RAINFALL INTERCEPTION EXPERIMENTS
AND
INTERCEPTION MAPPING USING REMOTE SENSING

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Master thesis

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ABSTRACT

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Interception mapping is one of the applications of the different remote sensing techniques. By linking the maximum amount of water that can be retained by vegetation, to a leaf area index map (derived from a remote sensing image), a quantitative interception map can be made for large areas. This technique has to be improved to get better results and for its usefulness in different areas with different vegetation species.

The aim of this study was to continue and improve remote sensing based interception mapping by gaining more information about specific vegetation species in the Peyne area, southern France, and to link that information to a HyMap image. Therefore eight abundant species were investigated and compared. More knowledge about the relationship between maximum storage capacity (*Smax*) and leaf area index (LAI) of different species can improve the quality of a large scale interception map. Also rainfall interception experiments were performed to measure interception for the different species and compare the results with calculated interception.

The results of the study can be divided in three parts. The first part provides the results from the interception experiments that were carried out for seven species at different plot locations. Interception was determined by subtracting measured througfall from precipitation. The results confirmed that in general, relative interception is larger for small events and smaller for big events. However, measurement errors occurred for species with overhanging and understorey vegetation. For the seven species, interception varied between 0% and 69%, with most species having a relative interception value around 40% for six measured rainfall events. Rainfall events varied from 11 mm up to 94 mm. The second part of this study provides the LAI – *Smax* relationships based on field data. The results show that different LAI – *Smax* relationships can be found for different species, although the strength of the relationships differs strongly. The weakest relation is found for *Quercus ilex* (R-squared is 0.21) whereas the *Castanea sativa* has the strongest relationship with an R-squared of 0.88. In the third part of this study interception maps were produced for the study area and the results are discussed. The interception maps are created with an LAI formula for the study area and an average *Smax* value based on field data.

The specified LAI formula is determined by a linear regression analysis of the relation between LAI values measured in the field (with hemispherical photographs) and NDVI values from the HyMap image. Interception losses appeared to be relatively large for small rainfall events and decrease for larger rainfall events.

The conclusions of this study are that the differences between mapped and calculated interception are highest for small rainfall events and prove to be most reliable for moderate rainfall events. Both methods show however, compared with previous studies, overestimated values for the average interception. The strength of the LAI and *Smax* relation for the different vegetation species is in some cases poor. This is generally caused due to some undersampled vegetation species. Besides this, the average *Smax* is for most species overestimated as well. When looking at mapped interception and assuming the study area with only one abundant vegetation species, interception is highest for tree species and smallest for shrub like vegetation species.

The results show in some cases large differences with other studies. These differences are caused due to the measurement method, undersampling of some species, interference of overhanging vegetation for bush species and due to measurement errors.

When strong *Smax* – LAI relations are found for different species and a classified vegetation species map can be constructed, the use of field data would no longer be necessary. More study is therefore required on deriving a classified vegetation species map from remote sensing images. In combination with 3-dimensional canopy models this classified vegetation map could result in improved large scale quantitative interception mapping.

PREFACE

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This thesis forms the final product of the MSc study that was carried out during the past ten months and forms a key part of the master Physical Geography at the Utrecht University. The project started in April 2009 with the selection of a subject and a fieldwork partner. In May and June fieldwork preparations were started by writing a literature review and a study proposal. The fieldwork took place from September 1st until October 31st in the Peyne area, southern France. Fieldwork conditions were generally good, with hot and dry weather conditions in September and unstable and cool to mild weather conditions in October. After the fieldwork, data analyses were performed and the final study products were produced.

The introduction, literature overview, chapters 4 and 5, and the data analysis of the thesis were done by Ruud. The abstract, methods, chapter 6 and remote sensing mapping were done by René. The conclusion and discussion were written by both authors.

Special thanks go to our supervisors during this project, Steven de Jong, Elisabeth Addink and Wiebe Nijland, who supported us and provided us with useful suggestions and constructive criticism. We'd also like to thank Chris Roosendaal for providing us with proper equipment and materials. Fellow fieldwork students Kevin Gortmaker, Ciara Backwell, Tom Bijkerk, Annekarlijn de Rijcke and Simone Hoogeveen are thanked for their help, comments and useful opinions before, during and after the fieldwork. Together we were able to keep up the fieldwork spirit during difficult moments.

René Oerlemans

Ruud Vink

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INTRODUCTION

1 INTRODUCTION

1.1 RESEARCH FRAMEWORK

Precipitation is a key element in hydrological cycles. Precipitation can infiltrate into soils, become surface runoff and can be intercepted by vegetation. Rainfall interception by vegetation is an important factor in hydrological models, accounting for 10 to 20% of total precipitation (Ward & Robinson, 2000). Reliable quantitative estimation of the interception loss is therefore required to obtain optimal model results. Hydrological models are used to predict floods and are therefore a valuable tool for governments when planning measures against floods.

As a part of hydrological models, interception models are used to determine interception. A key part in these interception models is the amount of water that can be retained by vegetation. This parameter, known as the maximum canopy storage capacity or simply *Smax*, is an important parameter. Because different vegetation species have different canopy structures and different leaf morphologies, *Smax* is likely to vary for different species. Previous study done on interception and LAI – *Smax* relations showed that for each vegetation species, a unique LAI – *Smax* relation exists (De Jong & Jetten, 2007). Field experiments are required to help finding these relationships.

The *Smax* – LAI relationships can then be used to connect field data and remote sensing to an interception map. The aim of this study project is to come up with an interception map based on remote sensing images and limited field data, and to develop a generic method to produce rainfall interception maps at regional scales with estimated *Smax* values obtained from remote sensing images.

In order to carry out this study project, the process of interception and methods to determine interception are studied. Also differences between different interception models are studied and the relation between interception and remote sensing is discussed.

This study is a follow up project on the study done by De Jong & Jetten (2007). Their study focused on different techniques to derive the interception loss from remote sensing images. This study will try to continue and improve the derivation of interception loss from remote sensing images by focusing on specific tree species and their unique *Smax* – LAI relationships.

The total study project can be divided into three parts: (i) a period of preparation, (ii) a fieldwork period and (iii) a period of data analysis and reporting. The first period was carried out in May, June and July 2009 and resulted in a literature review and a research proposal.

The literature review was a synopsis of available literature about the process of interception, interception modelling and the relation remote sensing – interception. The study proposal provided the final research questions, fieldwork planning and scheduling, properties of the study area and the final extend of the project. Also the used methods for data collection and data analysis were determined and reported.

1.2 RESEARCH OBJECTIVES & QUESTIONS

The aim of this study project is to obtain an interception map of a Mediterranean area based on a combination of remote sensing data and data obtained during fieldwork. The fieldwork data comprises data obtained from rainfall interception experiments and plot experiments. Focus of field data is on Leaf Area Index (LAI) and maximum storage capacity (*Smax*). Also canopy cover fraction, an important parameter for interception models, is derived from field data.

The second objective is finding a relationship between LAI and *Smax* for different vegetation species, with special interest in obtaining the best LAI-*Smax* relationship for these different species. De Jong & Jetten (2007) combined all species for their remote sensing based interception map. Knowing these relationships can possibly improve the quality of remote sensing based interception mapping because differences between vegetation species are taken into account when mapping interception.

The results of the study objectives will be presented in two final products: an interception map based on remote sensing and field data, and an overview showing *Smax* – LAI relationships of different vegetation species listed in table 1.1.

Species (Latin)	English
Quercus ilex	Holm Oak
Quercus pubescens	Pubescent Oak
Quercus coccifera	Kermes Oak
Pinus pinaster	Pine tree
Castanea sativa	Chestnut tree
Buxus sempervirens	European Box
Erica arborea	Tree Heath
Arbutus unedo	Strawberry tree

Table 1.1 Vegetation species used for *Smax* – LAI relationships

1.2.1 RESEARCH QUESTIONS

In order to quantitatively map interception by taking different vegetation species into account research questions are formulated. This thesis aims at answering the research questions that were formulated at the start of this study. These research questions were formulated as following:

- What are the differences in relative interception loss when looking at different vegetation species in a Mediterranean area?
- Can interception loss be mapped for different vegetation species using remote sensing at a regional scale?
- What is the relationship between LAI and *Smax* for different vegetation species in the Peyne area?

The different vegetation species that are investigated are listed in table 1.1.

1.2.2 HYPOTHESES

Different vegetation species differ in relative interception values because of different plant structures, different canopy properties and different leaf properties. Different leaf morphologies also influence the interception capacity, since broad leaves are expected to retain more water than thin needles or small *Buxus sempervirens* leaves.

When only looking at leaf sizes and leaf properties, *Arbutus unedo* and *Quercus ilex* are expected to have nearly the same interception values. For *Quercus coccifera* and *Buxus sempervirens*, *Castanea sativa* and *Quercus pubescens*, and *Pinus pinaster* and *Erica arborea* (which both have needles), similar interception values are expected.

Previous study done by De Jong & Jetten (2007) showed that mapping interception using remote sensing is possible, because a relationship between LAI and NDVI exists. If a classified vegetation map can be constructed from remote sensing images and LAI – *Smax* relationships can be found for different species, it is possible create an interception map based on those relations and remote sensing images.

1.3 THESIS STRUCTURE

The thesis starts with a literature overview that provides a brief overview of all literature that is used during this study. The methods chapter provides information about the techniques that are used during the fieldwork campaign and the formulas that are used to calculate parameters that are later on used for interception calculations. This chapter also describes how the interception map is constructed.

The next chapters, Interception experiments and calculated interception, LAI and *Smax* relations and Interception mapping using remote sensing, provide the figures and results. In the discussion chapter, the results are brought together and assumptions and uncertainties of the study project are mentioned. The conclusions provide the final outcome of the study.

LITERATURE OVERVIEW

2 LITERATURE OVERVIEW

This chapter gives a brief overview of the literature that was studied in advance of the fieldwork and is updated with current knowledge. Topics concerning the process of interception, interception modeling and the relation between interception and remote sensing are discussed.

2.1 INTERCEPTION

The process of interception is an important link between the relation of the hydrological cycle and vegetation. Interception losses can be significant and therefore have a severe impact on the water balance. Interception can also play a role when looking at soil erosion, in particular splash erosion. When rainfall travels through the canopy, the average drop size changes and drops become both larger and smaller. This change in drop size results in different drop impact on soils (Robinson & Ward, 2000).

