The Little Fire Ant (LFA) on Tahiti

Wasmannia auropunctata (Roger, 1863)

The solved issue of some colonies explosions

By Éric Loève – 18 May 2009.

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TABLE OF CONTENT

Introduction

The colonisation of Polynesia by the Little Fire Ant probably started on Tahiti during the early 90's from the town of Mahina after some previous failed incursion attempt elsewhere (Punaauia 1977).

This biological pollution probably remained invisible during about 15 years, which is the time needed by the first colonies to reach the critical surface that make the most pugnacious human victims react. It was in July 2004 that this ant was officially identified by the administration, but the news was broadcasted the following October only (Les Nouvelles de Tahiti, 12 octobre 2004).

At the same time, Polynesia was entering the very long political instability period, seeming to lightly stabilize in 2009. The main consequence of this institutional instability was that the administration was neither able, nor knowing how, to respond with a normal level of efficiency.

Moreover, this pest was the very first animal arriving in Polynesia with such a level of aggressivity.

Wasmannia auropunctata belongs to the very private group of the 10 World Worst Invasive Species, above more than 5.000 officially listed Invasive species. It is also belonging to the eight ant species listed as "Super-Invasive" among about 12.000 ant species on the Earth (though this estimation of 12,000 ant species is constantly increasing). It is also ranked in the top 3 of the most venomous species of the top 10 worst invasive organisms, a high podium that it shares with the Brown Tree Snake, *Boiga irregularis*, and its cousin the Red Imported Fire Ant, *Solenopsis invicta*. It is less immediately fatal than the two others, but just as invasive.

If the fight against this invasion has been more than chaotic (treatments breaks in 2006 and 2008), surveillance, even if too light, stood constant. The surveillance that did occur raised several questions, including why some populations exploded while others nearby remained unpretentious, all conditions seeming to be equal otherwise.

Results given by the contaminations surveillance since 2005 allow answer this puzzling question.

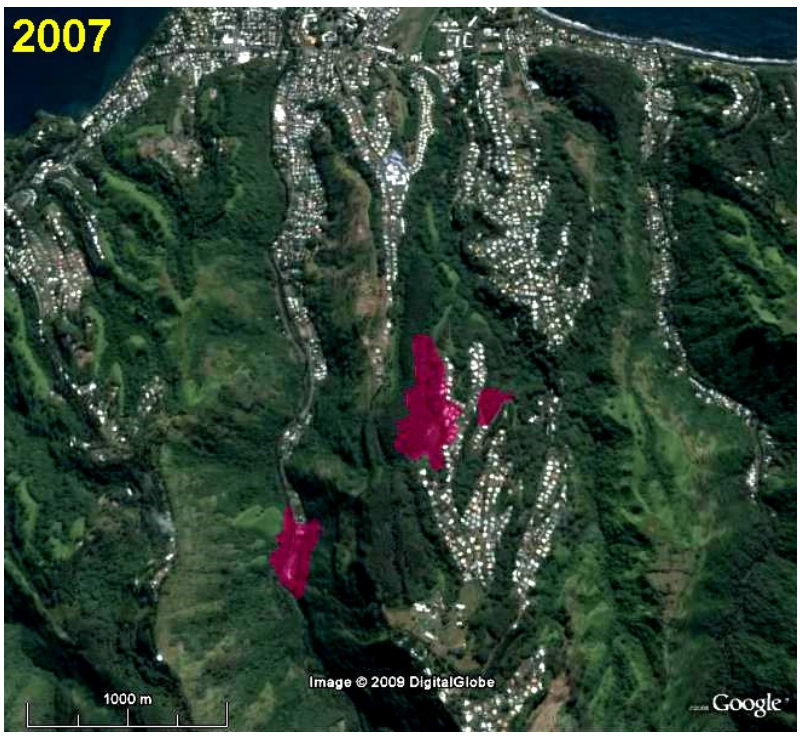
Observations

The question of why some colonies expanded much faster than others was raised early in 2007 by the examination of two neighboring little fire ant colonies in Mahina. These colonies were in valleys having the same orientation and had similar vegetation. The contaminations were named *Alizés Est* and *Alizés Ouest*. The fact was surprising all the more as the hypothesis of a dispersion by flotation was not apparently working: In the area and closely placed next, there were three similar colonies, the one of Tuauru being in contact with a river fairly stronger than the two others.

