Ips Sexdentatus Damage in Montesquiu Castle Park Scots Pine Stands;

Overview and Management Recommendations

Applied period project report
Course “Master of European Forestry Erasmus Mundus”

By Meelis Seedre

Supervised by Jordi Jürgens

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Preface

That is a report prepared during applied period (AP) in Spain, Barcelona in Diputació de Barcelona (Barcelona Provincial Council), Xarxa de Parcs Naturals (Natural Park Network) at **Oficina Tècnica de Parcs Naturals**. In frame of course "Master of Science in European Forestry, Erasmus Mundus" (MSc EF) (http://gis.joensuu.fi/mscef/).
Report is about Ips Sexdentatus (Six-toothed bark beetle) and its outbrakes in Scots Pine (Pinus Sylvestris) stands in the Park of El Castell de Montesquiu (Montesquiu Castle Park). The information about the details of the internship can be found in the AP diary. The supplementary information about the Natural Park Network and Provincial Council can be found in AP report and in Provincial Council's internet site www.diba.es.
The internship was carried out between October- December of year 2005.
To prepare the report I used literature available in internet and also had personal communication with European entomologists; Åke Lindelöw, Fredrik Schlyter and Juan Pajares (Attachment 1, Mail correspondence with Juan Pajares).
The current report will give overview of the problem and some management suggestions for future, in order to minimize bark beetle damage and grow healthy Scots Pine stands.
As the main result of the AP period work is the extra attention drawn into the bark beetle problem in Montesquiu Castle Park and authors work on gathering information and discussing relevant issues with people in charge, mainly with supervisor Jordi Jürgens who will work out the practical details for future beetle fighting projects. Some extra funds have been given to solve the problem. The report is designed and written in order to have a paper based copy of main issues concerning the problem and management suggestions agreed to be best in current case. Therefore the report does not cover all background information, as that it is known by the people who will use the report in the practical forest management.

Keywords: Scots Pine (Pinus Sylvestris); Six-toothed bark beetle (Ips Sexdentatus); Montesquiu Castle Park (Park of El Castell de Montesquiu); (?Mediterranean forests?)

Overview of the problem

In the foothills of Pyrenees in the Montesquiu Castle Park and surrounding areas previous (two) years a problem with dying Scots Pine has appeared. During the last years the precipitation has been lower than usual which is the most probable cause of weakened Scots Pine in its southern limit.
The weakened trees have been attacked by park beetle Ips Sexdentatus. Possibly some or more healthy and not weakened trees have also been attacked as the beetle population is big (personal observation).
Affected Pine stands lay in the altitude of 500 to 800 meters, the area of affected forest is ca. 5000 ha, situated in Montesquiu Castle Park areas and in its surrounding private forests.
The first *Ips Sexdentatus* outbreak at this kind in Catalonia region (Figure 1) was in 1994.

Figure 1. Catalonia region in Spain

About Montesquiu Castle Park

Accoridng to the park home page:

> “On the border between the districts of Osona and El Ripollès, the Park of El Castell de Montesquiu (Montesquiu Castle Park) is spread (Figure 2) over the municipalities of Montesquiu, Sant Quirze de Besora, Santa Maria de Besora and Sora, within the sub-district of El Bisaura. It covers a relatively modest area of 464.5 hectares (ca. 260 ha of Scots Pine), most of which lies within Montesquiu, and is divided into two parts by the River Ter: the larger part lies on the left bank and the smaller, with its more gentle contours, on the right. The entire area is made up of oak and pine woodland and ancient masies (traditional Catalan farmhouses), The Park has, since 30 July 1986, been legally protected by a special plan promoted by the Diputació de Barcelona.”