2.1.1 TERMINOLOGY

The term *interception* can be described as a process where water (mostly precipitation) is retained in vegetation canopies. The term *interception loss*, describes the amount of water that is evaporated before it takes part in the land-bound part of the hydrological cycle (Robinson & Ward, 2000). The amount of water that can be retained by vegetation canopies is named the *interception storage capacity*. The term *interception ratio* is determined by the ratio between the interception loss and the precipitation (Robinson & Ward, 2000). In this thesis, the term interception refers to the difference between gross precipitation and net precipitation, where gross precipitation is the amount of water before reaching the canopy and the net precipitation is the amount of water that reaches the soil after travelling through canopy. It should be noted that as well as with the interception loss, the measurements of canopy storage and storage capacity are all expressed as equivalent depths (usually mm) per unit ground area and not as physical thickness of water films on the foliage (Robinson & Ward, 2000).

2.1.2 CALCULATING INTERCEPTION

Interception is defined as the amount of water that can be retained by canopies. This amount is calculated using formula 2.1 (Robinson & Ward, 2000):

$$Interception = Gross\ Precipitation - Net\ Precipitation \tag{2.1}$$

The amount of rainfall that falls on top of the canopy is referred to as gross precipitation. The net precipitation or the amount of rainfall that is measured on the ground and under the canopy is given by formula 2.2 (Robinson & Ward, 2000):

$$Net\ Precipitation = Throughfall + Stemflow \tag{2.2}$$

Throughfall is determined by measuring the amount of precipitation that reaches the soil under the canopy.

Stemflow is the amount of precipitation that reaches the soil via stem and branches from the vegetation and will be affected by branch orientation and roughness of the bark (Robinson & Ward, 2000).

When the vegetation becomes more saturated during a rainfall event, the interception capacity decreases. The interception capacity also depends on season changes because the canopy cover changes over seasons. Finally, wind also plays a role in interception capacity variations. Stronger winds result in lower interception capacities because vegetation is less able to hold water in the canopy.

When looking more detailed into the process of interception, evaporation is an important factor. Water that is intercepted by canopy is subtracted from that canopy because of evaporation. Interception strongly depends on canopy structure and the evaporation rate. Since the rate of evaporation is generally lower than the precipitation rate, the amount of water that is intercepted by vegetation will increase with increasing precipitation rates.

2.2 MEASURING INTERCEPTION

The common method to determine interception in the field is measuring the net precipitation under canopies. The net precipitation is a combination of stemflow and throughfall. When the gross precipitation is known, formula 2.1 can simply be used to calculate interception (Robinson & Ward, 2000).

Measuring throughfall is mostly done by placing gauges outside and under canopies and measure the amount of water in the gauges after a rainfall event (stemflow is neglected). The gross precipitation is measured in the open field, away from canopy influences. Precipitation data can also be obtained from local weather stations, but introduces an uncertainty because precipitation amounts vary strongly on small distances due to heavy, local rainstorms, typical for a Mediterranean area.

Another method to determine throughfall is using large sheet gauges that collect both stemflow and throughfall. This method provides a good areal average value (Calder, 1996). This method is not feasible when looking at spatial variability and cannot be used when dense understory is present. Also measurements over longer periods are difficult using this method since litter and leaves on the sheet affect the measurements (Robinson & Ward, 2000).

Calder et al. (1983) also introduced weighing the difference between dry and artificially wetted vegetation for short vegetation using lysimeters. Rutter (1968) and Crockford & Richardson (1990) used measured weight differences for branches and leaves and used linear up scaling for the complete tree.

2.2.1 QUANTIFYING INTERCEPTION MEASUREMENTS

The magnitude of interception can also be determined using indirect measurement based on the water balance. Small scale catchment data can be used to obtain large scale interception information, as was done by Miner & Swank (1968) and Hibbert (1971).

To quantify interception, different approaches are available. One of the simplest approaches is to plot throughfall against gross rainfall and fit an upper envelope to the throughfall points. The line gives a negative intercept on the throughfall axis which represents the canopy storage capacity. The disadvantage of this approach is that data usually have large scatter due to the pattern of wetting and drying cycles between rainfall event, as well as large experimental variance. In addition there is subjectivity in excluding the smallest storms for which there was incomplete wetting of the canopy.

2.2.2 REMOTE SENSING

A totally different approach is the use of remote sensing. For instance, Calder and Wright (1986) used gamma-ray attenuation to measure the amount of water held on a whole forest canopy. A transmitter and receiver were suspended from two towers, 40 meters apart, and were raised and lowered to allow the beam to scan across different levels in the canopy. For safety reasons, the experiment could not be used for long-term unattended monitoring.

2.3 INTERCEPTION MODELS

Modelling interception of vegetation canopies can contribute in a more accurate quantification of the water balance. Modelling interception has some advantages: it provides a summary of the interception behavior, it is possible to extrapolate the results to other areas, and it can contribute to the understanding of the interception processes (Muzylo, 2009).

2.3.1 GASH AND RUTTER INTERCEPTION MODELS

Interception models are based on interception formulas that are modified for the purpose they are used for. Two major types of interception models are distinguished; (i) the conceptual, physically based Rutter model and (ii) the analytical Gash model (Muzylo, 2009).

Both models have resulted in improved models over the past decades and numerous modified models. These modified models are mainly changed for the purpose they are used for. The Rutter model shows satisfactory results when validating it with independent data sets, especially for temperate forests. For tropical forests, the results are less satisfactory. This might be caused by the larger spatial variability of rainfall in tropical forests, enhancing larger sampling errors (Rutter et al. 1975).

The Gash and Rutter models overestimate interception losses for sparse vegetated areas, like some Mediterranean areas, where shrubs and bushes often dominate the landscape (Rutter et al., 1975, Muzylo, 2009). The sparse models introduced in the mid-nineties dealt with this overestimation by calculating the evaporation loss not for the entire plot area, but only for the vegetated areas. This resulted in better model prediction for sparse canopies (Muzylo, 2009).

When comparing both Gash type models and Rutter type models, it can be concluded that both model types have nearly equal performances (Muzylo, 2009). The choice for one type of model is therefore mainly based on other factors: the data requirements, the usability, and the number of parameters. This explains the popularity of the Gash models, which have high data requirements and are user-friendly.

2.3.2 ASTON INTERCEPTION MODEL

The interception model used in this study project was formulated by Aston (1979) and yields:

$$I = C_p S_{max}(1 - e^{-kP/S_{max}}) \qquad (2.3)$$

Smax is the maximum storage capacity and was determined in the field, the canopy cover fraction (*Cp*) and leaf area index (LAI) were obtained using hemispherical photographs. From the LAI and *Smax* a relationship can be obtained using linear regression.

Parameter *k* gives the fraction of rainfall that falls on the canopy and is determined by calculating the fraction of canopy cover versus sky. When *k* equals 1, no direct throughfall occurs.

The motivation for using the Aston model is that the model can deal with different aspects of vegetation canopies and that some parameters can be obtained from hemispherical photographs. This model also takes exponential filling into account (De Jong & Jetten, 2007).

2.4 INTERCEPTION AND REMOTE SENSING

Remote sensing data can be used to map interception losses. This new technique was introduced by De Jong & Jetten (2007) and applied to the Peyne area using hyper spectral images. The Aston model was applied to calculate interception. This paragraph will explain why remote sensing images can be a valuable tool for interception mapping and will describe the interception models and formulas that are used.

The most suitable tool for mapping vegetation and modelling on larger scales is provided by remote sensing because spatially continuous datasets can be obtained with the introduction of hyperspectral remote sensing images (Nijland et al. 2009). The Average Local Variance (ALV) function and variograms were used to look at the optimal spatial resolution of a remote sensing image for vegetation parameters.

Where the ALV function is used to locate the size of scene pattern elements and the variograms are used to look at parameter variability. Nijland et al. (2009) stated that finding and using the optimal spatial resolution can result in significant better parameter estimations, in their investigation up to a 17% better prediction of the LAI.

From hyperspectral images vegetation variables such as the LAI can be determined. Reflectance properties of vegetation are used to evaluate vegetation cover with vegetation indices such as the NDVI, SAVI and the Red Edge Index. The relationship between NDVI and LAI differs for vegetation types and different meteorological circumstances and is determined using experimentally defined NDVI – LAI relationships. For the Peyne area a local, linear NDVI – LAI relationship was derived by Tabarant (2000):

$$LAI = 8.238 * NDVI - 2.93 \tag{2.4}$$

Where the LAI is in m^2m^{-2} and the NDVI is calculated from remote sensing images. The NDVI values range from -1 to +1 because the NDVI is an index based on a ratio.

An important parameter of the Rutter and Gash interception models is the maximum storage in the canopies (*Smax*). This parameter is directly related to the LAI and can therefore be made spatial for interception mapping. To calculate the maximum canopy storage, different equations are available for different types of vegetation.

Von Hoyningen – Huene (1981) proposed the following equation for crops based on field experiments:

$$S_{max} = 0.935 + 0.498LAI - 0.00575LAI^2 \tag{2.5}$$

And for olive trees Gomez et al. (2001) found the following relationship:

$$S_{max} = 1.184 + 0.490LAI \tag{2.6}$$

Both equations appeared to have similar value outcomes when the LAI varies between 0 and 10 m^2m^{-2}. Much study was done to find a general relationship between the canopy storage and the LAI (De Jong & Jetten, 2007).

Generally three classes can be distinguished; conifers, mixed broadleaf and shrubs/grasses. However, an important note is that the different studies used different measuring techniques and under different meteorological circumstances with unknown uncertainties.

For a coniferous forest the following relationship was found

$$S_{max} = 0.282LAI \tag{2.7}$$

For grass and shrubs the following relationship was obtained using data from 6 shrubs and grasses

$$S_{max} = 0.3063LAI + 0.5753 \tag{2.8}$$

The conclusion from all these different equations that estimate the maximum canopy storage, is that for each vegetation type a different relationship between S_{max} and *LAI* exists.

DATA & METHODS

3 DATA & METHODS

In this chapter field methods are described and an explanation is given on the plot selection. Data processing techniques are mentioned and a step by step explanation is given on the construction of the remote sensing based interception map. To start this chapter, a brief overview of the study area characteristics is given.