1. *Alizés* Colonies:

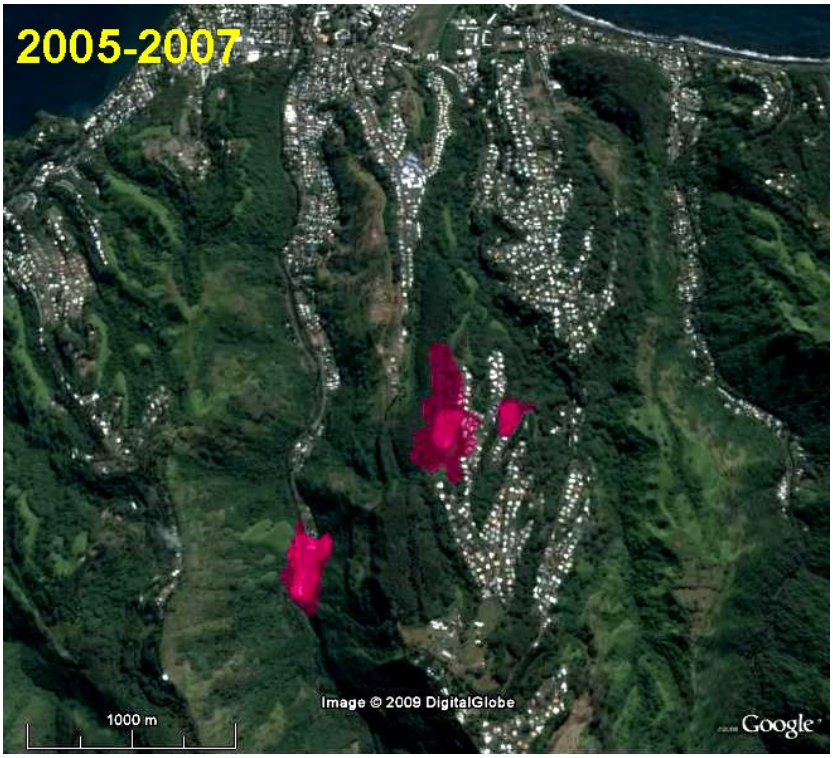
In 2005, the distribution of the ants is shown in the figure below (other colonies present in this area are not shown here):

Two years later, the situation evolved as:



It is undeniable that one of these colonies multiplied it's distribution by a factor of about five, while the other populations dispersed to a much lesser extent. The three populations were overlapping a thalweg or a river: If buoyancy has been the mechanism for this expansion of the Alizés Ouest population, other populations would have expanded just as much.

This is evident when we superimpose data on the map:



At a finer scale, the 2005-2007 situation is glaring in the Alizés:

To explain this phenomenon, physical and human factors seem to be ruled out. The three different areas have the same dense bush environment, same geology, same pedology, same climate, same dominants winds, same climate accidents, same incline, same treatments at the same moments and at same doses, the question rises immediately:

Why did one colony spread so much faster than the others?

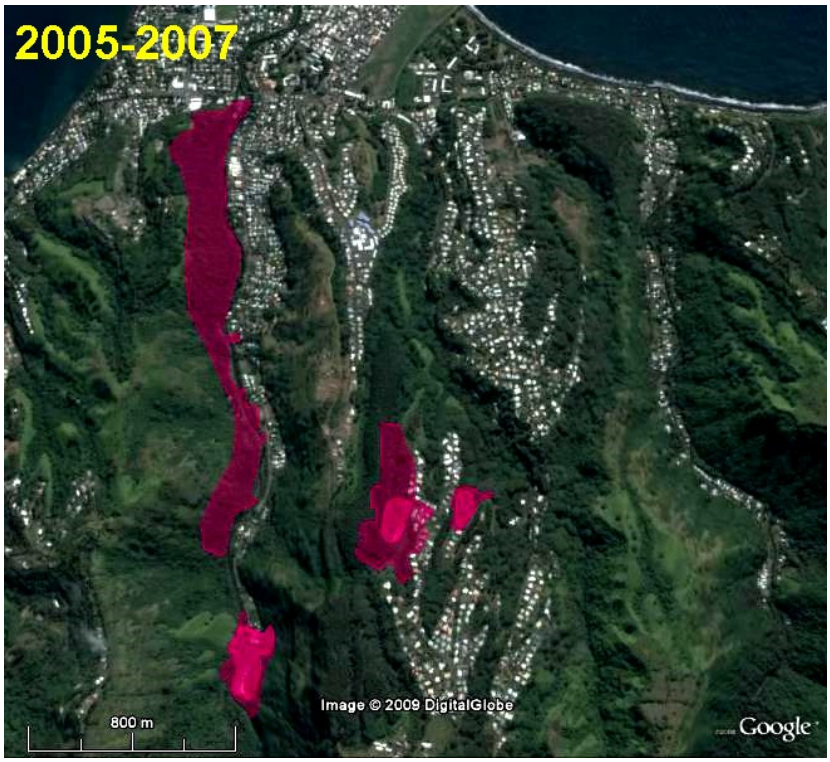
There are several hypotheses:

1. Perhaps some local vegetation was repellent or toxic to the ants?
2. Perhaps the soil was toxic to the ants?
3. Perhaps there were more aggressive insects in some areas?
4. Other?