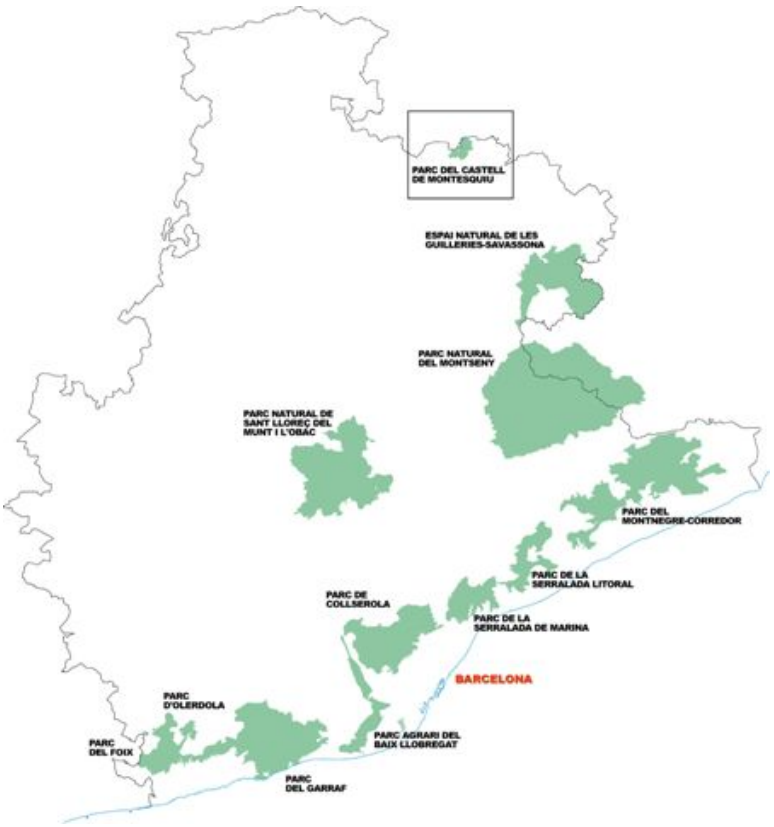

Figure 2. Montesquiu Castle Park location in Catalonia region

Scots Pine forest in Spain, Catalonia and Montesquiu Nature Park

According to Alía et al. (2001)

> "Scots pine (*Pinus sylvestris L.*) reaches in Spain the southern limit of its wide natural range. Spanish populations have been described as refugia of the species during glaciations. They occupy today more than 700 000 ha. About one half of this area is covered by natural and disconnected stands, different from the rest of the European populations. Spanish provenances offer high resistance to drought and several adaptations have been described, including low growth rate and branching habit. General interest comes mainly from the need to preserve genetic resources, their use for shelter plantations and their high wood quality."

The forest area in Catalonia region is a ca. 1.2 mill hectares which is 39.1% of the total land area (32'000 km^2). The region is biologically very diverse, for example there is 95 different tree species. The main forest types are; *Pinus Halepensis* (20.0%), *Pinus Sylvestris* (18.1%), *Quercus Ilex* (15.7%) and *Pinus Nigra* (11.9%).
Of Montesquiu Castle Park 464.5 hectares of forests *Pinus Sylvestris* in pure stands and in mixed stands (with *Quercus Ilex*) makes up half (Figure 3).

