Land degradation risks to forests in Aquitaine

Mark R Bakker[1,2] & L Augusto[2,1]

[1] Bordeaux Sciences Agro, UMR1391 ISPA, F-33175 Gradignan, France;
[2] INRA, UMR1391 ISPA, F-33140 Villenave d'Ornon, France

Outline of this regional contribution

- Semantics (~ introduction)

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« expertise-like approach » (~ i.e. no time to do better than that)

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Regrouped together

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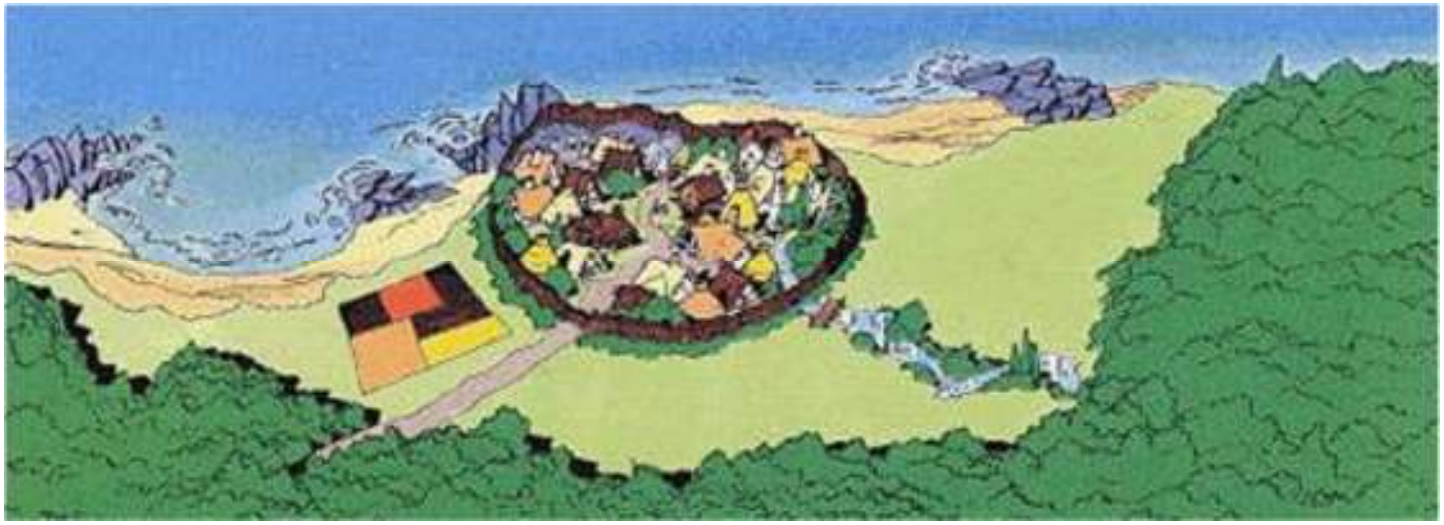
Land degradation is not necessarily confined to biophysical effects, nor is it limited to human-induced phenomena, but also includes natural impacts and effects.

Awareness about land degradation of land under forest cover: some old – Atlantic – evidence



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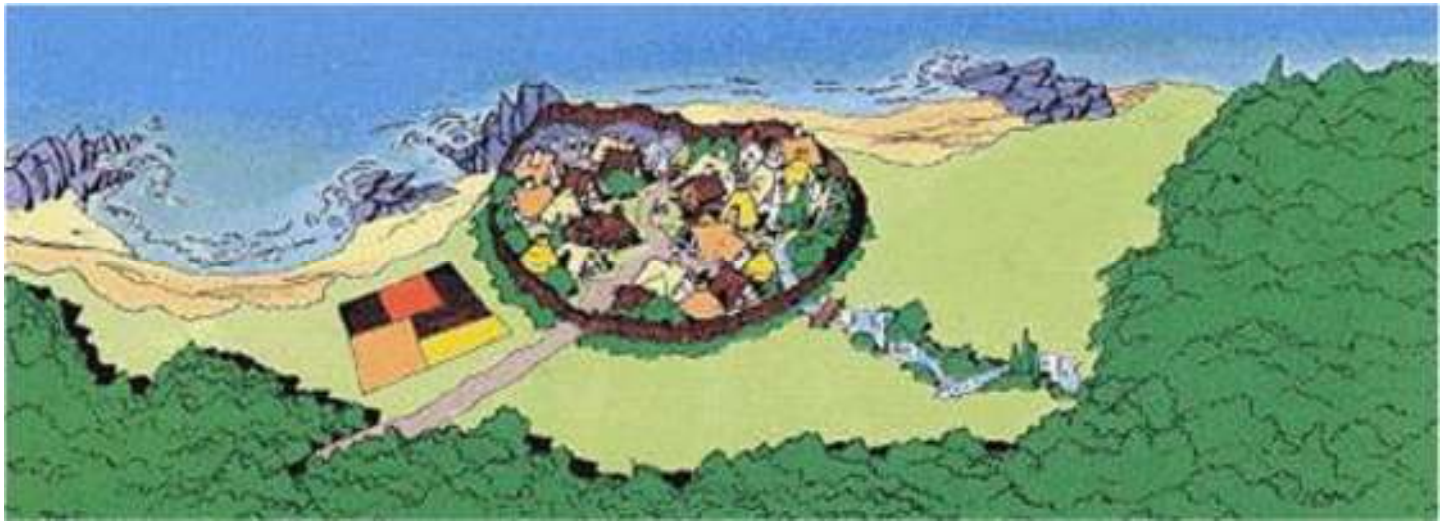
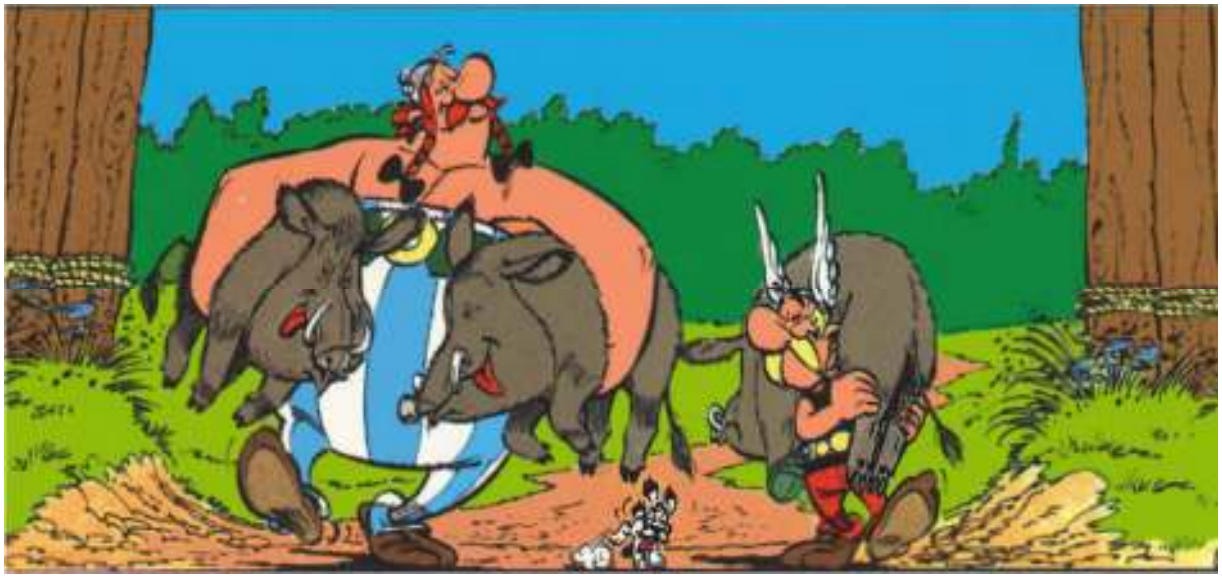