Perhaps due to a lack of means and interest, and despite requests for action, no scientific research had been possible, the question of why some colonies spread faster than others remained unanswered.

2. Tuauru Valley colonies:

At the same time, another puzzling phenomenon was noticed. The Tuauru river, free of LFA in 2005, revealed to be very quickly populated in a very streamlined colony all along its West side, which is not urbanized, while the colony just above it was quite not spreading:



Until now, the accepted hypothesis for this introduction of little fire ants was that someone may have dumped a large quantity of contaminated goods or soil, as spotted in small garbage dumps all along the river bank. It was thought that these small colonies merged together, before spreading toward cliffs.

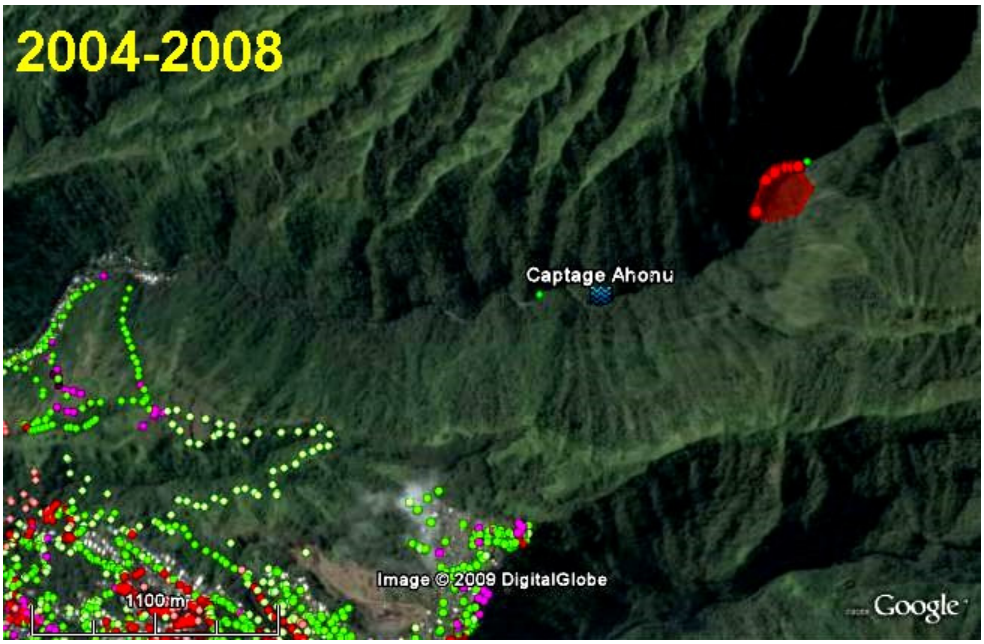
This hypothesis appeared all the more plausible given that this practice of dumping rubbish is common, though was at the same time denounced by some Ahonu Valley inhabitants who saw all along their river stacks of excavated earth, with the earth coming without authorization from the OPH working area in the same valley.

An alternative explanation is simple. It comes by the light of what happened on the heights of Ahonu River.

3. Ahonu Valley Colonies:

The origin of this population of little fire ants in Ahonu valley remains puzzling. It is a steep-sided valley, where the GPS we had at this time were unable to receive signals because of the relief.