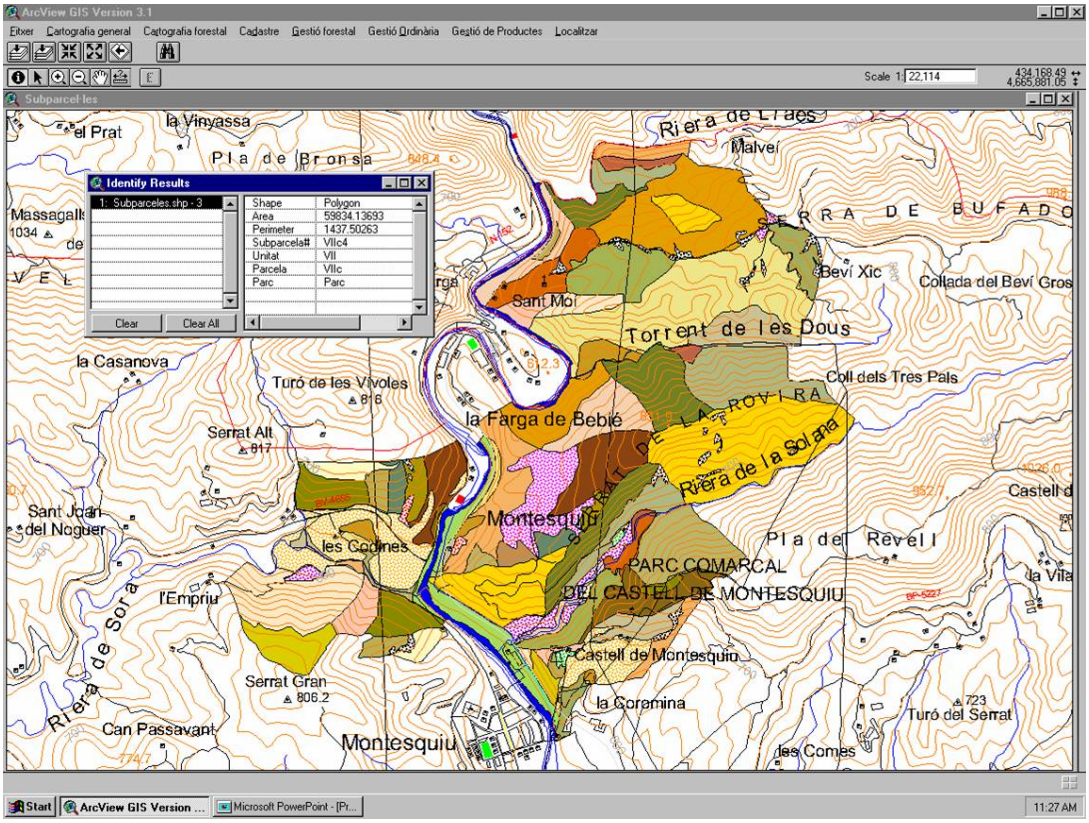

Figure 3. Forest stands in Montesquiu Castle Park (Scots pine stands in green colour's)

Ips Sexdentatus

According to CABI and EPPO, Data Sheets on Quarantine Pests:

Identity

Name: Ips sexdentatus (Börner)

Synonyms:
Dermestes sexdentatus Börner
Ips typographus De Geer
Bostrichus pinastri Bechstein
Tomicus stenographus Duftschmidt

Taxonomic position: Insecta: Coleoptera: Scolytidae
Common names:
Six-toothed bark beetle (English)
Stenographe (French)
Grosser 12-zähniger Kiefernborkenkäfer (German)
Tolvtannet barkbille (Norwegian)

Hosts

In central and southern Europe found on Pinus sylvestris and also on P. pinaster, P. heldreichii and P. nigra. It is occasionally recorded on species of Larix.

Figure 4. Some *Ips sexdentatus* individuals

Geographical distribution

Ips sexdentatus occurs in Pinus forests throughout Europe.

Biology

The species has four to five annual generations in the Mediterranean area and in other areas with a long, warm summer season.
The spring flight starts when the temperature exceeds about 20°C; in the north this is in May/June, in southern areas in March/April. The male beetle initiates the boring and releases an aggregation pheromone consisting mainly of ipsdienol (Vité et al., 1974). Brood development from the start of gallery construction until the emergence of the new generation adults may take 2-3 weeks at a constant laboratory temperature of 27°C and 3-4 weeks at 22°C. No gallery construction and brood production succeeds at a constant temperature of 12°C. Overwintering is in the adult stage. The supercooling point in hibernating adults is about -19°C, whereas in larvae it is only -9°C (Bakke, 1968).
In the Catalonia region the beetle has three generations; June, July and August, (30-45 days to develop), 50% of the population in June.
Natural main natural predators of *Ips Sexdentatus* are *Thanasinus formicarius* and *Temnochila coerulea.*

Detection and identification

Symptoms

Reproduction occurs under thick bark of pines. The gallery system has two to four female galleries up to about 1 m in length, half of them in each of two opposite directions. Larval galleries are 8-10 cm long. The wood under the gallery is stained blue from fungi transferred by the beetles (Chararas, 1962). As in the case of other conifer bark beetles, I. sexdentatus acts as a vector for a bluestain fungus (Ophiostoma brunneo-ciliatum) which also damages the tree (Lieutier et al., 1989).

Morphology

This is the largest beetle of the genus Ips, 7-8 mm in length (Figure 4). Both sexes have six spines at each side of the elytral declivity. The fourth is the largest and is capitate. Only the female has a longitudinal stridulatory organ on the upper hind part of the head (Balachowsky, 1949; Chararas, 1962; Grüne, 1979).

Means of movement and dispersal

Laboratory experiments have shown that adult Ips spp. can fly continuously for several hours. Jactel & Gaillard (1991) found, for example, that in a sample of 38 beetles, 98% could fly >5 km, 50% >20 km and 10% >45 km. The speed of flight was constant and equalled 1.3 m/s. In the field, however, flight has only been observed to take place over limited distances and then usually downwind. Dispersal over longer distances depends on transportation under the bark of logs.