« ecosystem goods and services » in the good old time




KAiiiiiii!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what about Aquitaine in 2014?

Land degradation risks to **forests in Aquitaine**

SW France

Dordogne

Landes

Pyrenees

Often indicated as ‘triangle’ Landais

Land degradation risks to **forests in Aquitaine**

SW France

- pine forests > 90%;
- monospecific
- clearcut systems
- 40-60 yr rotations
- private owners

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- sandy, podzols and arenosols

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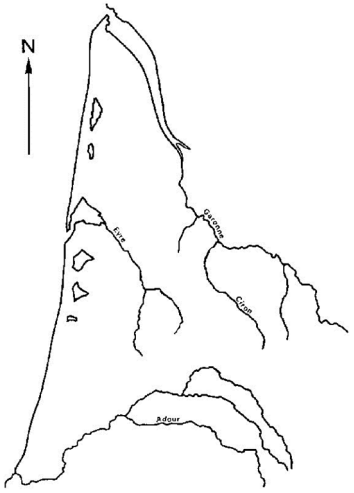

- nutrient poor, rather flat, few streams

Often indicated as ‘triangle’ Landais

Land degradation **risks** to forests in Aquitaine

A priori checklist of risks[1]

- **Biomass – land cover**: is the area covered by vegetation? Is the biomass of this vegetation stable or decreasing? ~link with production (if production increases does that put constrains on vegetation cover in the longer run)?

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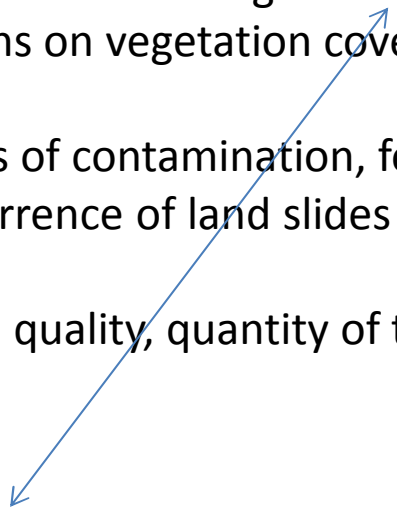

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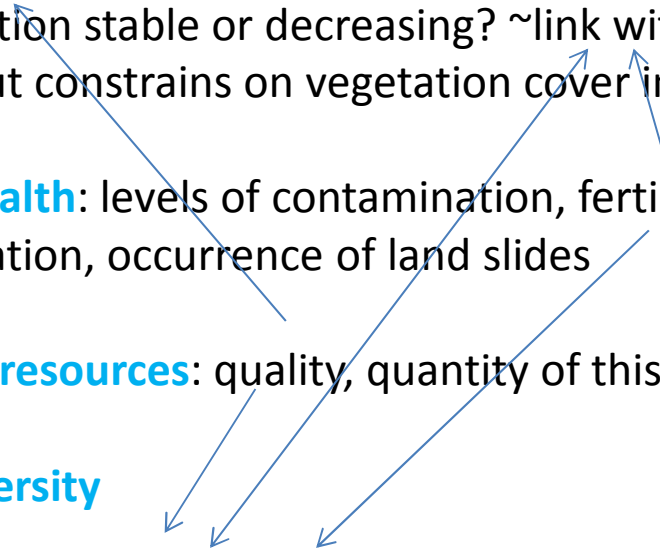

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What do we know?

Or what do we think we know

About threats to the forests in Aquitaine

Biomass – land cover

reference

[1]Pottier A (2013) La forêt des Landes de Gascogne comme patrimoine naturel? Echelles, enjeux, valeurs. PhD Thesis.