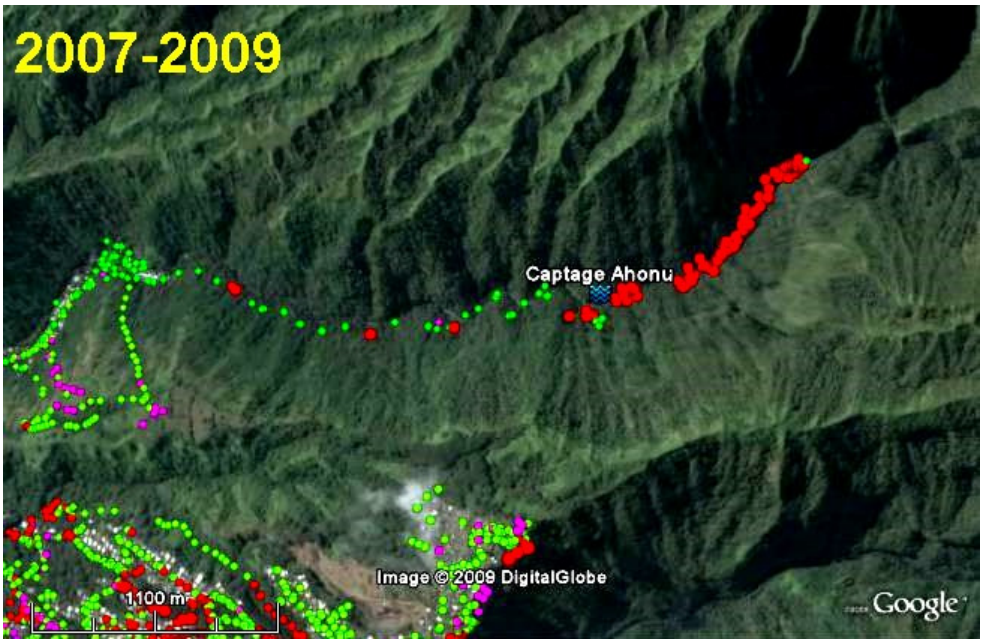
The *Ahonu Haut* colonie was discovered on the 1st July 2006, when it had a distribution of about 50 m along the river, with visible limits on the east side, but immeasurable limits on the west side due to the cliffs:



(Points: **Green** = other ant species; **Violet** = no ant trapped ; **Red** = LFA ; Pastel = Before 2007)

The difficulty in sampling the area resulted in no additional estimates of distribution were made between July 1st, 2006 and January 17th, 2008. At this time the whole river seemed relatively healthy, at least between the highest houses and harnessing water pumping station. The colony had apparently spread 50 m upstream, and 75 m downstream. Its progress in the masses of rocks slide appeared relatively reduced. This limited degree of spread seemed reassuring, in that a slow moving colony may later be able to be exterminated. It appeared not to have spread far over a 2 year period.

The following distributions were mapped at December 31st, 2008, over the downstream part up to the first residential area, and of April 22nd, 2009 for the colony itself. These distributions are without ambiguity. They show clearly how the LFA propagates by flotation and give an idea of the speed that this spread may have occurred:



As we can see, the satellite populations are sometimes distant from their apparent point of origin (here, 400 - 500 m between the most downstream satellite and its nearest upstream colony).

The hypothesis of possible spread by humans is dismissed because there is neither road nor runway along the river, the zone is of restricted access because of the harnessing of drinking water. Note that each population or colony is not bound with the others.

It is a clear example of how a river can become contaminated over its entire length.

4. Tuauru Bridge, Fritch area:

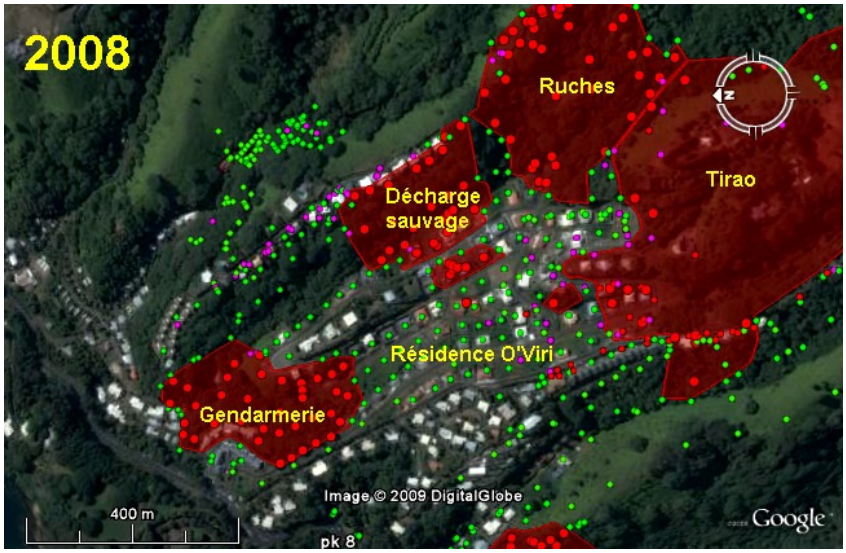
Everywhere on Tahiti, the belt road acts as a barrier for the LFA extension. This general phenomenon is evident in Mahina (the Commune with highest ant densities). Here, the belt road is crossed in one place only: the bridge over the Tuauru River (the strongest river of this Commune):

The origin of the unique seaside contamination in Mahina is evident: Ants appear to have crossed under the bridge, even before the upper colony reached the bridge.

