

Dealing with invasive alien species in the French overseas territories: results and benefits of a 7-year Initiative

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Abstract Invasive alien species (IAS) are one of the most serious threats to the rich and unique biodiversity of the 13 French overseas territories (FOTs) scattered across three oceans and two continents. To address this critical issue, a dedicated Initiative has been conducted since 2005, with the support of a large panel of national and local experts and stakeholders. This paper summarizes the main results and benefits of this project after 7 years. As a first phase, an unprecedented overview of IAS and their impacts in all the FOTs was achieved. A total of 630 alien taxa were recorded, among which 258 plants, 52 terrestrial vertebrates and 32 invertebrates were identified as a threat, or a potential threat, to native species and/or natural habitats. Gaps in the knowledge about invasive species were also highlighted and a comprehensive set

of recommendations was developed. Using a range of targeted collaborative actions and promoting the exchange of information and regional cooperation, the Initiative raised awareness of invasive species issues, improved access to information and strengthened local and regional capacities. In this paper, we report on the outcomes of the Initiative and what remains to be done with regards to the prevention of new introductions, early detection, rapid response and public awareness, as well as future challenges.

Keywords French overseas territories · Islands · Network · Capacity building · Regional cooperation

Introduction

The 13 French overseas territories (hereafter FOTs) are distributed across three oceans, at latitudes ranging

This paper is dedicated to the memory of Michel Pascal, alias “Ratator”, an active member of the Initiative.

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from sub-Arctic to sub-Antarctic, including equatorial and tropical regions (Fig. 1). Most of these territories are islands, with the exception of French Guiana in South America. They host a significant part of the world's biodiversity (Kier et al. 2009) and are home to more endemic species than the whole of continental Europe (UICN France 2013). They are also severely affected by the global biodiversity crisis (Vié et al. 2009), with 11 out of these 13 territories present in five global biodiversity hotspots, namely Polynesia–Micronesia, Madagascar and the Indian Ocean Islands, Caribbean Islands, New Caledonia and Mesoamerica (Myers et al. 2000).

Like most regions of the world, the FOTs face the growing threat of invasive alien plant and animal species. Impacts of invasive alien species (IAS) on native species or natural habitats are well documented on several French overseas islands such as the sub-Antarctic islands (Frenot et al. 2001, 2005), Reunion Island (Baret et al. 2006), New Caledonia (Beauvais et al. 2006) and French Polynesia (Meyer 2004). For instance, the tree *Miconia calvescens* in Tahiti (Meyer and Florence 1996) or the little fire ant *Wasmannia auropunctata* in New Caledonia (Jourdan 1997) are well known worldwide. In contrast, little is known about invasive species in some other territories (e.g. French Guiana, Saint-Pierre and Miquelon) despite these being an emerging threat to their biodiversity (Delnatte and Meyer 2012; Sargent et al. 2013).

As FOTs share many IAS and the same management issues, the solutions developed in one territory can be shared with the others. Local stakeholders also face common constraints, such as low public awareness, limited access to information, complex distribution of responsibilities across different relevant administrative services, lack of coordination or inadequate and/or limited proactive policies. Within this context, an “Initiative on invasive alien species in the French overseas territories” (hereafter the Initiative) was launched in 2005 by the IUCN French Committee, with the objectives of improving access to information, increasing management capacity, and strengthening cooperation among the FOTs (i.e. at the national level), and among FOTs and their neighboring countries (i.e. at the regional scale). This paper reviews the main results and benefits brought by the Initiative after 7 years of implementation.

Implementation of the Initiative

The idea to launch a specific action on IAS in the FOTs originated from the work led by the Overseas Territories Working Group of the IUCN French committee, whose aims are to enhance and disseminate knowledge, influence public policies and build the capacities of local stakeholders on the biodiversity of these territories.

The Initiative started in 2005 with the recruitment of a full-time project officer and the appointment of one or two local coordinators in each territory, chosen among recognized IAS experts and/or natural resource managers in their territory. Two action plans were implemented between 2005 and 2011, mobilizing a wide network of national and local experts and stakeholders, mainly from research institutions, NGOs and public agencies. The budget was approximately 140,000 € per year.

The first stage of the action plan (2005–2008) aimed to achieve a complete overview of IAS issues in the FOTs and to develop recommendations on all aspects of their management. Each local coordinator was in charge of mobilizing experts and stakeholders from their territory, in order to collect, compile and validate baseline information on IAS. In addition, a vast review of the literature was conducted and online databases were consulted, including the Global Invasive Species Database (GISD; www.issg.org/database/welcome), the Pacific Island Ecosystems at Risk project (www.hear.org/pier), the botanical databases of the *Conservatoire Botanique National de Mascarin* (flore.cbnm.org) and the *Herbier de la Polynésie française* (www.herbier-tahiti.pf), as well as other relevant information sources.