3.1 STUDY AREA CHARACTERISTICS

The study area is situated in the Peyne area, southern France (figure 3.1), around *Lac des Olivettes*, an artificial lake, near the village of Vailhan. The selection of this specific study area was done for a number of reasons. First of all, the Peyne area has been a Utrecht University study site for over a decade, which led to an advance in data availability and knowledge of the area. Secondly, HyMap remote sensing data are available from 2003 and 2008, which is important when working with vegetation in combination with remote sensing. And finally, the study area is characterized by a great differentiation in vegetation, land use, geology and hydrology. Practical considerations also played a role, since the roads around *Lac des Olivettes* provide relatively good accessibility to the denser, uphill forests.

Figure 3.1 Location of the Peyne study area

3.3.1 CLIMATE & TOPOLOGY

The climate of the Peyne area is characterized as sub-Mediterranean, with hot and dry summers and mild winters. The annual precipitation is 600 mm, with rain mostly during spring and autumn and is characterized by an irregular pattern (figure 3.2). Annual evapotranspiration is estimated at 1100 mm, far exceeding annual precipitation (Sluiter, 2005).

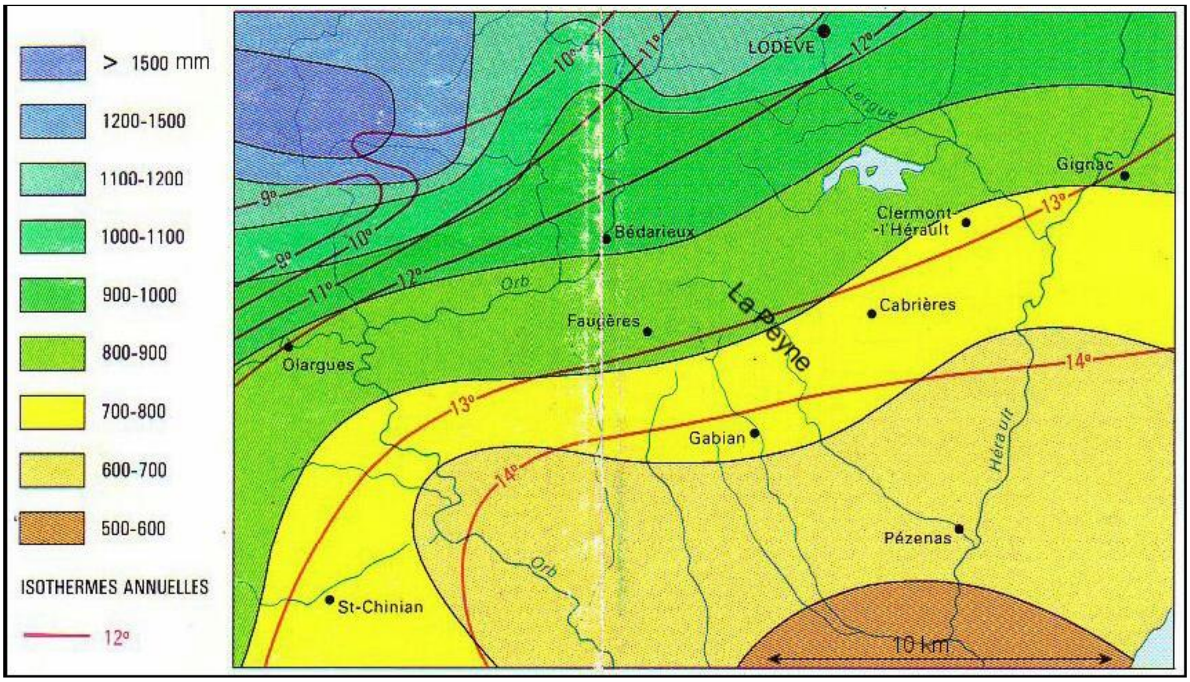


Figure 3.2 Isotherms of annual precipitation in the Peyne area (Bonfils, 1993)

The topology is characterized by gently sloped hills varying in altitude between 150 m in the south eastern part to 400 m in the northern part. Steep slopes are found near river gullies and around *Lac des Olivettes*.

3.3.2 HYDROLOGY & GEOLOGY

The Peyne River is the main river in the study area and flows from north to south, via *Lac des Olivettes*. Together with the Salagou and Boyne Rivers, the Peyne River is the main tributary of the Herault River. *Lac des Olivettes* is an artificial lake, constructed for irrigation purposes and flood prevention.

The Peyne area is a transition zone between the *Massif Central* in the north, the *Montaigne Noir* in the west and the coastal plain in the southeast. Sediment deposits of the Herault River are also found in this area (Sluiter, 2005).

3.3.3 VEGETATION & LAND USE

The Peyne area has a typical Mediterranean vegetation pattern, which can be classified into three classes. First the grasses, herbs and short bushes called *short matorral* or *landes*. Smaller shrubs and bushes on bare soil and rocks are classified as *middle matorral* or *garrigue*. Shrubby evergreen forests are called *tall matorral* or *maquis* (Tomasseli, 1981). *Quercus ilex* and *Arbutus unedo* dominate the *maquis* vegetation, but *Quercus pubescens*, *Castanea sativa* and *Pinus pinaster* are also found in the study area. *Buxus sempervirens*, *Erica arborea* and *Quercus coccifera* dominate the *garrigue* vegetation.

Land use is dominated by evergreen forests and middle matorral vegetation. Small vineyards are sparsely located over the area; grasslands and short matorral vegetation are sometimes used for herd grazing. Large scale logging of *Quercus ilex* forests in occurred in the past; only small scale logging of *Quercus ilex* forests is allowed nowadays.

3.2 PRECIPITATION MEASUREMENTS

The foundation of reliable interception measurements depends on accurate precipitation data. During the field campaign in the fall of 2009, two tipping buckets were set up to provide the precipitation data. The first tipping bucket was placed in an abandoned agricultural field close to *Lac des Olivettes*, in the center of the study area. The second tipping bucket was placed in the village of *Neffiès*, south of the study area. This tipping bucket was placed to provide reference data for the tipping bucket near the lake, since rainfall events in the study area can have a strong irregular spatial distribution. Tipping buckets register precipitation by recording the number of tips during a rainfall event. Each tip stands for 0.203 mm, which was determined before the fieldwork. By knowing the amount of tips that are recorded, the amount of rainfall can be calculated.

Before the tipping buckets were placed, the exact location of the tipping buckets was carefully chosen. The tipping buckets had to be placed in an open space to avoid interception of rainfall by trees or shrubs. Practical considerations had to be made to avoid human interference and disturbances such as hiking trails and farmer activities.

3.3 RAINFALL INTERCEPTION MEASUREMENTS

By determining interception for different species, interception itself is not measured but the amount of throughfall is determined. The interception is then calculated by subtracting the throughfall from the amount of precipitation. The purpose of the rainfall interception measurements is to use the obtained data as a reference to the calculated interception for different species.

Seven measurement locations were set up over the study area. Plot locations were chosen upon vegetation homogeneity and absence of understory vegetation that might disturb the interception measurements. The exact location of the measurement plots was however bound to some restrictions. These restrictions were induced by practical and technical limitations. The practical limitations yield the accessibility of the plots and the time necessary to reach the plots. The technical limitations comprise the free space under the tree and the homogeneous character of the measurement plot. The free space under the tree is required to improve the measurement quality and to avoid interference or interaction with shrubs and grasses. The homogeneous character of the measurement plot is a prerequisite to ensure optimal reliability of the data collected.

The rainfall interception measurements were carried out for seven different vegetation species. For *Quercus pubescens* no suitable location could be found, therefore no interception measurements were carried out for this species. When the plot location was carefully chosen, 5 or 6 (depending on the plot size) rainfall gauges were placed randomly under the canopy. One gauge was placed outside the reach of the canopy and was used to measure the amount of precipitation close to the plot location. The data obtained from the rainfall gauges outside of the canopy is used to compare with the precipitation data from the tipping buckets.

The rainfall gauges are constructed from 1.5 l empty supermarket water bottles. All bottles used were from the same brand and supermarket, to avoid small variations in size and volume between different brands. These empty water bottles were chosen above traditional gauges due to transportation limitations. The top of the bottles was cut off and placed upside down on the lower half of the bottle. All bottles were labeled and numbered to avoid disorder.

After each rainfall event, all rainfall meter plots were visited and the amount of throughfall in the rainfall gauges was measured. After that the gauges were emptied and put back in place.

The interception for all seven tree species is calculated for every rainfall event using formula 3.1.

$$Interception = Precipitation - Measured\ Throughfall \qquad (3.1)$$

Formula 3.1 gives an interception value in mm. To compare the interception for different rainfall events, interception is converted as a fraction of precipitation:

$$Relative\ Interception = \left(\frac{Absolute\ Interception}{Total\ Precipitation}\right) \qquad (3.2)$$

3.4 PLOT MEASUREMENTS

The plot measurements were carried out to obtain detailed information about interception from tree branches. This information is used as input for calculations of the maximum storage capacity and LAI's of branches.

The locations of the plot measurements were determined using a number of boundary conditions. The first boundary condition is provided by the area covered by the HyMap images of 2003 and 2008. In order to use these images in further data analysis, the plot locations require being located within this area. Secondly, the plot locations need to be diverse when looking at vegetation. To determine this diversity, two different maps are used; a NDVI map constructed from the 2008 HyMap image and an unsupervised classification map, also based on the HyMap image. Thirdly, the plot locations had to cover the entire fieldwork area, to secure optimal spatial plot distribution. The final condition is determined by practical limitation.

All plots have to be easily accessed by foot and need to be within 300 meters from a road, due to the use of heavy equipment and the need for water during the plot measurements. The number of 165 plots was determined by estimating the amount of time that was required, doing measurements at one single plot and looking at the available time for fieldwork.

The three boundary conditions and the number of plot locations led to the construction of a plot locations map using ArcMap. The coordinates of all plot locations were put in a GPS. This was done as preparation in advance of the fieldwork campaign. In the field, the exact plot location could often not be reached due to dense vegetation, logged areas and other practical reasons. Taking the boundary conditions in mind, an alternative plot was chosen, as closely possible to the original location. To avoid temporal variations caused by different weather conditions, plots were as randomly as possible visited.

When the (approximate) plot location in the field is reached, a suitable tree is chosen to perform measurements on.

The weather conditions, coordinates and general plot properties, such as the type of forest and the local topography, are registered. After that the number of branches of that specific tree is counted and *Smax* and LAI parameters are measured.