All Tuauru banks should have to be very closely and permanently watched, from the highest contamination up to the river mouth.

5. O'Viri – Gendarmerie du Taharaa:

Early 2008, the Taharaa crest inhabitants organized several days of little fire ant surveillance on their Housing Estate. These surveys confirmed the Tirao colony, and found others, and more critically indicated that O' Viri is quite heavily surrounded:



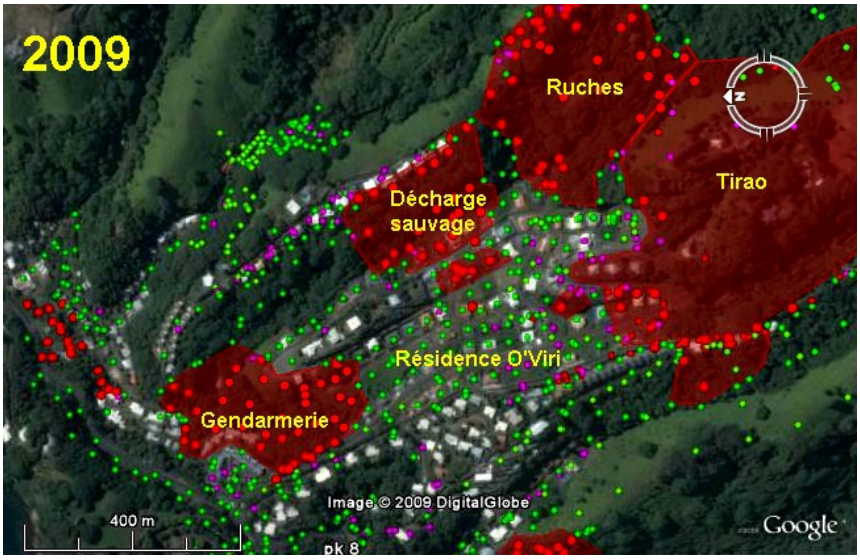
In its exact centre, the colony said "*of the hives*" (Ruches) houses a container and wears excavator tracks. This colony almost complete circles that area, and goes onto merge with the Tirao mother colony. The uncontrolled dump site colony extends to the Baccino Housing Estate access road, which blocks its way. These satellite contaminations are almost certainly the fruit of human activities.

In contrast, the contamination described as "*of the Gendarmerie*" extends in bush below the end of O' Viri's gutters, in a zone without known constructions for many decades. It is apparently exempt of constituted or uncontrolled dump sites.

The 2009 data thus appear to confirm the powerful diffuser effect of rivers and pipes: O' Viri gutters are concreted, deep with vertical walls. They are probably not able to hold ants flooded by rains; a lack of chance for the ants to extend their distribution along the route of the pipes, a chance for the inhabitants.

It is at the place where they break off abruptly that the surviving castaways appear to have dispersed, given that this is a blank place and convenient for their proliferation. As a consequence, the centre of the Housing Estate escaped this plague.