A workshop held in Paris in 2008 with all the local coordinators validated the conclusions of the overview on IAS in the FOTs and developed a comprehensive set of recommendations, which was then published as a technical report widely distributed at the national level (Soubeyran 2008).

In total, more than 100 experts and stakeholders from the FOTs and Metropolitan France were mobilized over the 3-year first stage. Information on the major IAS in FOTs was integrated into the GISD, both in English and French, in collaboration with the IUCN/ISSG (Invasive Species Specialist Group of IUCN). A dedicated website (www.especes-envahissantes-outremer.fr) was set up to provide access to all the

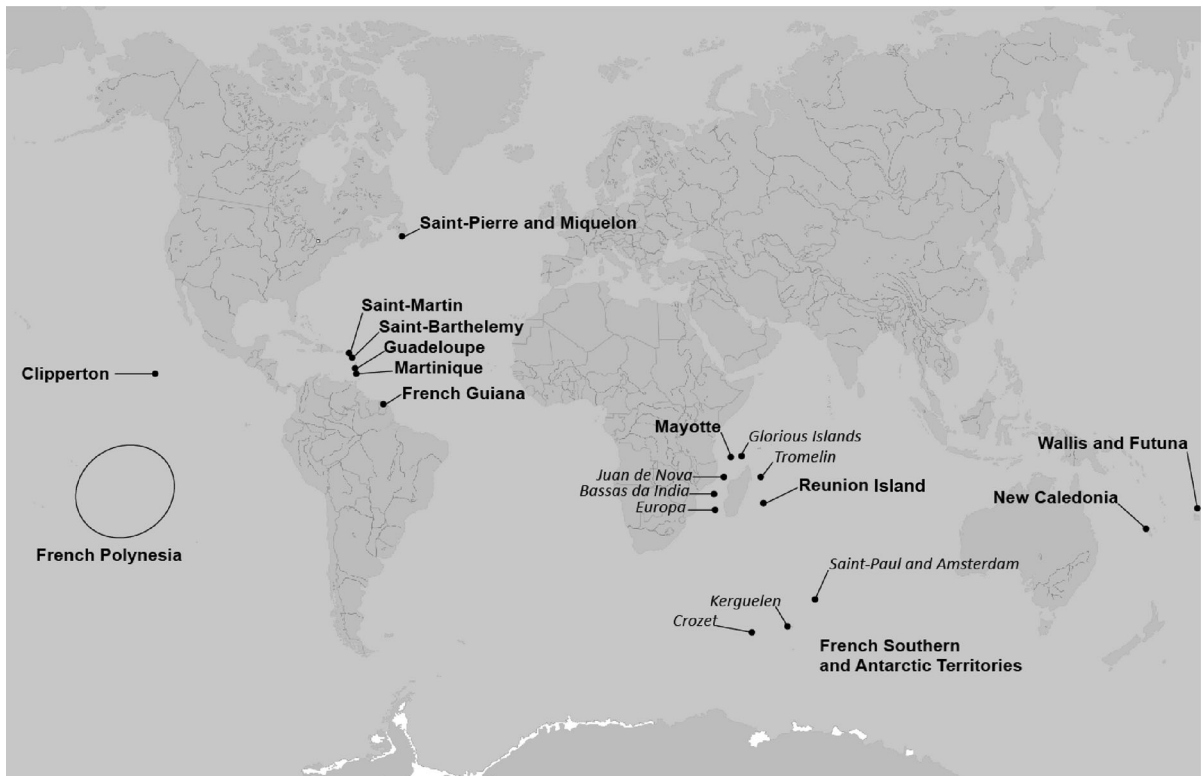


Fig. 1 Location of the 13 French overseas territories (in *bold*). Among these, only the French Southern and Antarctic Territories (made up of the lands in *italics*) and Clipperton have no permanent human population

data gathered in the FOTs, including a species database (630 alien taxa), a bibliographic database (490 references) and numerous documents such as protocols for control, guidelines for preventive action and regulations in force.

The aims of the second stage of the action plan (2009–2011) were to implement the priority recommendations from the first phase, to strengthen the stakeholders' network and to promote regional cooperation. As IAS are a global issue, supporting a regional approach and developing cooperation with neighboring countries was crucial. The highlights of this second phase were the organization of three regional workshops in the Caribbean (Guadeloupe, November 2009), the Pacific (New Caledonia, December 2010) and the Indian Ocean (Mayotte, January 2012). Each workshop gathered about 60 participants from the FOTs and neighboring countries, including researchers, land and resource managers, local authorities' services from the environment, agriculture and forest sectors, members of NGOs, representatives of

the private sector, etc. Each workshop was dedicated to priority IAS issues identified by local stakeholders and concluded in specific recommendations on the topics addressed.