3.5 LAI AND HEMISPHERICAL PHOTOGRAPHS

An important variable in the interception formula is the Leaf Area Index (LAI) and the canopy cover fraction (cover). The LAI is a ratio between total leaf area and total area, resulting in a dimensionless value. The LAI is used at two scales, at tree scale and on branch scale, whereas the canopy cover fraction is exclusively used at tree scale. The LAI of branches is calculated from branch measurements, the LAI of trees is directed from hemispherical photographs.

To obtain the LAI of branches, three suitable branches were cut from the tree's canopy. To obtain the most realistic data, these branches varied in size, cover and leaf area, and were cut from different locations in the canopy. The three branches are then measured by length and width. When trees showed large variations in branch properties, five branches were cut and measured. The leaf cover and the number of leaf layers were also estimated.

At branch scale, the LAI is calculated by dividing the amount of leaf area by the total branch surface area. The leaf area index of a single branch is calculated by multiplying the estimated leaf cover, the number of leaf layers and the total area of a branch as given in formula 3.3.

$$LAI_{Branch} = Leaf\ Cover * Leaf\ Layers * Total\ surface\ area\ branch \qquad (3.3)$$

The total surface area of a branch is calculated by multiplying the length and the width of the branch, and multiplying this with a factor of 0.5.

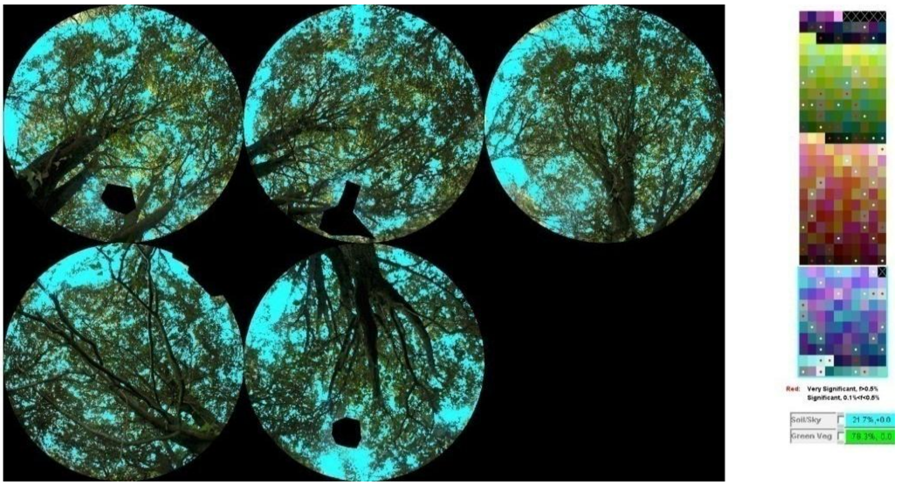
This factor is used because the total surface area of a branch is assumed to be diamond shaped (formula 3.4).

$$Total\ surface\ area\ branch = Length_{branch} * Width_{branch} * 0.5 \qquad (3.4)$$

At tree scale, the LAI and canopy cover fraction are derived from the hemispherical photographs using the imaging process software Caneye (figure 3.3). For every plot location, five hemispherical photographs were taken to minimize disturbances from understory vegetation. LAI and canopy cover fractions were averaged for those five photographs to determine LAI and canopy cover fraction per plot.

The photos taken for each plot location are checked for disturbing factors, such as sunspots, leafs just in front of the camera lens or persons accidentally caught on the photo. These factors can influence the resulting LAI and coverage values.

The most common disturbing factor is the sun. When taking a photo of the canopy the camera points directly to the sky. Therefore the sun can be visible as an overexposed spot. With Caneye these spots and any understorey vegetation can be masked out.



Red: Very Significant, f>0.5%
Significant, 0.1%<f<0.5%

Soil/Sky ☐ 21.7%,+0.0
Green Veg ☐ 78.3%, 0.0

Figure 3.3 Screenshot of the computer program Caneye, showing five hemispherical photographs of which the pixels are divided in sky (blue) and vegetation (other colors) pixels and with some masked out areas (black spots).

3.6 *SMAX*

The maximum storage capacity (*Smax*) of branches is calculated by dividing the measured LAI of a branch by the amount of water that can be stored in a branch, which is given by formula 3.5.

$$Storage = W_{wet} - W_{dry} \qquad (3.5)$$

Where W_{wet} is the weight of the branch when fully saturated and W_{dry} is the weight of the branch before wetting. This difference is determined in the field were three branches are weighted using a spring scale. The spring scale can measure up to 10 kilograms with 10 grams accuracy. When the dry branches are weighted, the branches are wetted using a watering can for optimal rainfall simulation. On average, 1,5 liters of water was used to wet one branch, however this amount depends on the branch size, larger branches with more canopy require more water to reach full saturation. As soon as the branches are wetted, they are again weighted. The difference between the dry and wet branches is used to calculate the amount of water a single branch can hold (formula 3.5).

From formula 3.3 and 3.5 follows formula 3.6, which calculated the maximum storage capacity of a single branch.

$$Smax_{Branch} = \frac{Storage}{LAI_{Branch}} \tag{3.6}$$

The maximum storage capacity of a single tree is calculated by scaling up the *Smax* obtained from the tree's branches. By estimating the number of equivalent branches on the investigated tree, the total *Smax* can be calculated using a simple linear up scaling as given in formula 3.7.

$$Smax_{Tree} = Smax_{Branch} * Total\ number\ of\ branches \tag{3.7}$$

3.7 INTERCEPTION MODEL

In this study, interception is determined using two different methods. The first method uses only experimental data to obtain the fraction of intercepted precipitation, whereas the second method is calculated using an interception model.

When calculating interception using an interception model, several formulas are used to determine the interception fraction. The formula used to calculate interception is taken from Ashton (1979) and describes the filling up of a canopy exponentially:

$$I = C_p S_{max}(1 - e^{-\frac{kP}{S_{max}}}) \tag{3.8}$$

Where I is the total amount of interception loss during that particular rainfall event (mm), C_p is the canopy cover fraction (determined from the hemispherical photographs), *k* is the fraction of rainfall that falls on the vegetation canopy (Aston, 1979) and is the opposite of the free throughfall coefficient. When *k* reaches 1, almost all rainfall is stored in the canopy. Parameter *k* is determined by the ratio fraction of canopy versus sky, and is derived from hemispherical photographs.

3.8 INTERCEPTION MAPPING USING REMOTE SENSING

The HyMap remote sensing image of 2008 is used to derive a regional interception map of the Peyne area. HyMap is a hyperspectral sensor with 126 spectral bands in the solar spectrum (400–2500 nm) and provides images with a spatial resolution of 5 by 5m (*De Jong & Jetten, 2007*). The hyperspectral image of the Peyne area was taken on July 23rd 2008 around 11 am.

To compute a regional, quantitative map of rainfall interception loss depending on rainfall event characteristics, several steps are made.

First the original HyMap image is spectrally checked for bands containing noise with low quality information. Of the 126 spectral bands, band 63, 64 and 126 were erased, by making a spectral subset. A spatial subset of the study area was made from the total hyperspectral image and used in further analysis.

Because the NDVI is used to calculate LAI values, an NDVI map is created with bands 12 (619 nm) and 20 (735 nm). With this NDVI map, an LAI map was calculated using the LAI formula based on field data.

The LAI formula is obtained by plotting field LAI values (calculated from the hemispherical photographs) against the NDVI values calculated from the HyMap image. With a linear regression analysis this formula is determined. This is the same type of formula that Tabarant (2000) introduced, but now specified for the study area. The formula is given by formula 3.9:

$$LAI = 1.7408 * NDVI + 2.8657 \tag{3.9}$$

Besides this specified formula, also for the different vegetation species within the research area the LAI formula is determined. Therefore a linear regression analysis is applied on the field LAI and NDVI values of the different species. The field LAI values are obtained from the hemispherical photographs taken on plot locations of the involved vegetation species. Using the coordinates of that plot location, the NDVI value is obtained from the NDVI map. The different LAI formulas are used for calculating interception with different vegetation scenarios. The different scenarios consist of the assumption that only one of the investigated vegetation species is abundant in the study area, so that the influence of that species can be determined.

To improve the reliability of the results of some of the scenario LAI maps, a data range mask was applied. Due to the abundance of some roads and villages (non-vegetation pixels), these maps showed initially negative values. To minimize the influence on the average LAI values of the vegetation, the negative values are set to zero by applying a data range mask of 0 to 25 to the image. The maximum of the range (in this case 25) is determined with a statistical analysis of the initial LAI map, which shows among other things the maximum LAI value in the area.
The data for two vegetation species contained some values different from the bulk data. These abnormal values are very likely caused by measurement errors and are therefore not taken into account by determining the LAI formula for that species.

Another necessary parameter to compute the rainfall interception loss map, is the maximum storage capacity (*Smax*). In this case an average value is used, based on field data.

To obtain realistic results, *Smax* is determined by a combination of the average *Smax* for each species and the abundance of that species in the study area. This means when a certain vegetation species has a higher abundance in the study area, the average *Smax* of this species counts more in the total average of all species together.

To calculate the overall canopy cover fraction, C_p, the Spectral Mixture Analysis (SMA) approach is used. Three reference spectra (end-members) are defined in the HyMap image. The selected end-members are green vegetation, water, and bare soil. The HyMap image is unmixed using the 'Linear Spectral Unmixing' method and the selected end-members.

The computed bare soil fraction is one of the resulting abundance maps. The inverse (1—bare soil fraction abundance map) is per pixel used as an indicator for the overall canopy cover fraction C_p.

The final step is to compute the absolute values (mm) for the rainfall interception map by applying the Aston interception formula (formula 3.8). The input parameters a based on the created maps earlier described.

The interception maps are calculated for all the rainfall events fallen during the field campaign. The resulting maps are further processed with the software program ArcMap. In order to see what happens with the interception values when the study area is totally covered with only one of the vegetation species used in this study, extra interception maps are made. Per species a specified LAI formula and the average *Smax* value of that species is then used.

3.9 SPECIES PROPERTIES

In this study, eight different vegetation species are investigated. In this paragraph, the vegetation properties of these species are listed.

Quercus ilex: large evergreen oak tree which can become up to 25 meters tall. The leaves are persistent leather like and are variable in form and size and are most elliptical 2-7 cm long, 1-3 cm broad and sometimes with a spiny edge. It grows on all well drained soils and is abundant in large parts of the Mediterranean area. In the Peyne area the *Quercus ilex* is abundant in forests and also in Maquis, but then in a shrub like form with multiple stems and 2-6 meters high (from Nijland, 2005).