Pest significance

Economic impact

This species is of no significance as a pest in northern and central Europe, where it breeds only in fresh logs or in weakened or dying trees**. It has caused death of Pinus sylvestris and P. radiata suffering from drought stress in central and southern France, northern Spain and Portugal** (Goix, 1977; Perrot, 1977; Lieutier, 1984; Ferreira & Ferreira, 1986; Lieutier et al., 1988; Paiva et al.,1988; Cobos-Suarez & Ruiz-Urrestarazu, 1990), often in association with other pests (I. acuminatus, Tomicus piniperda). Outbreaks have occurred on Picea orientalis in Turkey (Schimitschek, 1939; Schönherr et al., 1983).
Its caused death in Pinus sylvestris stands in present case does not cause big economic losses to Montesquiu Castle Park but is an economic problem for the owners of neighbouring stands. Therefore successful handling of the problem in Park and used practical measures are useful for other forest owner with similar problems as they can use

Figure 5. Damaged trees in Montesquiu Castle Park neighbouring area

the experience and information from current project.
Ca. 1000 individuals of *Ips Sexdentatus* per trap per year is considered to be indication of outbrake.

Identification of the damage

According to the report Common Forest Pests and Diseases in SW-Europe- *Ips sexdentatus.*

- Tree tops become discoloured (needles turn yellow then red-brown) (Figure 5).
- Orange or yellowish sawdust coming out from insect entry holes on the trunk (between March/April until September/October). Sometimes presence of pitch tubes around the entry holes. (Figure 6)
- Presence of galleries under the bark. The galleries system is very typical with 2-5 main branches (maternal galleries). The length of these egg galleries is variable and can go until 1 meter or more.
- In the gallery system larvae (white and c-shaped), pupae or (immature) adults can be present. Immature adult beetles are yellowish-brown in colour, mature beetles have an almost black body (and grooved elytra). The beetles are 5-8 mm long, their hind end is cut off and bordered on each site by 6 spines.

Figure 6. Pines died because of *Ips Sexdentatus*

Damage

- Reduction of tree growth.
- Weakened trees often die. At high population levels massive attacks can lead to the death of healthy trees.
- The beetles transmit fungi that cause blue stain.

Risk factors

- Stressed trees are more prone to attacks. Therefore attacks are more intense in successive years of drought and on trees ravaged by fire or storms. The drought is most probably the main reason in present case why the trees became weakened and attacked.
- Timber piling near stands or presence of burnt or fallen trees (which are very susceptible to this species), increases the risk for neighbouring healthy trees.

Phytosanitary risk

According to EPPO/CABI:

I. sexdentatus is not considered to be a quarantine pest by EPPO or any other regional plant protection organization. It is not generally a primary pest and is only capable of attacking trees already suffering stress, either environmental or from other pests. It is already very widespread in Europe. The island of Ireland remains the principal area facing a certain risk Ips sexdentatus from this pest. I. sexdentatus is unlikely to spread there naturally, so that phytosanitary measures could be justified. However, it should be stressed that I. sexdentatus is a much less important pest than I. typographus (EPPO/CABI, 1996), and so presents a much lesser risk than that species.

Management

According to CABI and EPPO, Data Sheets on Quarantine Pests The most effective control measure is to remove infested trees before the new generation of adult beetles emerge. If it is judged necessary to take phytosanitary measures against I. sexdentatus, measures equivalent to those taken against I. typographus would be effective. That is also in accordance with correspondence with

Detailed management suggestions

The measures are written to fight *Ips typographus* but it has been said that the measures taken against *Ips Sexdentatus* should be similar. From mail correspondence with Spanish entomologist Juan Pajares: “Even though of lesser agressivity (i.e probably higher outbreak threshold), the dynamics of this species is similar to that of *Ips typographus* and management measures are thus the same. Best described by Kulikova 2001:

Urgent protective measures

In particular, *urgent protective measures* can involve following:

1. clear sanitation cuts in areas with degree of stand injury more than 30%; using traptrees, pheromones and strictly controlled insecticide treatment;
2. limitation of main cuts instead of cuts in injured stands;
3. sanitation cuts with removal of newly infested trees;
4. obligatory cuts of infested trees with their immediate debarking or removal before emergence of young generation beetles during spring and at the beginning of summer (May-June), to ensure;
5. using pheromone traps for population monitoring and as additional tool of reducing number of beetles;
6. in some cases, near large infested areas, harvesting weakened spruce (pine) trees and using them as trap-trees and placing on them pheromone dispensers to increase tree attractiveness and catch ability with further debarking and removal of those trees;

7. removal of forest debris left after the storm all over the damaged areas and
8. assistance to natural regeneration or creation of forest plantations.