Biomass – land cover

reference

forest fires

- **Forest fires** in the 1940s (see b) : destroyed >150 000 ha in 1949 alone (risk could increase, but so far prevention measurements efficient)

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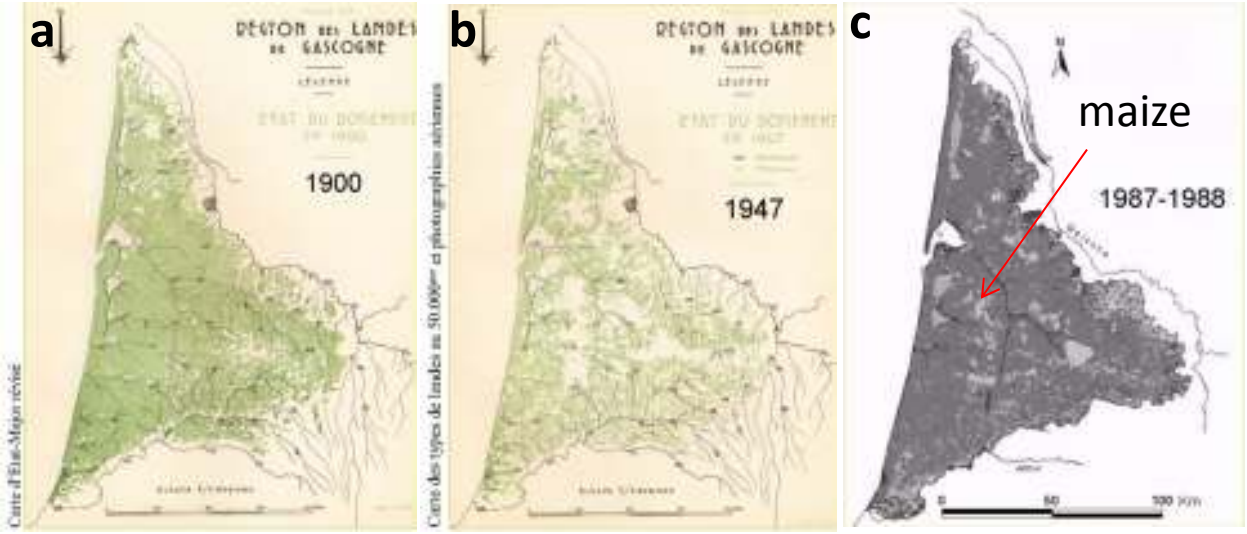
Biomass – land cover

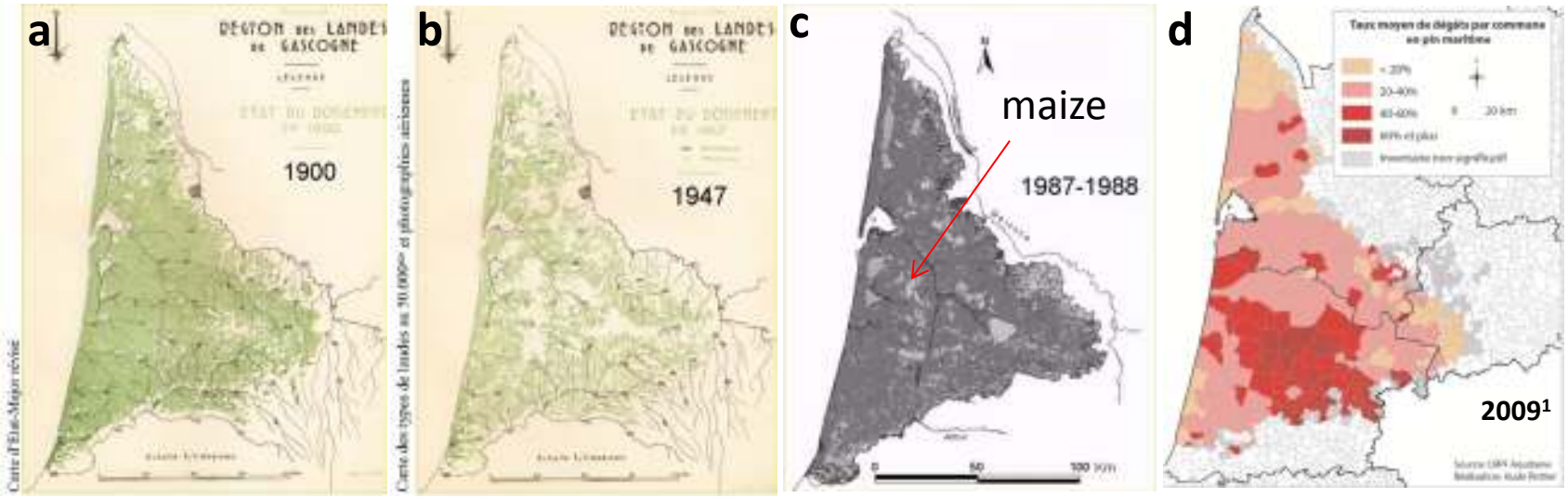
reference | forest fires | agriculture



- **Forest fires**
- **Transformation to other land use:** agriculture (see c; > 100 000 ha) , but also urbanisation, solar energy farms, infrastructure): ongoing

Biomass – land cover

reference | forest fires | agriculture | storms



- **Forest fires**
- **Transformation to other land use:**
- **Storms:** 1883, 1915, 1976, 1999, 2009: 238 000 ha in 1999, 600 000 ha affected 2009, occurrence predicted to increase (due to CC)