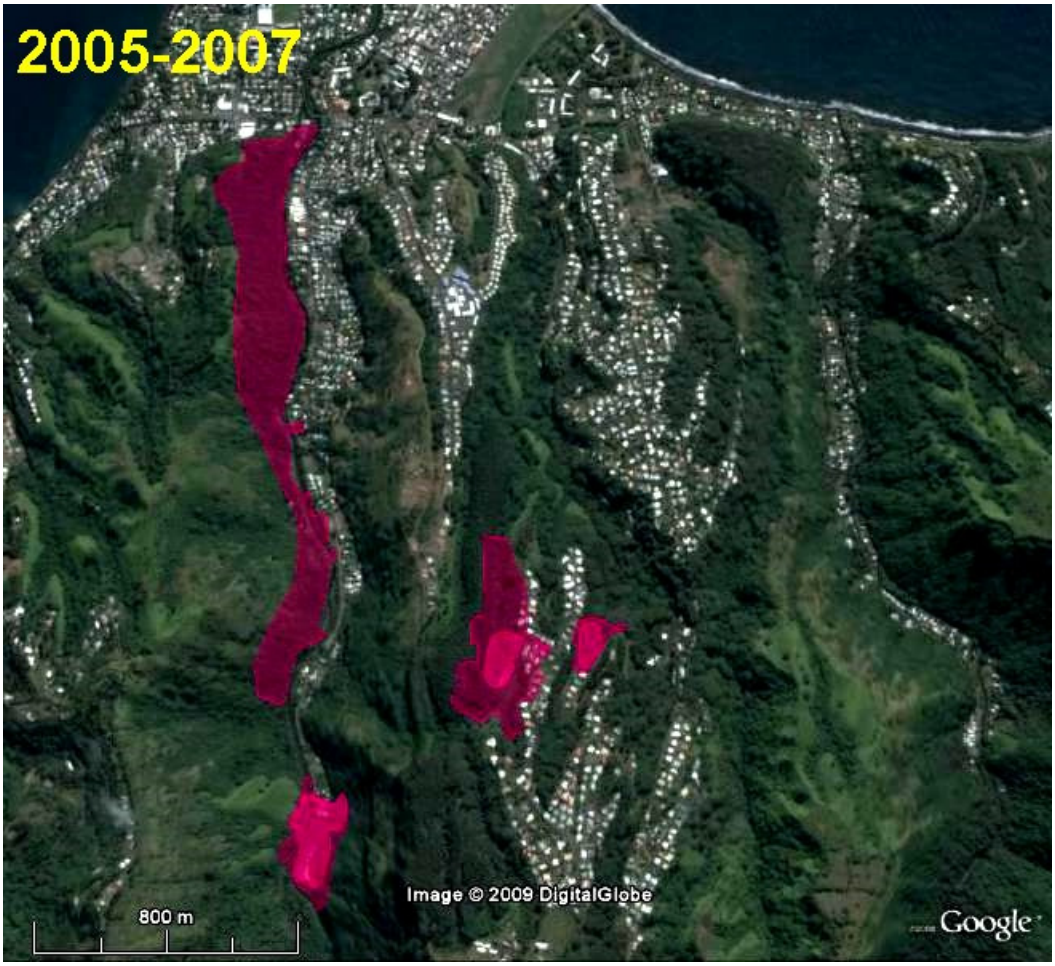
Downstream, the stream reaches the sea. The 2009 survey reveals a new, widely distributed contamination:



If the O' Viri Housing Estate gutters had been built up to the sea, the situation would certainly be less critical for all the district, because LFA doesn't survive long in sea water***.***

Discussion

If we revise the initial question under the hydrographical angle, the spread of these ant colonies becomes coherent:



- Tuauru is a major river of the North coast of Tahiti. The founding colony was situated at more than 5 km from the sea. These 5 km are now heavily contaminated, with some hundreds of meters between sites lacking infestations. The disentangled shape of the contamination is coherent with a scattering by flotation.
- The fact that the Tuauru mother colony did not seem to evolve is a "sampling effect": Due to the lack of means, tests were concentrated too close to it to reveal the disaster which was spreading downstream.
- The *Alizés Ouest* colony covers a minor river, but a river of a more regular flow than the *Alizés Est* one. Thus the LFA propagated quicker in the first one, probably by following banks.
- The *Alizés Est* colony is on a temporary river. This simple fact is enough to explain its visible slowness with regard to the two others, an evolution similar to the one of colonies on crests.

The distance between satellites created by flotation is thus all the bigger as the stream flow has an annual average and\or important peaks of activity.