Arbutus unedo: tree-like shrub of the heather family up to 10 m high. The leaves are dark green and glossy, 5-10 cm long and 2-3 cm broad, with a serrated margin. The flowers are white, bell-shaped, 4-6 mm in diameter, produces panicles of 10-30 together in autumn. The fruit is a red berry 1-2 cm in diameter, with a rough surface. Grows well in limy soils and is found Maquis together with *Quercus ilex* and *Erica Arborea* (from Nijland, 2005).

Erica arborea: shrub or small evergreen tree with a height of 1-4 m. It has small persistent leaves grouped by 4, 1-3 mm long and the white flowers are numerous and small (1mm). It prefers acid soil conditions and is found in the Peyne area in Maquis type vegetations (from Nijland, 2005).

Quercus pubescens: medium-sized deciduous tree growing up to 20 m. Forest-grown trees grow tall, while open-growing trees develop a very broad and irregular crown. The leaves are lobed, 4-10 cm long (rarely to 13 cm) and 3-6 cm wide, the upper leaf surface is dark green and rough, the lower light green. Both leaf surfaces are covered with minute pubescence. *Quercus pubescens* grows in dry, lime-rich soils. In the Peyne area it is found in well developed forests in combination with *Quercus ilex* and with an understory of *Buxus sempervirens* (from Nijland, 2005).

Quercus coccifera: shrub of maximal 2 meters high, often less. Bright green persistent leaves with sharp spines, 1-4 cm long. The acorns are 2-3 cm long and are held in a characteristic cup covered in dense, elongated, reflexed scales. In the Peyne area abundant in low garrigue, forming dense patches with many individuals, 50-100 cm high (from Nijland, 2005).

Buxus sempervirens: an evergreen shrub or small tree growing to 1-9 m tall. With a trunk up to 20 cm diameter the *Buxus sempervirens* is relatively large for a small evergreen bush (exceptionally to 10 m tall and 45 cm diameter). The leaves are arranged in opposite pairs, green to yellow-green, oval, 15-30 mm long and 5-13 mm broad. The hermaphrodite flowers are inconspicuous, greenish-yellow, with no petals and are insect pollinated; the fruit is a three-lobed capsule containing 3-6 seeds. The species typically grows on soils derived from chalk, limestone, usually as an understorey in forests of larger trees, but also sometimes in open dry montane scrub, particularly in the Mediterranean region (from Flora Europea).

Pinus pinaster: is a medium-size tree, reaching 20-35 m tall and with a trunk diameter of up to 1.2 m, exceptionally 1.8 m. The bark is orange-red, thick and deeply fissured at the base of the trunk, somewhat thinner in the upper crown. The leaves ('needles') are in pairs, very stout (2 mm broad), 12-22 cm long, and bluish-green to distinctly yellowish-green.

The cones are conic, 10-20 cm long and 4-6 cm broad at the base when closed, green at first, ripening glossy red-brown when 24 months old. They open slowly over the next few years, or after being heated by a forest fire, to release the seeds, opening to 8-12 cm broad. The seeds are 8-10 mm long, with a 20-25 mm wing, and are wind-dispersed (from Flora Europea). In the Peyne area, *Pinus pinaster* is only found in the *Forêt Communale*, an artificial homogenous pine forest.

Castanea sativa: is a medium-sized to large deciduous tree attaining a height of 20-35 m with a trunk often up to 2 m in total diameter. The oblong-lanceolate, boldly toothed leaves are 16-28 cm long and 5-9 cm broad. The flowers of both sexes are borne in 10-20 cm long, upright catkins, the male flowers in the upper part and female flowers in the lower part. In the northern hemisphere, they appear in late June to July, and by autumn, the female flowers develop into spiny cupules containing 3-7 brownish nuts that are shed during October. The female flowers eventually form a spiny sheath that deters predators from the seed (from Flora Europea). For the Peyne area, *Castanea sativa* is mostly found in forest patches with *Buxus sempervirens*.

INTERCEPTION EXPERIMENTS & CALCULATED INTERCEPTION RESULTS

4 INTERCEPTION EXPERIMENTS AND CALCULATED INTERCEPTION RESULTS

In this chapter the results of the interception experiments are stated. These interception experiments comprise measured interception at seven different plots, the results from 166 plot measurements and the precipitation results obtained from the tipping buckets.

4.1 PRECIPITATION MEASUREMENTS

The tipping buckets provide the necessary precipitation data for the interception calculations. No large variation in recorded precipitation is found between the tipping buckets near *Lac des Olivettes* and in the village of *Neffiès* (figure 4.1). A total of seven rainfall events is recorded. The rainfall event of September 21st recorded on average only 3.3 mm, making it too small for reliable interception measurements and is therefore neglected in further analysis.

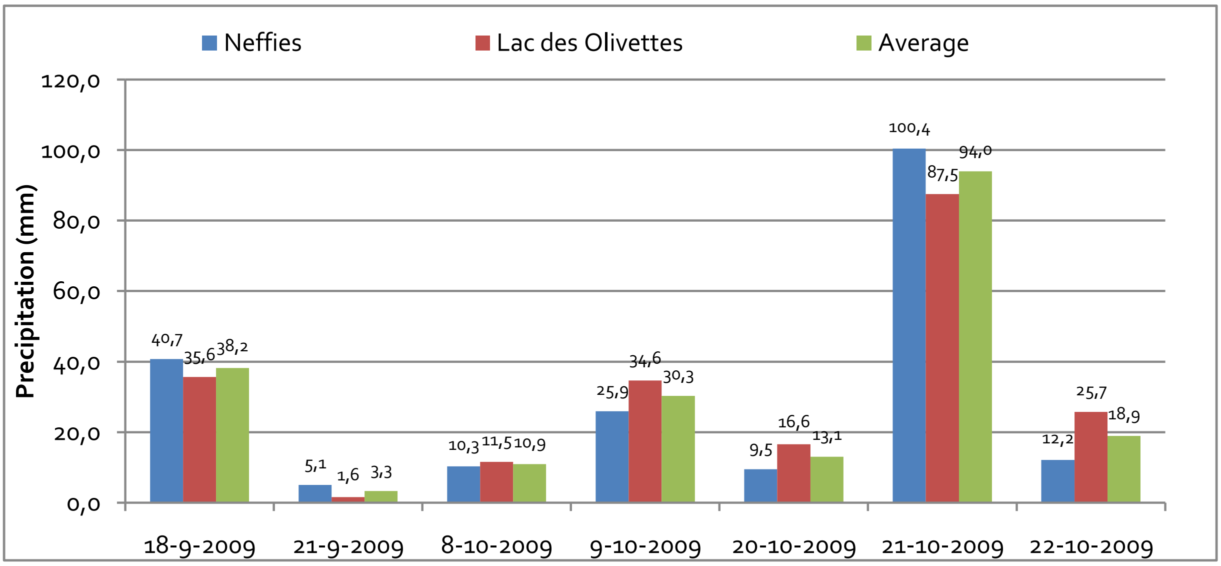


Figure 4.1 Precipitation recorded by two tipping buckets near Lac des Olivettes and Neffiès for the period September – October 2009

The total amount of precipitation recorded by the tipping bucket in *Neffiès* is 204.10 mm for the period September – October 2009. For the tipping bucket near *Lac des Olivettes* this is 213.25 mm, a difference of 4.29% compared to the tipping buckets in *Neffiès*.

When comparing this data with the data from the official *Météo France* weather station in Montpellier (figure 4.2) it is clear that in the Peyne region more precipitation was recorded compared to the coastal areas near Montpellier.

Météo France registered a total sum of 115 mm for the period September – October 2009 (compared to an average 209 mm for the Peyne area). This difference can partly be explained by the rainfall events around October 21st, were for the Peyne area almost 100 mm was recorded in a single day. In Montpellier only 20 mm was recorded that day. Furthermore, precipitation in September was extremely low for Montpellier with only 10 mm when 82 mm for September is normal. For October the amount of precipitation was in accordance with the average precipitation (105 mm recorded against 102 mm normal).

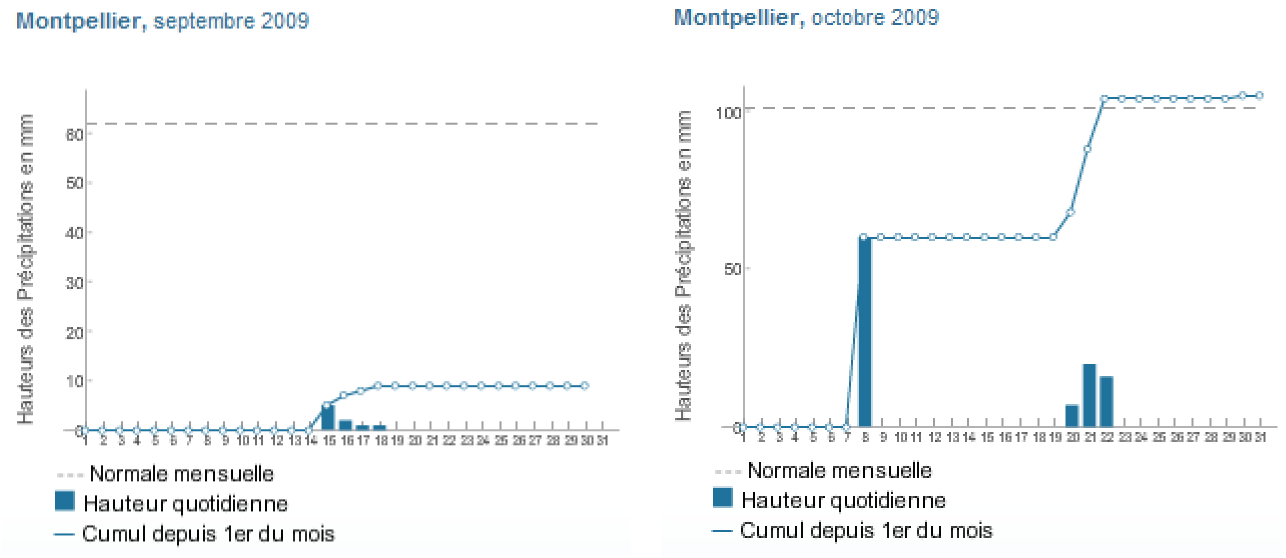


Figure 4.2 Precipitation recorded in Montpellier for the period September – October 2009 by Météo France (Météo France, 2010)

The weather situation of October 21st was serious enough for *Météo France* to give a weather alert for extreme rainfall and risk of flooding in five departments (Hérault, Gard, Ardèche, Bouches-du-Rhône and Var).