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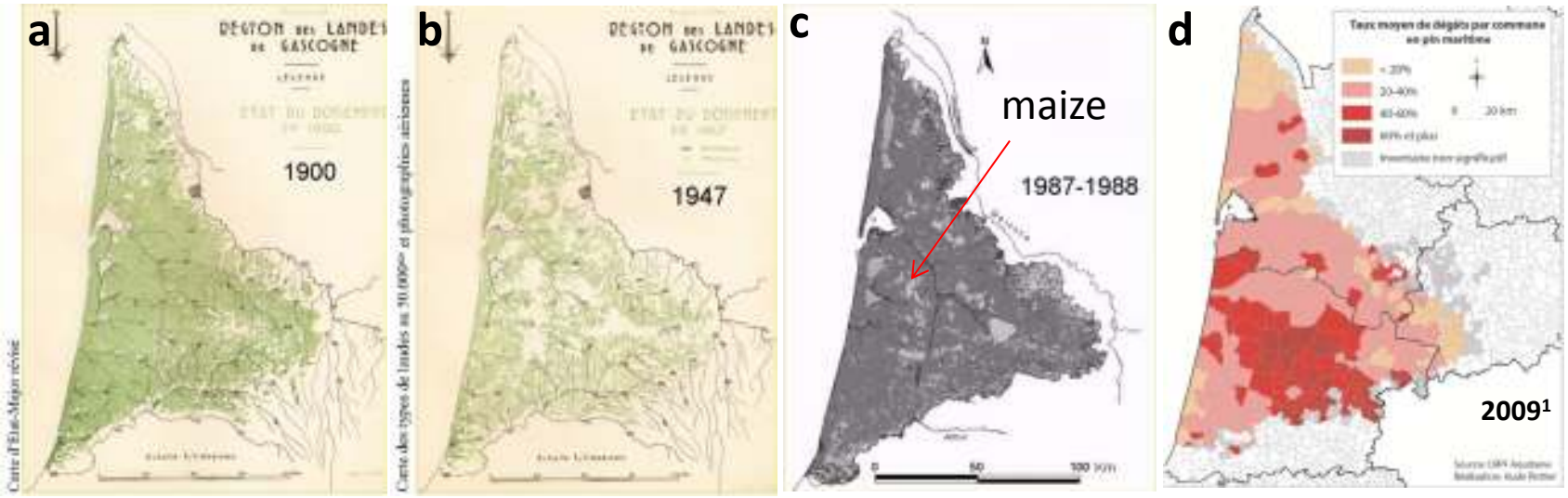

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- **Transformation to other land use**
- **Storms**
- **Severe frosts** (1956, 1963, 1985): 100 000 ha affected in 1963, 30 to 50 000 ha 1985

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Biomass – land cover

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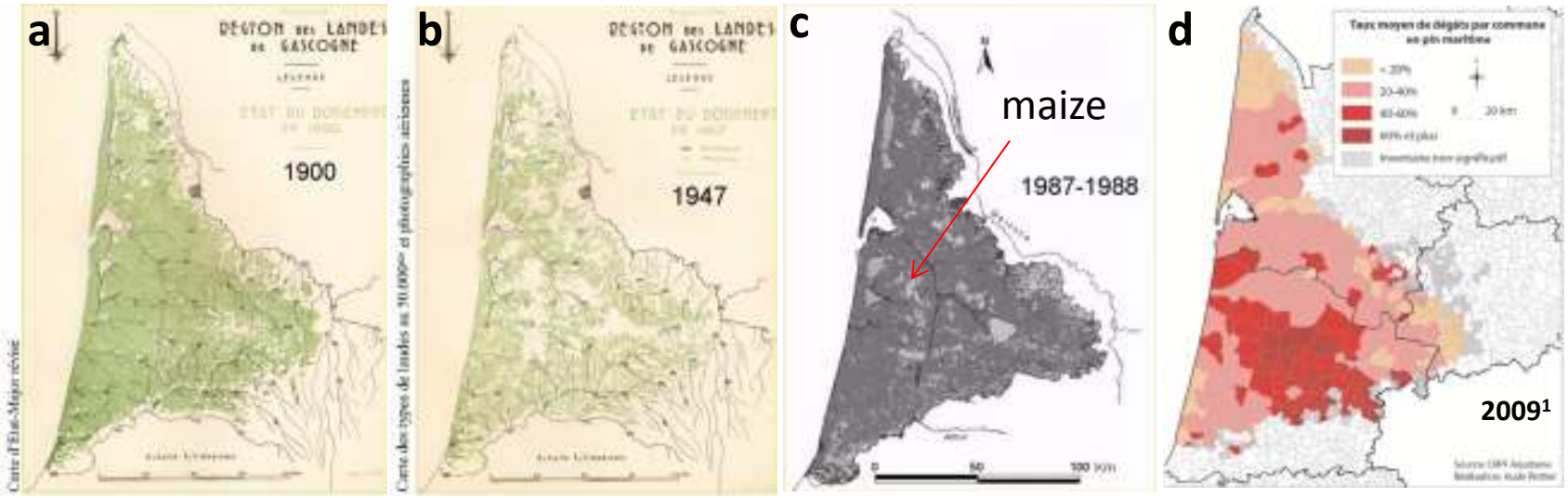

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- **Transformation to other land use**
- **Storms**
- **Severe frosts**
- **Drought:** 2003 very severe, weakening the forest (expected to increase; CC)