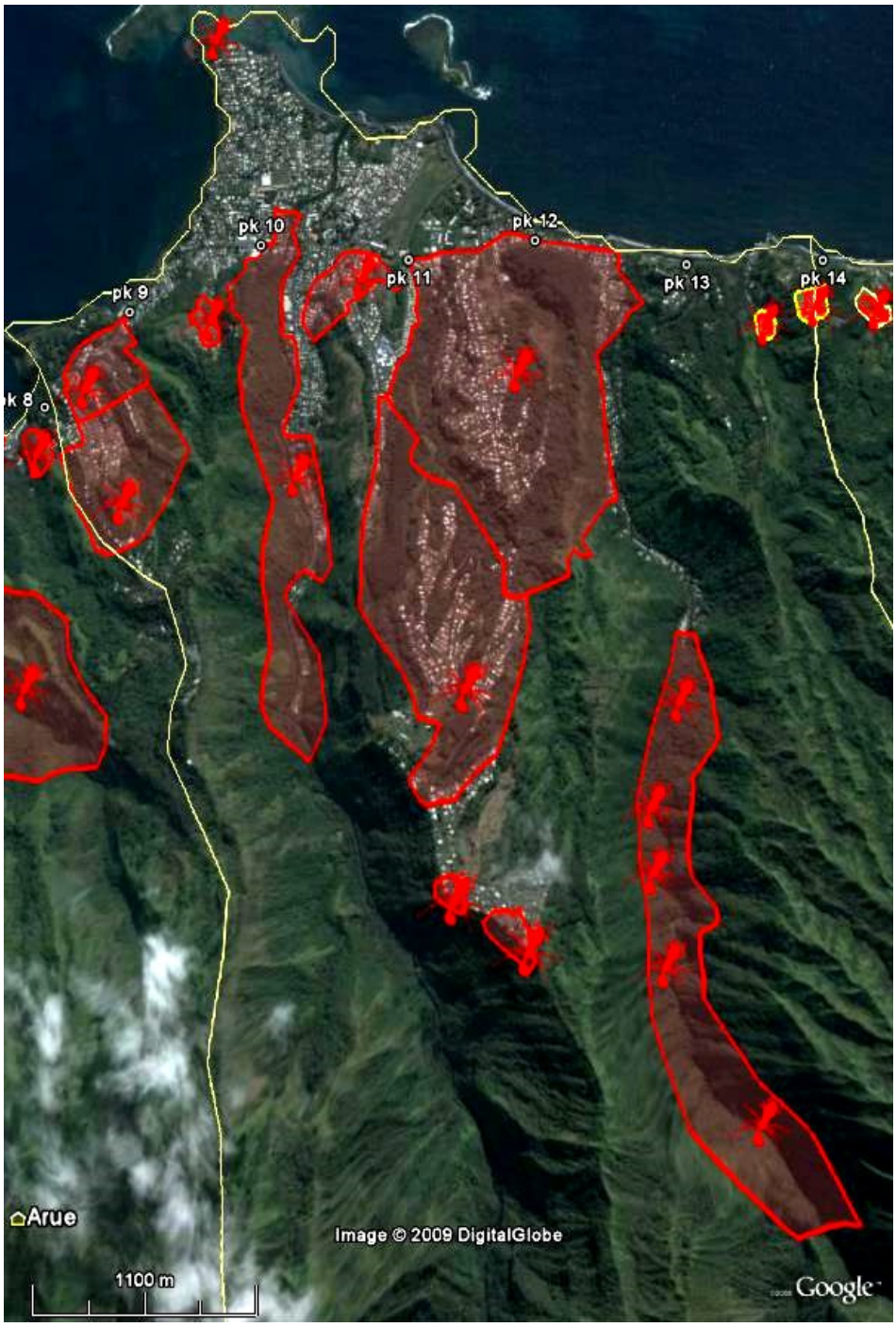
Conclusion

As a consequence of these observations, I consider that all colonies located on border of river and which are far from the sea are the most dangerous in terms of future spread. Such contaminated rivers necessitate the regular sampling of their banks, from the highest contaminated point up to their mouth, and the immediate treatment of any spotted budding.

A considerable technical problem is that hydraméthylnon, the only product currently effective against big contaminations, disintegrates immediately when in contact with water. We have, here, a big problem.

Thus, all the important rivers should be monitored from the moment there are human activities aside or overhanging their banks. Such monitoring is all the more if the rivers are already contaminated. All agricultural areas, all areas worked by the industry (BUILDING AND CIVIL ENGINEERING WORKS in particular) and garbage dumps, should be closely watched as a precaution.