Extreme floods did not occur that day in the Peyne region, but the weather alert appeared valid looking at the precipitation sum that day.

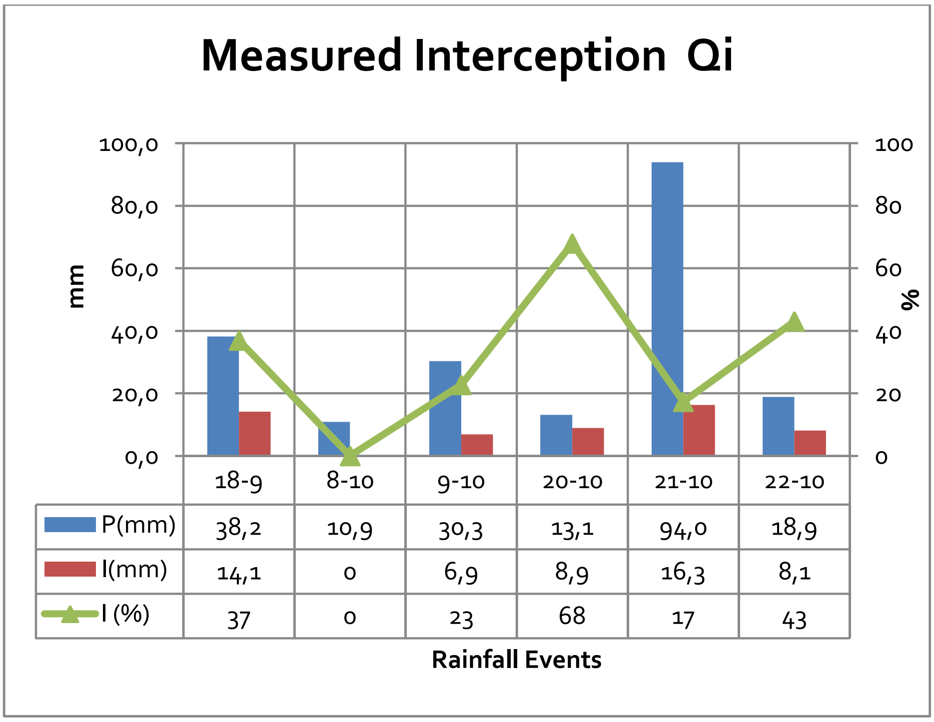
4.2 MEASURED INTERCEPTION OF DIFFERENT VEGETATION SPECIES

For seven vegetation species a plot location was set up to measure the amount of throughfall to determine the interception.

4.2.1 QUERCUS ILEX

The *Quercus ilex* is the most abundant species in the Peyne area and can be found in many shapes and sizes. The plot location of the *Quercus ilex* is located in the southern part of the study area on a slope facing southwest. This plot location is characterized by homogeneous *Quercus ilex* forests with trees up to 3 or 4 meters. Measurement disturbances caused by understorey vegetation was absent.

The results for the *Quercus ilex* (Qi) experiment are plotted in figure 4.3. The amount of precipitation and the absolute interception are plotted on the left vertical axis whereas the relative interception is plotted on the right vertical axis. The measurement dates are plotted on the horizontal axis.



	18-9	8-10	9-10	20-10	21-10	22-10
🟦 P(mm)	38,2	10,9	30,3	13,1	94,0	18,9
🟥 I(mm)	14,1	0	6,9	8,9	16,3	8,1
▲ I (%)	37	0	23	68	17	43

Figure 4.3 Results interception measurements for *Quercus ilex* (Value 0 means no data available)

The average relative interception of the *Quercus ilex* is 38%. For bigger rainfall events the relative interception drops to 17% for the 94 mm rainfall event. When looking at smaller rainfall events the relative interception increases to 68% for the 13.10 mm rainfall event. For the event of October 8th, measurements were disturbed by wild pigs and therefore not taken into account.

4.2.2 ARBUTUS UNEDO

The *Arbutus unedo* (Au) is the second most abundant species in the study area and is mostly found with *Quercus ilex*. Mixed *Arbutus unedo* and *Quercus ilex* forests are widely spread around *Lac des Olivettes*.

The *Arbutus unedo* plot is located in the center of the study area. This plot is characterized by low *Arbutus unedo*, *Quercus ilex* and *Erica arborea* trees up to 2 m. Understorey vegetation is absent. Figure 4.4 shows the results of the *Arbutus unedo* interception experiments. Data for the September 18th event is missing because no suitable plot location was found before October 8th.

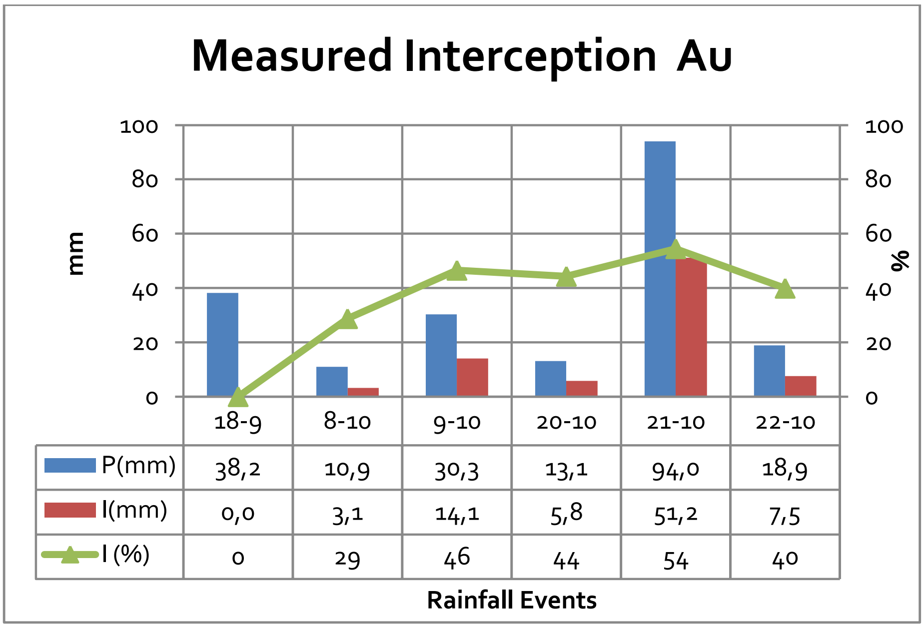


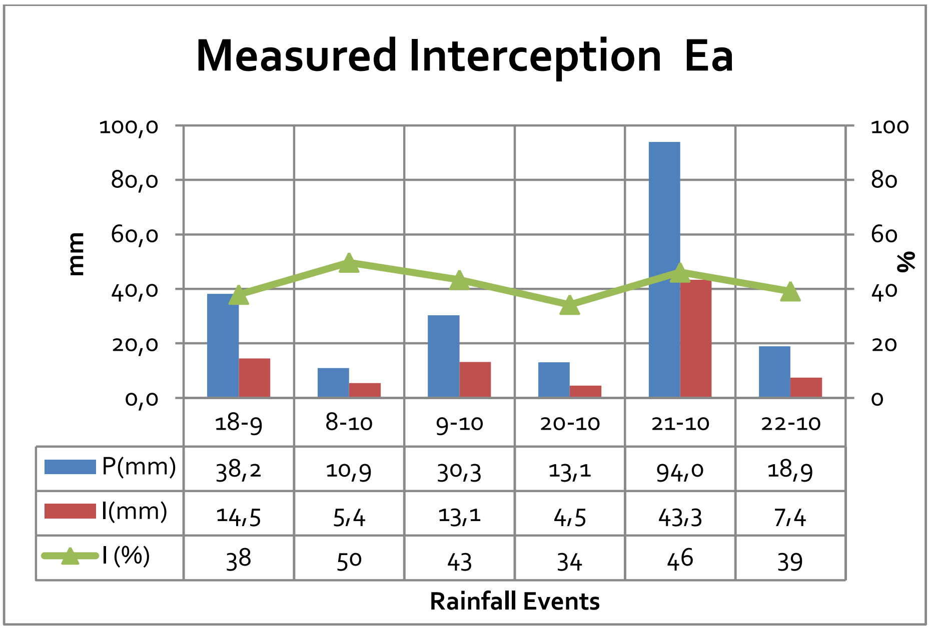
Figure 4.4 Results interception measurements for *Arbutus unedo* (Value 0 means no data available)

Interception values vary from 29% for the smallest rainfall event to 54% for the 94 mm rainfall event. These results are in contrast with *Quercus ilex* results, were interception values were lowest for the biggest rainfall events and higher for the smaller events, meaning that there is no strong relation between precipitation and relative interception.

4.2.3 ERICA ARBOREA

The *Erica arborea* is mostly found in mixed forests with *Arbutus unedo* and *Quercus ilex*. The *Erica arborea* is mostly present as understorey vegetation. The plot location is next to the plot location of the *Arbutus unedo*, near plot 166.

The results of the *Erica arborea* interception measurements are displayed in figure 4.5.



	18-9	8-10	9-10	20-10	21-10	22-10
🟦 P(mm)	38,2	10,9	30,3	13,1	94,0	18,9
🟥 I(mm)	14,5	5,4	13,1	4,5	43,3	7,4
▲ I (%)	38	50	43	34	46	39

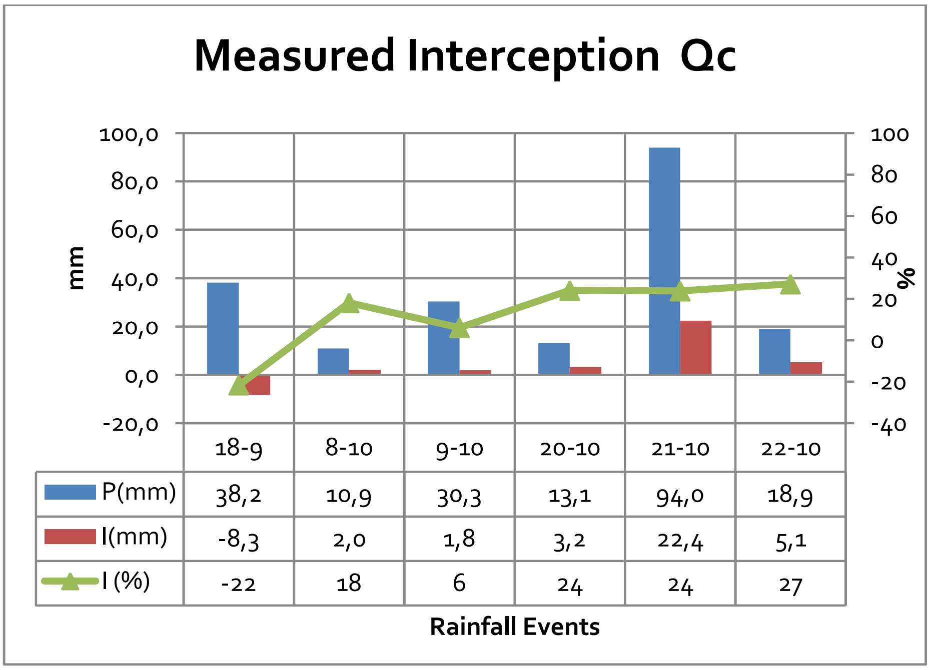
Figure 4.5 Results interception measurements for *Erica arborea*

The interception values of *Erica arborea* show no large variations. For all events, interception values vary from 34% to 50%. Remarkably, largest interception is found at the biggest and smallest rainfall event. These results show no clear trend of increasing interception with increasing rainfall.