Preventive measures

Preventive measures can include:

1. increasing stability of forest stands by thinning which improves wind firmness of trees with well-developed root systems;
2. implementing thinning preferably at an early age of stands;
3. removing harvested timber from forest areas in time to protect logs from *Ips typographus (Ips Sexdentatus)* colonization;
4. avoiding Norway spruce (Scots pine) growing in lowlands and drought-prone areas until old age. Overaged unstable stands represent potential danger to neighbouring forests by serving as breeding sites for *I. typographus (Ips Sexdentatus)* beetles;
5. introducing of other age groups or tree species which will reduce habitat continuity, and may play a preventive role against *I. typographus (Ips Sexdentatus)* proliferation and
6. creating stand edges made with regard to maximum stability, taking advantage of natural windbreaks and well-rooted trees, as *I. typographus* frequently attacks the wind-affected and sun-exposed trees.

Final remarks

Long term measures;

- Grow healthy Scots Pine stands,
- study more the ecology of the *Ips Sexdentatus,*
- study more the prey-predator mechanism and
- study more the beetle outbreak and Scots Pine health relations to climate change.

Shortly;

- Debarking,
- sanitary cuts,
- massive trapping with Theyson traps and SEDQ bait (Figure 6) and
- proper silvicultural management.

Figure 7 Theyson trap

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Montesquiu Castle Park homepage,
http://www.diba.es/parcsn/parcs/plana.asp?parc=1&m=203&o=2

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Appendix 1

The mail correspondence with Mr. Juan Pajares

From: **Meelis Seedre <seedre@gmail.com>**
To: **Juan Pajares <jpajares@pvs.uva.es>**
Date: **14-Nov-2005 15:30**
Subject: **Re: Ips Sexdentatus in Pyrenees**

Dear Mr. Pajares

I'm a student from international MSc course "European Forestry" currently carrying out training in Spain, at the Barcelona Provincial Council's Natural Park Network administration . I got suggestion to contact you from César Gemeno.
I'm dealing with a pest problem in the Natural Park of El Montseny
(http://www.diba.es/parcsn/parcs/plana.asp?parc=3&m=197&o=2)
At the foothills of the Pyrenees a problem with Ips Sexdentatus attacks to Pinus Sylvestris occurred lately. We assume that due to water stress the trees get weak and the beetle attacks. At present 5000 ha of pine forest (altitude 500 to 800m) are affected and there are patches of dead pines scattered around (from 1 tree to some hectares). The problem occurred few years ago and we assume its correlated low precipitation during last summers, which weakens the pines on its southern limit where it's quite weak already. My task is to provide park managers with relevant information and provide with management suggestions. My present main questions are weather the outbreak can grow to larger extent and cause large scale problems and how similar are the preventive measures taken against Sexdentatus the ones used for Typhographus.
I've contacted entomologists to find information about that problem and now writing to you hoping you might have some useful information concerning the problem.

Thanks ahead,
Meelis Seedre

From: **Juan Pajares jpajares@pvs.uva.es**
To: **Meelis Seedre seedre@gmail.com**
Date: **15-Nov-2005 14:21**

Dear Meelis,
The situation you mention results very interesting. Outbreaks of Ips sexdentatus can grow larger if left unmanaged indeed. It is likely that the eruptive outbreak arose as consequence of the lowering of stand vigour as you suggest, but even if tree vigour returns, once the outbreak threshold has ben surpassed, cooperative behaviour (mass attack) will enable the beetle population to go up and colonize healthy trees, following a eruptive pulse pattern. Even though of lesser agressivity (i.e probably higher outbreak threshold), the dynamics of this species is similar to that of Ips typographus and management measures are thus the same: prompt removal of attacked trees before brood emergence (only debarking is neccessary) and removal of beetle population by mass trapping with pheromones; Pheromone baits for this species, containing Ipsdienol, are available at SEDQ (Barcelona) or at ECONEX (Murcia); there are two types of suitable traps available for bark betles: Theyson traps (slit traps) that can be purchased from

