooperation
- Availability of financial resources
- Efficiency of coordination mechanisms (Management Agency)
- Unforeseeable disasters (e.g. large-scale fire)
- Economic, social and cultural processes at a larger scale

According to the assessment of the protected area (PA) system of Greece by WWF Greece (2004), the Greek state should:

- Develop a visionary national policy for PAs, with specific objectives and clear targets
- Promote the incorporation of environmental conservation into the other sectoral development policies.
- Advance the institutional consolidation of the PAs (including clear protection zone delineations and definition of levels of permitted activities).
- Ensure satisfactory and constant funding both through the national budget and from elsewhere to cover core management activities in each PA based on integrated planning (agreed management plans for periods of 2–5 years).
- Ensure the operation of the NATURA 2000 Committee, a national coordination body, so it can fulfil its crucial role of supporting the national PA system.
- Advance the discussion among the stakeholders so that they fully understand environmental and socio-economic advantages of PAs and achieve consent on their conservation and sustainable development.
- Make sure the chairs of the board of governors should be competent and with a proven track record in conservation issues and that stakeholders' representatives are people serving local interests and not those of political parties.

A specific body of PA wardens should be created or the mandate of the already existing forest and agricultural-police bodies must be extended to cover environmental matters with emphasis on control of law infringements in the Natura 2000 sites and be equipped to cope with the task.

The forestry legislation must be modernized as regards its institutional framework, and the requirements of forest management studies must be changed to include consideration of parameters of conservation and natural resource use in decision making. Adoption of modern technological tools and recent scientific findings on forest management, as well as the incorporation of modern sustainable practices, is imperative. Furthermore, the national forest policy should be revised to comply with the European Union policies (Stamou et al. 1998).

From a purely legislative point of view, the Joint Ministerial Decision (JMD) for the park establishment is too little and too late. According to national legislation, the park should have been established under legally stronger and more binding Presidential Decrees. Such a decree had been drafted and has been pending since 1995. It is therefore imperative that while the JMD is still in force, all efforts should be made to proceed with the signing of the Presidential Decree.

The relevant law should also provide for the permanent participation of a representative of the Municipality of Tychero on the board of the management agency. A few of the JMD articles pertaining especially to permissible features of farmers' infrastructure need to be clarified as is the case with a small number of issues where a partial conflict with forest legislation exists. A definite priority for the near future should be to permanently resolve all problems and imperfections related to the laws pertaining to the park so that there is a strong baseline for the formation of management policies.

The prefectural and regional authorities on the board of the park's management agency should be represented consistently and by delegates who do represent these authorities' policies. Both these should also strive to raise and solidify the status and authority of the MA among the local and regional services. Many of the serious problems that the primary sector of the area faces can best be resolved on a regional level. Both the prefectural and regional services must strive to promote the new CAP and the Cross Compliance, making use of all available agri-environment measures, giving priority to the farmers of the DNP and its surroundings by providing information about CAP opportunities.

Local and regional public awareness campaigns should help people understand the interplay between the serious issues the park faces: expansion and densification of forest, role of livestock grazing, forestry management, agriculture, large fire risk, vulture food self-sufficiency, identity and properties of the tourism product, conservation of all features that enable the high raptor diversity, role of landscape.

Both the prefectural and the regional authorities have to realize that local management measures and plans implemented within the park do not suffice to ensure conservation of its birds of prey in the long-term. Specific efforts to promote agri-environment measures must be taken in order to arrest undesirable land-use changes in the northwestern and central Evros and Rhodopi prefectures. A coordinated effort must be initiated to establish broad trans-boundary cooperation with the Bulgarian authorities and environmental non-governmental organisations of the Eastern Rhodopes region, towards joint monitoring and conservation management initiatives and the designation and management of trans-boundary protected areas.

At the strictly local level, the management agency should strive to employ high-standard environmental scientists and conservation biologists. In addition it

must use every available means, and invest substantial effort, to achieve the best possible synergy among the competent services in order to set up a decent patrolling system which would safeguard the natural values of the park. Of equally high priority is to design and implement specific management measures in Zone A, since if left un-managed, more conservation problems will be created. Forest should not be allowed to expand any further in Zone A. At the same time it is of the utmost importance to safeguard the naturalness of this zone, as this constitutes its unique character and irreplaceable aesthetic value. Along the same lines, management intervention in Zone B should be organized in such a way as to arrest woodland expansion and increase the ratio of open spaces to forest. An effective monitoring plan for the main natural assets of the DNP must also be established.

Last but not least, care must be taken on a regional level to ensure that the DNP will not be an isolated island and that continuity, connectivity and cohesion of the various habitats and protected areas will be safeguarded.

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