During both action plans, technical guidelines (e.g. UICN France 2010; UICN France and ONCFS 2011) and information leaflets were produced, for practitioners and the general public respectively, and local media were mobilized to raise awareness on IAS issues.

IAS and their ecological impacts in the FOTs

One of the first results of the Initiative was the unprecedented inventory of IAS and their impacts in all the French overseas territories (Table 1). Among the 630 alien taxa recorded in the online Initiative IAS database, 258 plant species, 52 terrestrial vertebrates and 32 invertebrates are listed as causing substantial impacts or as being potential threats to native species

Table 1 Estimated numbers of alien and invasive alien terrestrial plant, vertebrate and invertebrate species in the French overseas territories

| Territories | Plants | | Mammals | | Birds | | Reptiles | | Amphibians | | Freshwater fishes | | Terrestrial invertebrates | |
|---|--------|----------------|---------|------------|-------|------------|----------|------------|------------|------------|-------------------|------------|---------------------------|------------|
| | Alien | Invasive* | Alien | Invasive** | Alien | Invasive** | Alien | Invasive** | Alien | Invasive** | Alien | Invasive** | Alien | Invasive** |
| Saint-Pierre and Miquelon | 196 | 4 | 6 | 5 | 4 | ? | 0 | 0 | 1 | 0 | 0 | 0 | ? | ? |
| Saint-Martin | 130 | 3 | 7 | 6 | 7 | 2 | 12 | 3 | 3 | 2 | ? | ? | ? | 2 |
| Saint-Barthelemy | 150 | 2 | 3 | 3 | ? | ? | 10 | 2 | 4 | 2 | ? | ? | ? | 1 |
| Guadeloupe | 1260 | 11 | 8 | 6 | 15 | 2 | 11 | 3 | 4 | 3 | 3 | 3 | ? | 4 |
| Martinique | 1260 | 4 | 6 | 5 | 20 | 1 | 6 | 3 | 4 | 3 | 5 | 3 | ? | 5 |
| French Guiana | 490 | 2 | 4 | 4 | ? | ? | 4 | 1 | ? | ? | ? | 1 | ? | ? |
| Mayotte | 585 | 25 | 9 | 6 | 11 | 2 | 6 | 1 | 0 | 0 | 1 | 1 | ? | 3 |
| Reunion Island | >2,000 | 102 | 14 | 10 | 26 | 5 | 15 | 4 | 2 | 0 | 11 | 4 | ? | 6 |
| New Caledonia | 2,008 | 100 | 12 | 11 | 14 | 4 | 4 | 2 | 1 | 1 | 9 | 5 | >518 | 6 |
| Wallis and Futuna | 338 | 18 | 8 | 8 | 5 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | ? | 6 |
| French Polynesia | >1,558 | 59 | 12 | 11 | 13 | 4 | 3 | 2 | 0 | 0 | 4 | 2 | ? | 9 |
| Clipperton | ? | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | ? | ? |
| French Southern and Antarctic territories | | | | | | | | | | | | | | |
| Scattered Islands (Europa, Bassas da India, Juan de Nova, Glorious Islands, Tromelin) | | 2 [£] | 5 | 5 | 7 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | ? | ? |
| French Subantarctic islands (Crozet, Kerguelen, Saint-Paul and Amsterdam) | 118 | 11 | 8 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 37 [§] | 7 |

* Main invasive alien plants in natural and undisturbed habitats

** Invasive alien terrestrial vertebrates and invertebrates species with local impacts on native species and/or natural habitats, locally documented or known to be important in other similar ecological contexts

* and ** According to the online database of the IAS Initiative in the French overseas territories. The main references used appear in “[Appendix 1](#)”