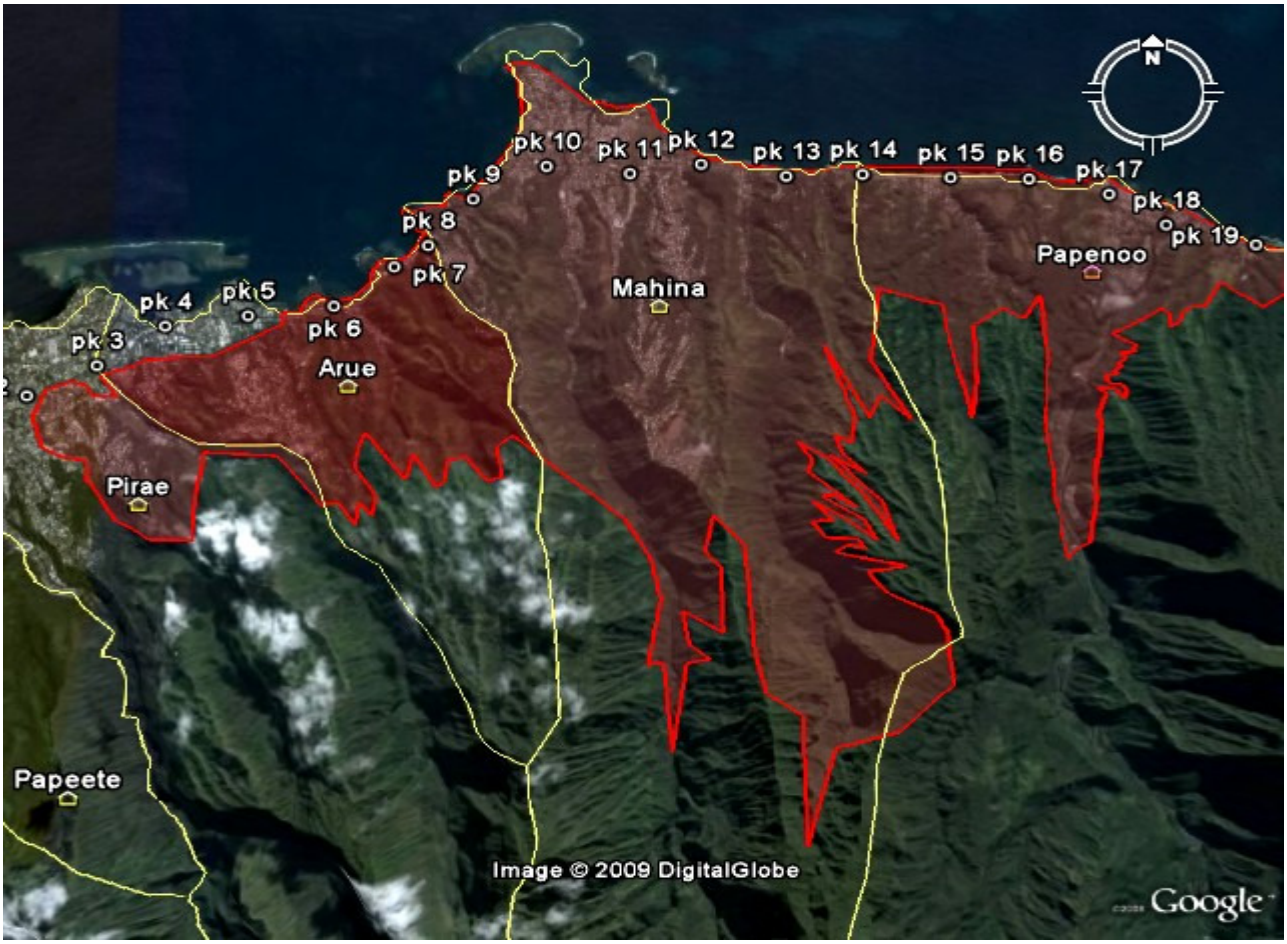
The situation in treatments on Mahina is the following one, for 2009:



Little fire ant infestation routes are now predictable. For example, the Ahonu and Tuauru Valleys will eventually be contaminated over their length, up to the sea. It's the same for the Opaerahi river, for the Gendarmerie colony, and for all the colonies in watersheds containing a stream.

Another consequence of infestations in river systems, the Commune of Mahina is stricken at more than 80 %, and will soon be at 100 %. The nearby municipalities should be concerned; in particular that of Arue whose biggest colony also engulfs a river lined up to the sea with houses.

The stop or the decline of the fight would send us directly to this degree of infestation within just a few years, or months, and this for the North of the Island only:



This rate of spread is, however, likely to increase because ***the larger the contaminated area, the more passive dispersal cases are frequent, which will accelerates and extend this invasion.***

On Papenoo, the entire Island crossing road is under threat of invasion, with the Vahiria valley included. The least well known area begins at the karting and goes to the sea, but the whole valley is in danger, as well as Vahiria's because of the Island's crossing road.

On Punaauia, the district below the RDP (=belt road) under the Punavai big colony is a critical place to monitor.

On Papara, the Ahoaraa River must be sampled along its entire reach because the colony found at this site is wide and situated exactly at its mout. We have no idea where this propagule came from or how it had been able to settle there.

On the peninsula, Faratea harbour and the Taravao plateau are very threatened, because they are modified by human disturbance.

The question as to how the mother colony of *Ahonu Haut* has been able to build up remains open, which lets promise other unpleasant surprises for whole Polynesia.

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Mahina, 18 May 2009.

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