4.2.4 QUERCUS COCCIFERA

The *Quercus coccifera* is less abundant in the study area compared to the earlier discussed species. The *Quercus coccifera* can mostly be found in the pine forest and in the southern part and in less dense vegetated areas. *Quercus coccifera* is small shrub *middle matorral* vegetation with heights up to 1 m. The plot location was near plot 10 in the Pine forest.

The results (Figure 4.6) show a variation in interception, least interception is recorded during October 9th rainfall event; most interception is recorded during the October 23th rainfall event. Interception values vary between 6% and 27%, which is much lower compared to the other vegetation species. Again, no clear relation is found between the amount of precipitation and relative interception.

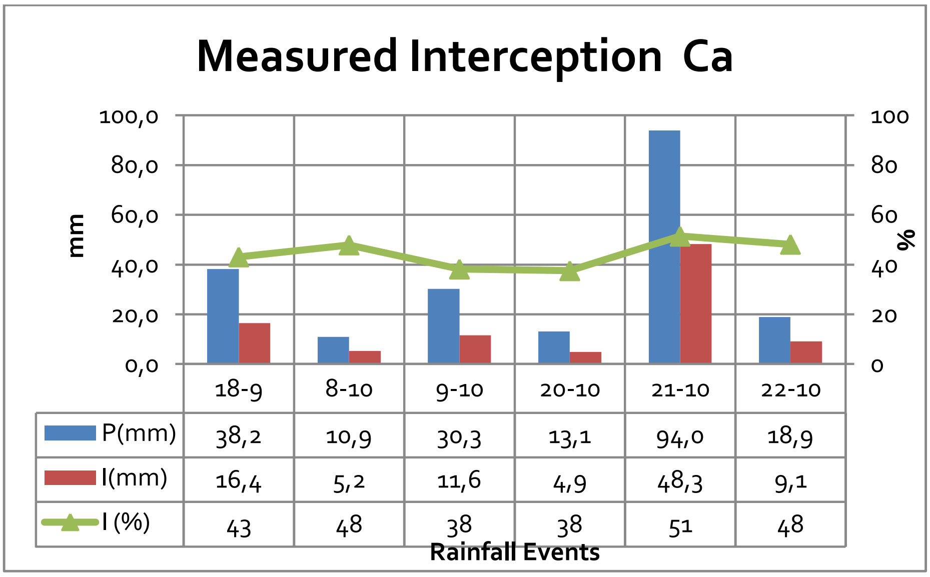


	18-9	8-10	9-10	20-10	21-10	22-10
P(mm)	38,2	10,9	30,3	13,1	94,0	18,9
I(mm)	-8,3	2,0	1,8	3,2	22,4	5,1
I (%)	-22	18	6	24	24	27

Figure 4.6 Results interception measurements for *Quercus coccifera*

4.2.5 CASTANEA SATIVA

The *Castanea sativa* is found in small forest patches all over the study area and occurs mostly with shrub *Buxus sempervirens* vegetation. The interception measurements were taken at a plot northeast of *Lac des Olivettes*, which is characterized by dense, mixed forests. *Castanea sativa* varies greatly in size and age in the study area and can be found in small forests patches over the area. At the measurement plot, the *Castanea sativa* trees were relatively young and high.



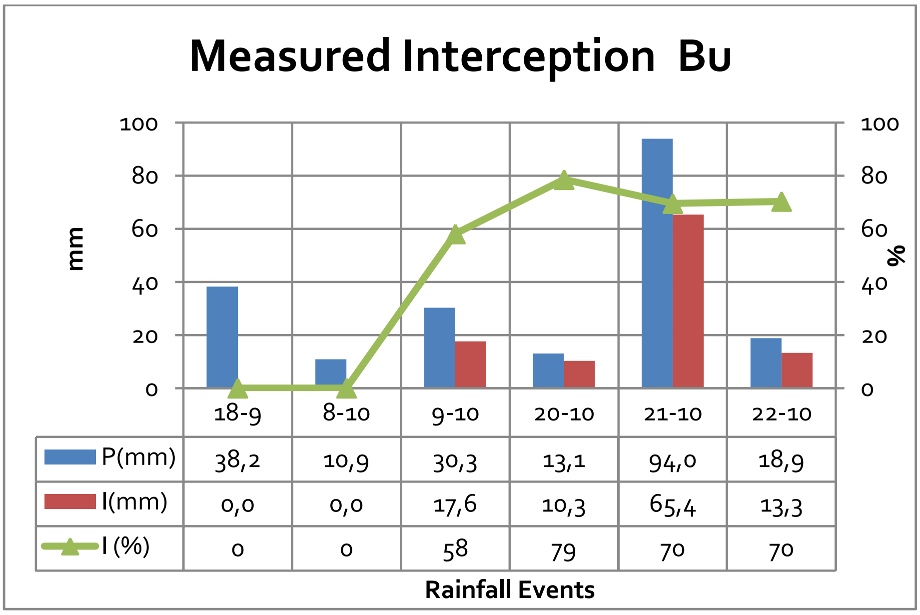
	18-9	8-10	9-10	20-10	21-10	22-10
P(mm)	38,2	10,9	30,3	13,1	94,0	18,9
I(mm)	16,4	5,2	11,6	4,9	48,3	9,1
I (%)	43	48	38	38	51	48

Figure 4.7 Results interception measurements for *Castanea sativa*

Figure 4.7 shows the measured interception results for *Castanea sativa*. Interception values did not change much for different rainfall events. In general interception varies between 38% for 13.1 mm event and 51% for the largest rainfall event. Especially the large interception for the 94 mm event is remarkable, since more than 50% of the total precipitation is intercepted. Lower relative interception was expected, because relative interception decreases with increasing precipitation.

4.2.6 BUXUS SEMPERVIRENS

The *Buxus sempervirens* interception plot location was located near the river Peyne, in a mixed *Quercus ilex*, *Arbutus* and *Buxus sempervirens* forest. *Buxus sempervirens* can be found in open areas as bush vegetation and can also be found as understorey vegetation for *Quercus ilex* and *Castanea sativa* forests. In this plot, *Buxus sempervirens* was present as bush vegetation and was characterized by much denser vegetation compared to other plots.



	18-9	8-10	9-10	20-10	21-10	22-10
🟦 P(mm)	38,2	10,9	30,3	13,1	94,0	18,9
🟥 I(mm)	0,0	0,0	17,6	10,3	65,4	13,3
▲ I (%)	0	0	58	79	70	70

Figure 4.8 Results interception measurements for *Buxus sempervirens* (Value 0 means no data available)

The results of the *Buxus sempervirens* interception measurements (Figure 4.8) show a very large relative interception, with interception values varying from 58% to almost 79% for the 13.1 mm event. These large interception values may have been caused by the very dense vegetation in the plot. A small negative trend is found between the amount of precipitation and relative interception, where larger rainfall events show lower interception values compared to the smaller events that have relatively higher interception. No data is available for the September event and the event of October 8th, because the site was not installed until October 9th.

4.2.7 PINUS PINASTER

The *Pinus pinaster* can only be found in the southern part of the study. The *Pinus pinaster* is originally not present the natural vegetation of the study area but was introduced by the creation of *Forêt Communale de Neffiès*, a homogenous *Pinus pinaster* forest.

The plot location of interception measurements was taken together with the *Quercus coccifera*. The plot is characterized by large pine trees with *Quercus coccifera* bush vegetation.

The results (Figure 4.9) show great differences in interception values, with negative interception values for three rainfall events. Because interception cannot be negative, the interception measurements at this plot are unreliable. And because of the large measured interception differences, this plot location appears to be unsuitable for measuring interception.

Due to the negative values for three rainfall events, the average interception is -3%. When neglecting the negative values, interception values are in general relative low (24%) compared to other vegetation species.

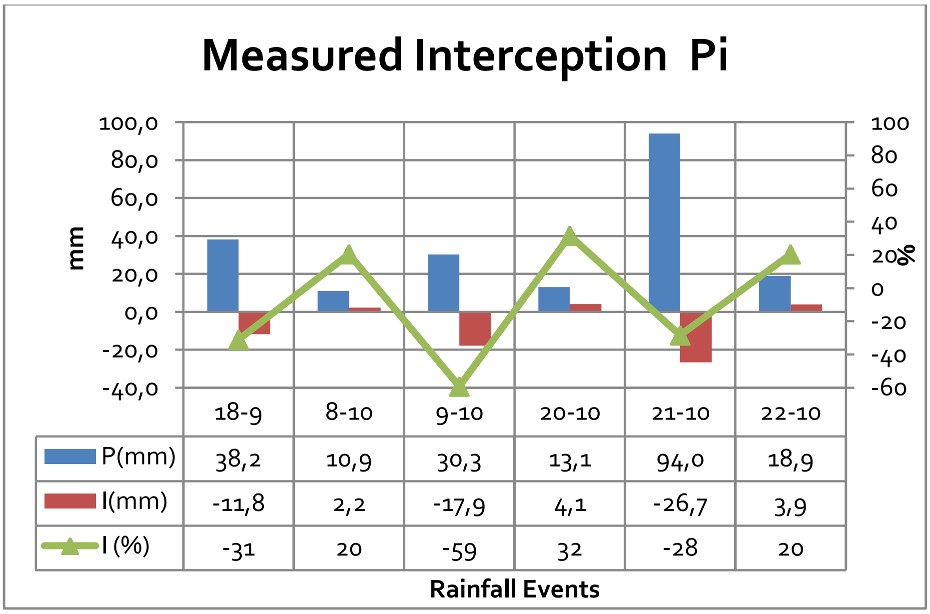


Figure 4.9 Results interception measurements for *Pinus pinaster*

4.2.7 MEASURED INTERCEPTION: SPECIES COMPARED

After all specific vegetation species are investigated; interception values are compared to determine the differences between the species.