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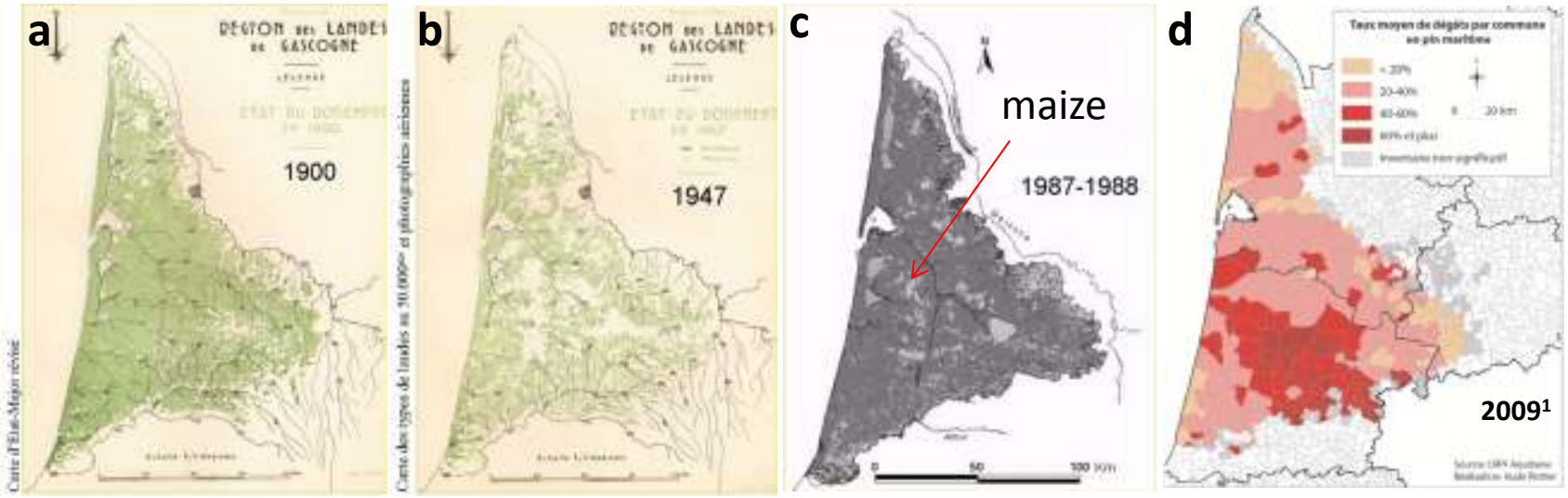

- **Forest fires**
- **Transformation to other land use**
- **Storms**
- **Severe frosts**
- **Drought**
- **Pests** (scolytes, processionary moths….. Pine nematodes expected (monoculture is a risk)

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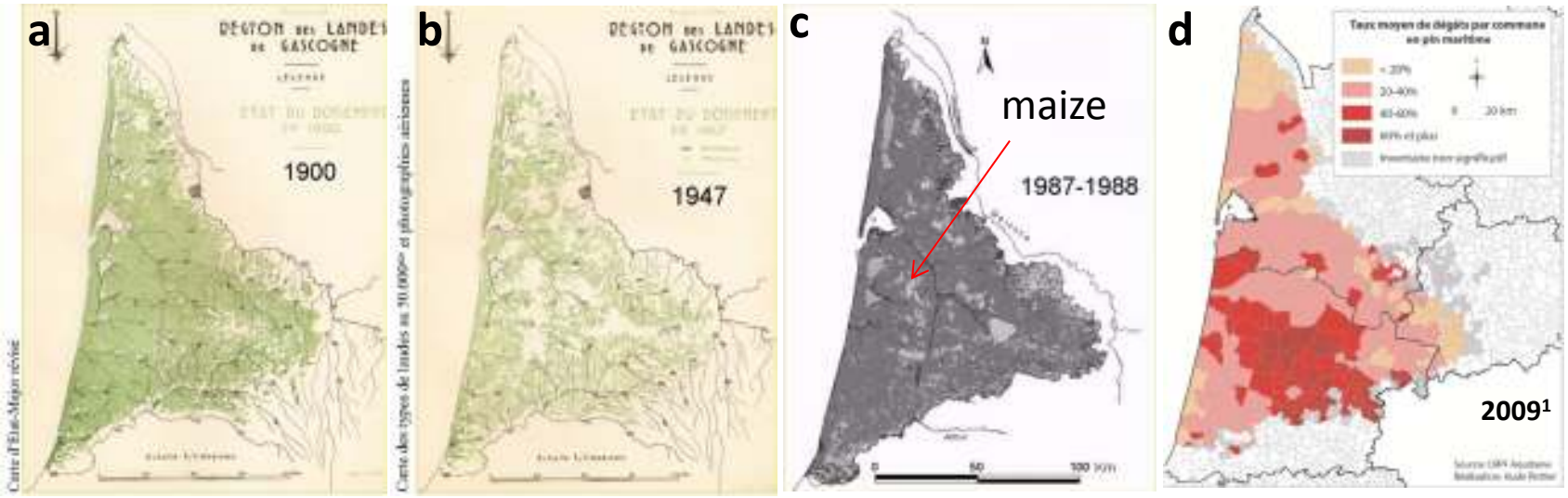

- Forest fires
- Transformation to other land use
- Storms
- Severe frosts
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Land cover / biomass will probably decrease ….
…… perhaps productivity after a while as well (water, nutrients, events)
….. and thus economic productivity (viability of the system)

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Soil health

- **Soils are primarily limiting in P**, in the dry moorlands and dunes in N and locally in K or Mg (Augusto et al. 2010). P fertilization is used since the 1960s (Trichet et al. 2009)