£ Data for Europa

§ Data for Crozet and Kerguelen

? indicates unknown data

and natural habitats. The Initiative showed that IAS have largely contributed to the documented loss of native biodiversity in the FOTs and are still a major threat to native species and habitats (Soubeyran 2008). For instance, the plant species *M. calvescens*, *Psidium cattleianum*, *Clidemia hirta* or *Hedychium gardnerianum* invade natural tropical forests in several tropical islands and prevent the germination, growth and reproduction of many native and endemic plants (e.g. Baret et al. 2006; Lavergne et al. 1999; Meyer 2004). Goats (*Capra hircus*), sheep (*Ovis aries*), rabbits (*Oryctolagus cuniculus*), cattle (*Bos taurus*), pigs (*Sus scrofa*), the Javan deer (*Cervus timorensis*) and the white-tailed deer (*Odocoileus virginianus*) cause severe damage to native vegetation, affecting the associated wildlife and accelerating soil erosion (e.g. Chapuis et al. 1994; De Garine-Wichatitsky et al. 2005; Meyer 2007; Micol and Jouventin 1995). Rats (*Rattus rattus*, *Rattus norvegicus*, *Rattus exulans*) and cats (*Felis catus*) are predators of many native seabirds and terrestrial birds, some of them being critically endangered (e.g. Faulquier et al. 2009; Jouventin et al. 2003; Thibault et al. 2002). The rosy wolf snail (*Euglandina rosea*) and the little fire ant (*Wasmannia auropunctata*) disrupt native invertebrate communities (e.g. Coote and Loève 2003; Jourdan 1997). Freshwater native fauna is threatened by introduced tilapias (*Oreochromis mossambicus*, *Tilapia* sp.) and guppies (*Poecilia reticulata*) (e.g. Keith 2002, 2005). Finally, half of the 100 of the world's worst IAS (Lowe et al. 2000) are established in the FOTs.

The Initiative also highlighted gaps in knowledge. For instance, it was impossible to give accurate estimates of alien invertebrates in each territory because of the poor taxonomic knowledge for several invertebrate groups and sometimes because of the lack of species inventories. Similarly, marine alien species are poorly known although they can be a serious threat, as demonstrated by the recent invasion of the lionfish (*Pterois volitans*) in the Caribbean Sea (Arias-González et al. 2011) and the reporting of the invasive tunicate *Cionia intestinalis* in Saint-Pierre and Miquelon (Sargent et al. 2013). More generally, the impacts of the majority of alien species considered as invasive or potentially invasive in FOTs have not been quantified, and the mechanisms underlying these impacts (e.g. competition, alteration of species interactions, hybridization, etc.) are still insufficiently studied.

Benefits of the Initiative

The Initiative resulted in many benefits, including an increase in public and local politics awareness, local capacities, networking among territories and regional cooperation.

First of all, the Initiative has contributed to raise awareness on the ecological and socio-economic issues regarding biological invasions and it has accelerated recognition by stakeholders of IAS being an important threat to tackle. Informal working groups with many different stakeholders were set up in most of the territories at the start of the Initiative to carry out the data collection process. Knowledge gaps were highlighted, which led to the launch of local studies in some territories to address the identified lack of data. For instance, in 2007, the Wallis and Futuna local authorities launched an inventory of alien species on the three archipelago islands with the support of regional experts from New Caledonia and French Polynesia. For territories with more experience on IAS, such as the French sub-Antarctic islands, French Polynesia and Reunion Island, the Initiative focused on consolidating local interest and support for actions already being implemented. Recognition of the importance of IAS issues in the FOTs by the French Government also favorably changed since the beginning of the Initiative. In 2008, guidelines were issued by the French Ministry of Environment for the implementation of local strategies against IAS in the French overseas territories, endorsing a recommendation of the Initiative. Since then, Reunion Island published its strategy in 2010 and French Guiana in 2012. The French West Indies (Guadeloupe, Martinique, Saint-Martin) are expected to publish their strategies in 2014.

As the FOTs share very similar IAS issues, with sometimes different solutions being developed in the different territories, they have a strong interest in an enhanced cooperation. By collecting, synthesizing and providing IAS information to all stakeholders in the FOTs, the Initiative promoted information exchanges and experience sharing among territories through an informal network formed by the local coordinators and all the contributors. Thanks to this network, New Caledonia benefited from the preparatory steps carried out in Reunion Island for the implementation of an "IAS Monitoring Committee"; and the "Cybertracker" software (<http://cybertracker.org/>) used in New

Caledonia for the early detection of invasive plants was subsequently tested in Martinique. The three regional workshops that were organized between 2009 and 2012 contributed to identifying priority actions and enhancing regional cooperation. For instance, the recommendations developed at the Guadeloupe workshop (2009) were used as a basis to draw up the French West Indies strategy on IAS. And among the outcomes of the Mayotte workshop (2012) was the adoption by all participants of a motion to build a regional network on IAS in the Indian Ocean. The idea of this network was subsequently supported by the Indian Ocean Commission, a regional intergovernmental organization, and it should now be developed in the near future. Through collaboration with the GISD team, the French expertise on IAS found a global audience. This collaboration resulted in a lot more new data being added into the GISD and into the development of multi-language capabilities to serve a broader audience. The completed and updated IAS information for FOTs in the GISD will benefit neighboring countries facing similar invasive species.