Germany and are used mainly in Europe, or Multiple funnel traps (Lindgren traps) available from Pherotech (Canada) and also from ECONEX , that are routine operated in North America. I have tested both of them in capturing Ips sexdentatus and no differences were found; Multiple funnel are easier to carry and to install but in our experiments they also trapped more bark beetle predators; In a single experiment, the SEDQ bait resulted significantly more effective than the ECONEX bait. Pheromone trapping will not be feasible until the next spring flight of the overwintering population (from mid of march), but in any case sanitation is a neccessary measure to carry out; it is advisable to sanitate already the trees containing overwintering larvae and callow adults (much of the adults however are by now overwintering in the forest litter) and those dying trees that are susceptible to be attacked next spring. Well, I hope these comments are useful to you. Do not hesitate to contact me for further questions. Best Regards

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From: **Meelis Seedre <seedre@gmail.com>**
To: **Juan Pajares <jpajares@pvs.uva.es>**
Date: **16-Nov-2005 19:16**

Dear Mr. Pajares

Thanks for the fast replay. I appreciate your comments very much, they are helpful in solving the "Catalonia Scots Pine" problem. Regarding your answer and our work here I have some new issues that could be commented by you. I'm also communicating with some Swedish and French entomologists but you are "closest" to the problem and probably better informed. If you have a moment to take a look and give some comments.

1. Mass trapping- what kind of density of traps could be reasonable?

2. Debarking before brood emergence- Sexdentatus can have 4-5 generations in Mediterranean area. Is there a best time for debarking (and for tree removal) or it should be done continuously?

3. Is there a way to increase the number of predators, what to keep in mind concerning the predators?

4. Usefulness of silvicultural treatments (mainly thinning) to improve the stand vitality?

I have not found literature in English concerning that issue, maybe you have something to suggest.
Also one out of subject question, from Jordy Jürgens, my supervisor here- "he is wondering weather you gave lectures in Madrid some 10 years ago, when he was studying there?".

My work here at Barcelona Provincial Council will result a project report which will be used as a guidelines when dealing with the problem, in Natural Park forests and also in neighbouring affected areas.

Thanks ahead again,
Meelis Seedre

From: **Juan Pajares** **jpajares@pvs.uva.es**
To: **Meelis Seedre** **seedre@gmail.com**
Date: **22-Nov-2005 13:55**

Dear Meelis

I´ll try to give some answers to your pertinent questions:
1. It is difficult to give a particular number of traps. It will depend on the number, size and distribution of the infestation spots, and size of the trees. Furthermore, mass trapping of Ips sexdentatus is quite new and there is no much practical experience on it (this one of the goals of our project). I think that at least one trap for each small size spot (10 to 15 trees). Experience on mass trapping for I. typographus would be valuable. Position of the traps is also important: traps must be outside the spot, at least some 50 to 100 apart from live trees and very visible (open sites) so they are well targeted by the inflight beetles.
2. Debarking or tree removal must be done sistematically all the fligh period around, upon detailed monitorig of attacked trees.
3. Pest management by means of manipulation of predators is one of the goals of our study. So far the only practical measure is to minimize impact of mass trapping on predators (mainly Thanasimus formicarius and Temnochila caerulea which are kairomonally attracted to Ips pheromones). We are currently testing trap modifications to filter out these predators but the only thing that can be done by now is: using slit (Theyson) traps, that have a minimal impact on T. formicarius (they are quite agile and most of them are able to escape from the traps) and monitor trap catches frequently (once per week) to free T.caerulea adults that are still alive in the traps (however they are quite agressive and many of them are badly damaged).
4. Increasing tree vigour is a accepted measure to prevent bark beetle outbreaks. Suitability of thinnings for this purpose is not clear cut though, and it will depend on the particular situation of your stand (ie, excesive density for that species of that age in that site. Forest managers will give an estimation of the range of suitable densities for the case). One advisable practice however is to selective thin the stand removing all weak, supressed, overdominated or slow growing tress that are most susceptible to be attacked.

On the wondering of your supervisor, I gave classes on forest pests in the School of Ingenieros de Montes in Madrid during the spring of 1994, but I do not remember of any other lectures by that time. Well I hope you find some help from my comments.
Best Regards
Juan