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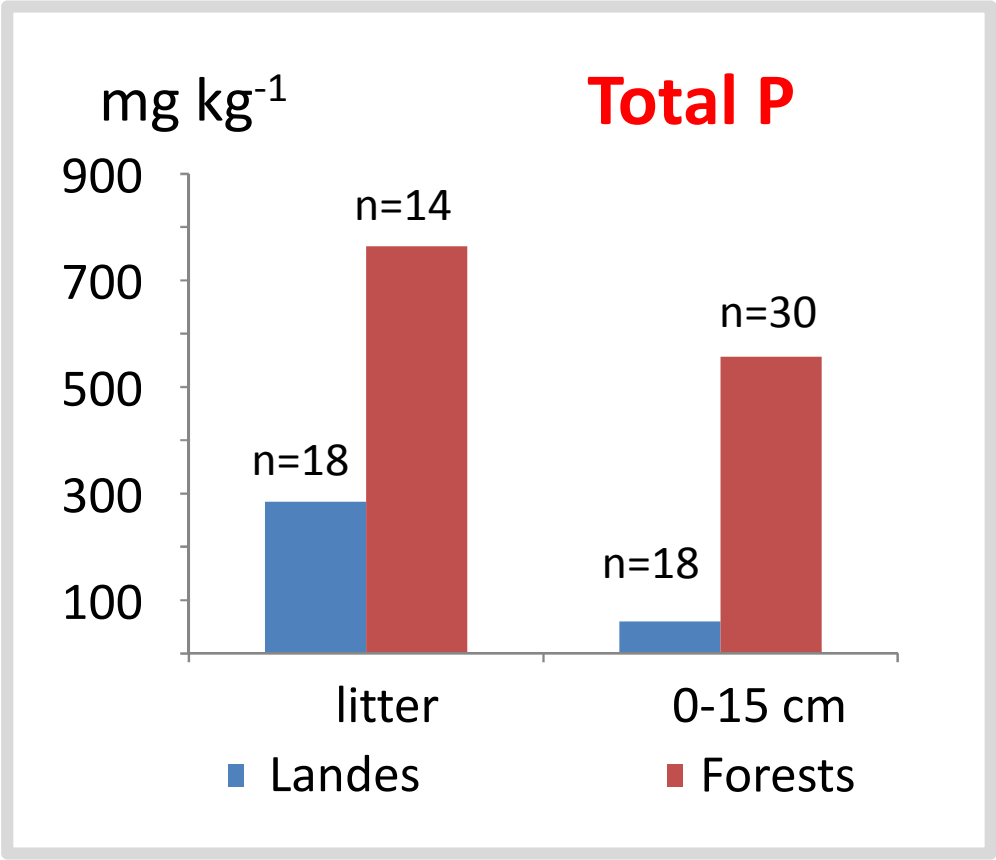


Comparison field data with literature data

after Achat et al. 2009 Biogeochemistry

Soil health

- **Soils are primarily limiting in P**, locally N

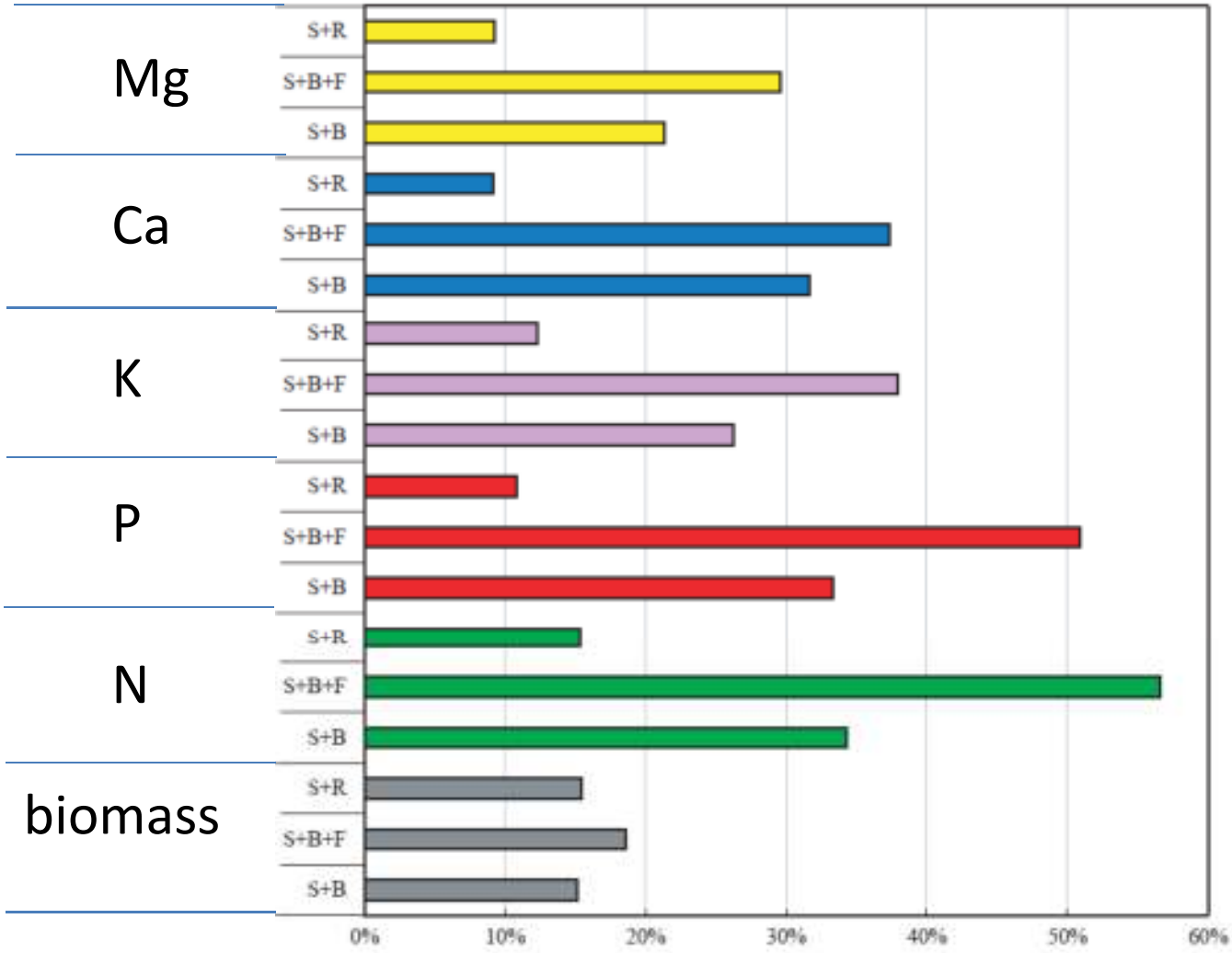
- Harvest intensity: for increasing intensity (stem only > stem plus branches > whole tree > whole tree plus variable part of the root system) a **30 to 57 %** increase of nutrient exportations has been estimated (Augusto et al. accepted). This is not sustainable.