Overall, the Initiative contributed to reduce the differences on the IAS issue among the FOTs. The longevity of this ongoing project is a good indicator of the positive dynamic it has generated, with important results being achieved and a strong and persistent interest from local stakeholders. Due to the worldwide distribution of the FOTs, the Initiative has enabled the sharing of information and knowledge at large regional scales and provided outcomes of international scope.

Future challenges

The number and impacts of IAS might increase in the near future, due to four main factors: the increasing traffic of passengers and goods, the growing demand for ornamental plants, domestic animals or exotic pets, the accelerated degradation of natural habitats due to growing populations and urbanization, and climate change which could favor the establishment of new alien species, their spread and the magnitude of their negative impacts (Hulme 2009; Hellmann et al. 2008; Kueffer et al. 2010; Lebouvier et al. 2011). Early detection and rapid response to emerging IAS are recognized as critical steps to reduce the high ecological and economic costs of biological invasions. Very

few coordinated systems on this issue are implemented in the FOTs (as well as in continental France), such as those existing in New Zealand or in USA (e.g. Kraus and Duffy 2010), but early detection and rapid response systems are being developed in Reunion Island, New Caledonia and in the French sub-Antarctic islands. In addition, the trade of exotic pets, aquarium fish and ornamental plants (including Internet sales) should be better regulated and controlled. Legal frameworks have evolved to deal with the introduction and management of IAS, but their implementation is often hampered by limited human, technical and financial resources, and they still need to be strengthened. Further efforts are also required to increase awareness, notably towards policy makers and administrations, especially regarding the IAS subject to conflicts of interest among local stakeholders. This is the case, for instance, with *Acacia mangium*, used in Mayotte and in French Guiana for agricultural or mine restoration projects (Delnatte and Meyer 2012), and *P. cattleianum*, which is cultivated in Reunion Island for its edible fruit, but recognized as one of the worst IAS in the world. Community networks also have a key role to play in mobilizing and informing society, for example through citizen science programs developed in partnership with research (Crall et al. 2010). Further research programs are still needed to better quantify the ecological and socio-economic impacts of IAS, to understand local communities perceptions and attitudes to these, and to assess the interactions between climate change and biological invasions. The continuation of the Initiative should help to fill these gaps, in collaboration with the wide range of stakeholders involved and with further involvement of the French government and local authorities.

To date, Europe has paid little attention to IAS issues in the European overseas territories. The last relevant European research projects (DAISIE—“Delivering Alien Invasive Species Inventories for Europe”—and ALARM—“Assessing Large-scale Risks to biodiversity using tested Methods”) aimed at informing the future European Union IAS strategy, have been limited to continental Europe and its very close overseas territories (Madeira, Canary islands, Azores). However, the 34 European overseas territories, composed mainly of oceanic islands scattered around the world and receiving large goods and passenger flows, have an outstanding biodiversity

highly vulnerable to IAS. With these territories, France and Europe have an important role to play, as well as a global responsibility regarding IAS issues. As they have to address the 2020 “Biodiversity Conservation Aichi Targets” (www.cbd.int/sp/targets), especially targets 5, 9 and 12 dedicated respectively to ecosystem restoration, IAS and preventing species extinctions, they will have to act with some urgency in their overseas territories in regard to invasive species.

Conclusion

After 7 years, some lessons of generic value can be drawn from the Initiative, which may be useful to address IAS issues in other countries and situations. Among the points that have contributed to the success of the project, the light and flexible operating mode, without over-formalization, played an important role. The relatively simple model implemented, with a full-time project officer for the overall coordination and local volunteer coordinators involved in each territory, proved to be both easy to manage and efficient. It also resulted in relatively moderate financial requirements, as compared to other large-scale biodiversity projects. However, the annual budget needed may still represent a constraint to overcome in some countries. Another key point was that the Initiative was coordinated by a national “neutral” organization, which allowed to give voice to all stakeholders interested, to identify the blocking points and raise the problems that had to be addressed, and to tackle some picky issues in a frank and objective manner. As a last point, the good results obtained owed much to the fact that a wide range of stakeholders were involved at all stages, with researchers, NGOs, local authorities and national public institutions invited to contribute to all activities undertaken. In the future, the Initiative will have to continue in this way, but also to be opened to other segments of society, especially from the private sector, in order to enhance the scope of the actions and to reach a wider audience.

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Appendix 1: Main references used to build Table 1: Estimated numbers of alien and invasive alien terrestrial plant, vertebrate and invertebrate species in the French overseas territories

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