Example 1: comparison of three harvest types

Example 2: comparison including root system harvests

Harvest scenarios:

S + R: (stem + coarse roots);
S + B + F: (stem+branches+foliage)
S + B: (stem+branches);

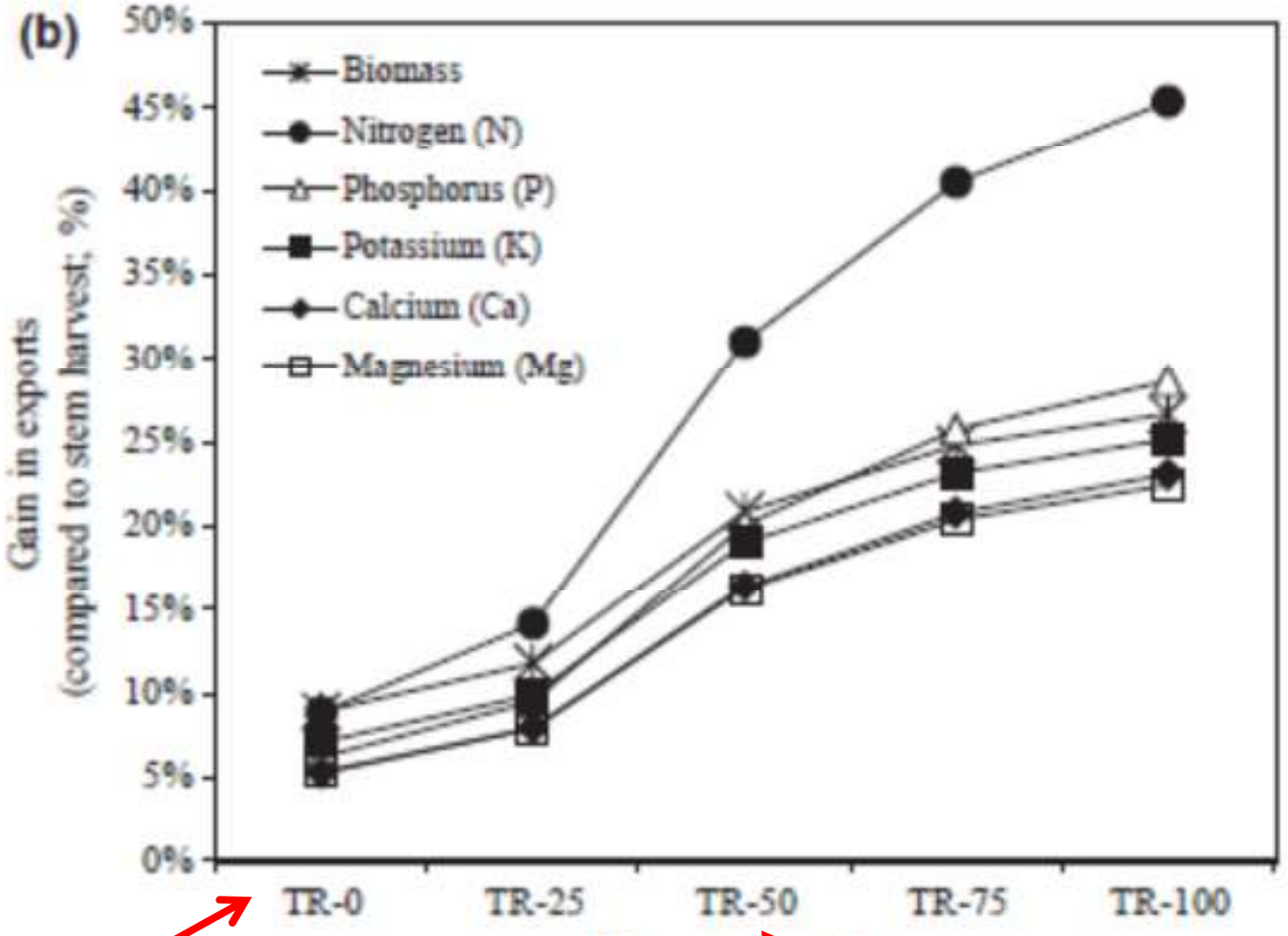


cf Augusto et al. GCB-Bioenergy *in press*

Increase of exports (in % compared to stem-only harvest)

From Augusto et al. GCB-Bioenergy in press

EXPORTS



HARVEST SCENARIO

Stump + tap root

Stump + tap root + roots in radius of 50 cm

Soil health

- **Soils are primarily limiting in P**, locally N
- **Harvest intensity**: for increasing intensity, losses can be substantial

- **Silvicultural management** (clear cuts or thinning with machinery) did **not** result in measurable **compaction** (Dousseron 2006) but resulted in **redistribution of organic matter**

Soil health

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- **Harvest intensity**: for increasing intensity, losses can be substantial
- **Silvicultural management**: no compaction but OM distribution

- **Tillage** (labour of the inter tree rangs within the first few years after planting) could **damage roots** (resulting in problems for **wind stability**, work F Danjon)

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- Related to **increased droughts** (due to CC): **organic matter** could **degrade faster**, perhaps leading to more risks for erosion (even though most of the area is flat) by water and perhaps wind; adaptive management necessary? *NB: soils are only sandy (no clay), so water holding capacity strongly depends on organic matter*

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- **Increased droughts**: faster OM degradation?

- **Very locally** (coastal or continental dunes, along river valleys), direct **erosion** may occur, but often these zones have different management objectives, decreasing such risks; *overall erosion is no issue*.

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- **Increased droughts**: faster OM degradation?
- **Very locally**: some direct erosion, but not general issue.

- **Contamination**: no issue so far, but *trace metal elements* concentrate in wood ash (product of the wood industry after combustion => where and how this may be used in the forest is an issue and may pollute the forest (Augusto et al. 2008);
- also experiments with *waste water / sludge* are ongoing (and may lead to authorisation of such practices in the forest).

- **Land slides**: no issue

Augusto L, Bakker MR and C Meredieu (2008) Wood ash applications to temperate forest ecosystems —potential benefits and drawbacks. Plant Soil 306 :181–198.

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- **Contamination**: no issue yet, but potentially in the future.
- **Land slides**: no issue

Soil health: due to limited fertility, intensification of harvests may lead to lower potential productivity. *In future perhaps trace metal pollution*

Risk that this happens = high.

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So, water is a key production factor (lesser growth on drier sites or on sites with drainage through agriculture), presumably (despite uncertainties related to model predictions)
of increasing importance

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For the moment not a particular issue

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If economics weak, then degradation possible

Social and cultural services

- Quite some people employed in the wood sector, living in the area and attached to the forest in their surroundings
- People use it for leisure and mushroom collection
- Some studies on human well being
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- Some studies on human well being
- Promotion of the attractivity of the region (coast + quiet forest) in the sense of tourism

Presumably service level ok as long as forest persists

Conclusions

At present land degradation (i.e. threatening the Pinus pinaster production forests with all the assets related to that) is **not a main issue** in Aquitaine

Main risks would include:

Conclusions

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Main risks would include:

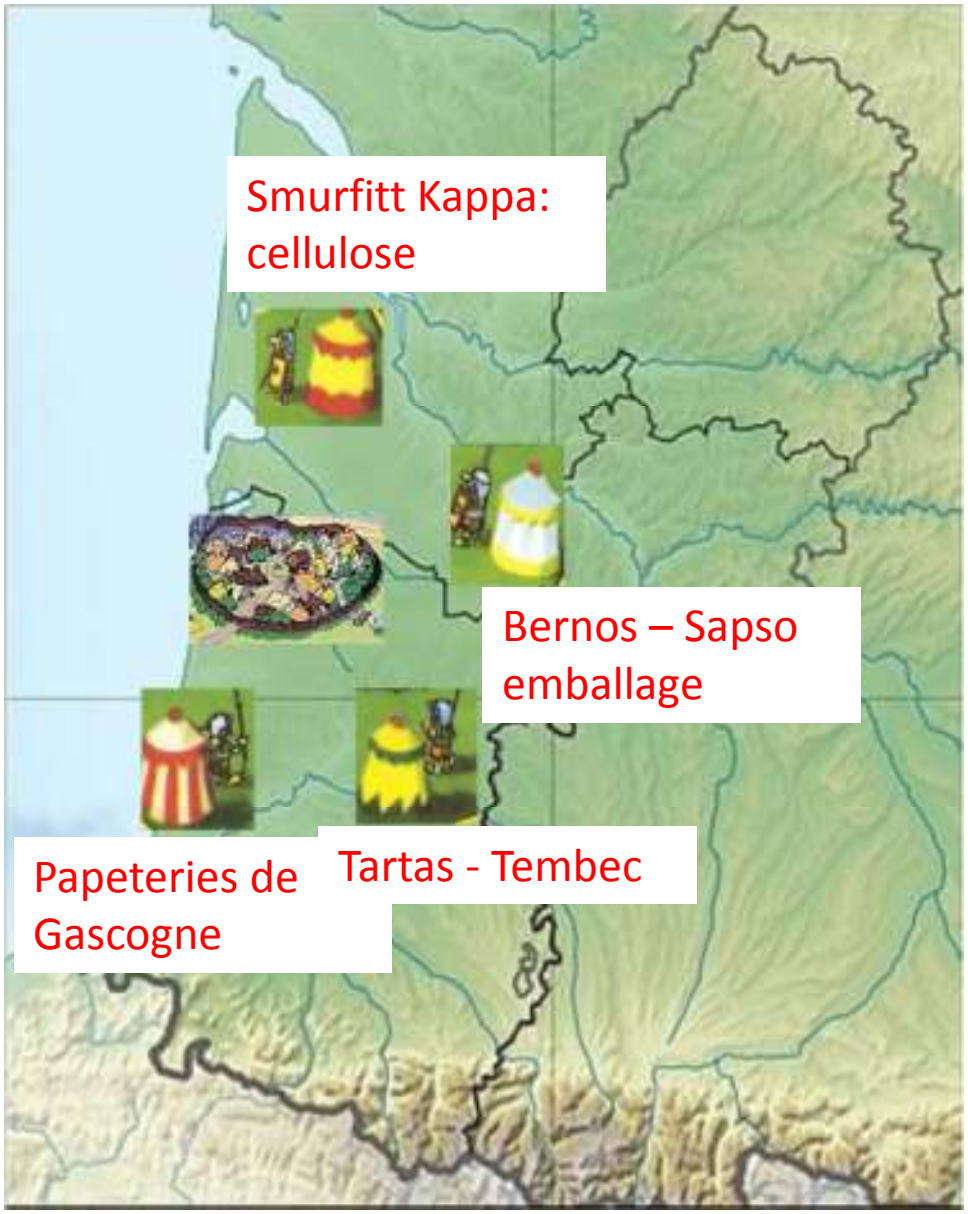
- Loss of biomass (land cover) due to transformation to other land uses (frequent fires or storms would accelerate this; new pests such as nematodes could be a disaster)
- Decrease in the soil health function (at least nutrient level in case of increased harvests)
- Increased occurrences of water stress and or water limit growth

All may lead to lesser production (economic production function potentially under pressure)

Conclusions

Erosion, pollution, soil compaction seem of negligible effect

Biodiversity, Social and cultural services: presumably proportional to the amount of forest cover remaining



Do we need to protect against the wood sector or does the forest need the sector?