This is done by averaging the relative interception from all six rainfall event for seven species (events with missing data for some species are not used in the calculation). The results are given by figure 4.10.

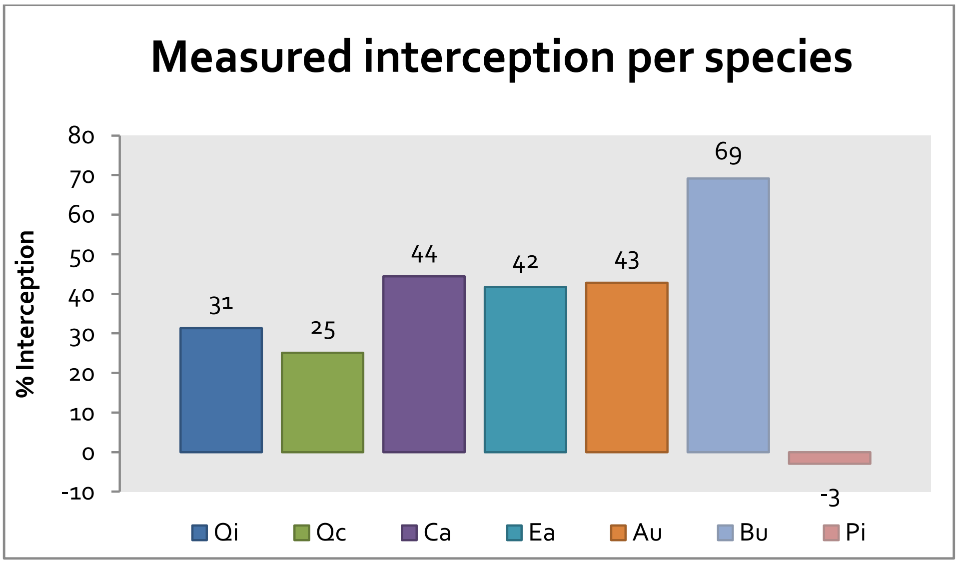


Figure 4.10 Average measured relative interception for seven vegetation species

Figure 4.10 shows that largest interception values are found for *Buxus sempervirens*. The average measured interception for *Buxus sempervirens* is much larger compared to other species, which is probably caused by the much denser vegetation in that plot. *Arbutus unedo*, *Quercus ilex*, *Erica arborea* and *Castanea sativa* show similar results for relative interception. The *Pinus pinaster* and *Quercus coccifera* have lower interception compared to other species, however the *Pinus pinaster* interception measurements are not representative. Especially the *Erica arborea* was expected to have lower interception, since this is a small needle bush with only healthy canopy at the top. *Quercus ilex* and *Arbutus unedo* have similar tree structure and leaf size; therefore they are expected to have about the same interception values. At first hand interception values of the *Castanea sativa* were expected larger due to leaf properties and tree structure. However, *Castanea sativa* can be found in many heights and sizes what may explain the similar interception values compared to *Quercus ilex* and *Arbutus unedo*. It is important to note that precipitation amounts can vary per plot location, thereby influencing relative interception values.

Summarizing, from the interception experiments it is clear that different vegetation species have different relative interception values. Interception also differs per rainfall event, in general larger rainfall events have a relatively lower interception, although this rule was not always supported by the field data and measurement errors occurred especially for *Buxus sempervirens* and *Pinus pinaster*. In general, relative interception values are high, when comparing them to other Mediterranean species.

4.3 CALCULATING INTERCEPTION USING FIELD DATA

Interception can also be calculated using the interception formula of Aston. The input variables of this interception formula are obtained from measured parameters in the field. The interception is then calculated for every recorded rainfall event and is compared to the measured interception values. Interception is calculated for eight species, including *Quercus pubescens*, only the calculated interception of the *Quercus pubescens* could not be compared with measured interception values.

4.3.1 *SMAX*

Determining the *Smax* in the field is based on measuring LAI and *Smax* on branch scale and scaling up these variables to tree scale. The LAI is calculated from branch characteristics measured in the field and the *Smax* is determined by measuring the difference between dry and saturated branches. Figure 4.11 shows the average difference between the dry weight for 542 investigated branches and the completely saturated branches.

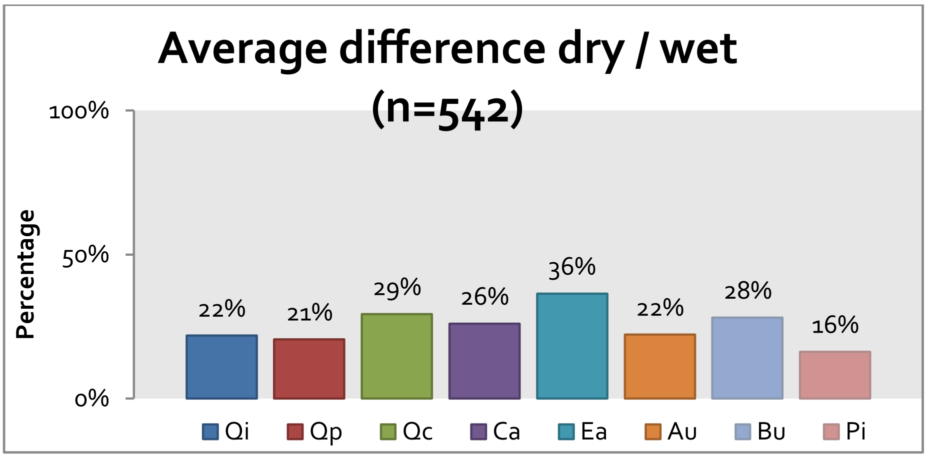


Figure 4.14 The average difference between dry and wet branches for 8 different vegetation species and 542 branches

The average difference between dry and wet branches is 25% for all species meaning that on average, every branch can take up 25% water compared to its own weight. Figure 4.11 shows that *Pinus pinaster* has the lowest difference dry/wet with only 16% and *Erica arborea* has the largest difference with 36%. So *Erica arborea* can relatively take up most water. All other species vary between 20 and 30%.

Looking at LAI of branches (Figure 4.12), larger differences between species are found. *Erica arborea* and *Quercus coccifera* have the largest LAI per branch. *Castanea sativa* has the lowest average LAI per branch. The average LAI per branch of all species is 0.31.

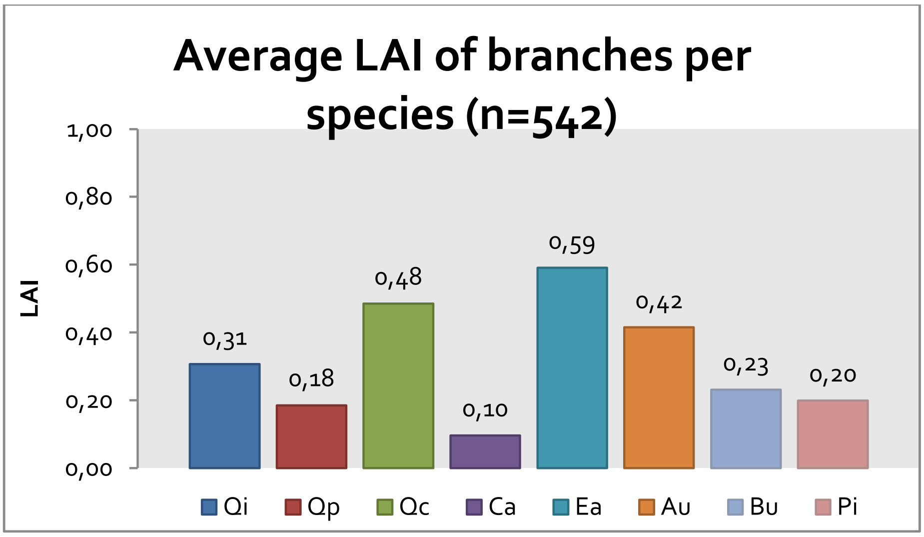


Figure 4.12 The average LAI of single branches per vegetation species

The results of the calculated average *Smax* of branches, per species are shown in figure 4.13.

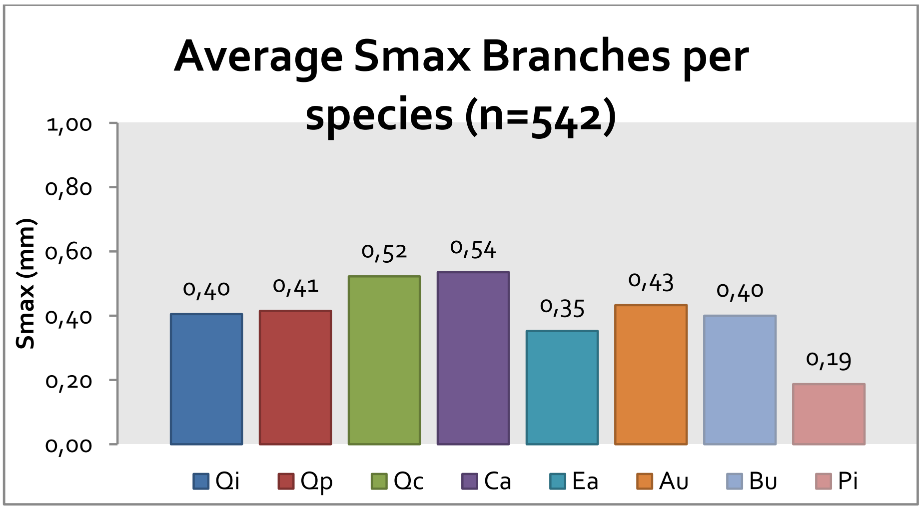


Figure 4.13 The average *Smax* of single branches per vegetation species

The average *Smax* of a single branch is 0.41 mm. Most species have *Smax* values around this average. The *Quercus coccifera* and *Castanea sativa* have significant larger *Smax* values whereas *Pinus pinaster* has a much lower *Smax* value for single branches.

4.3.2 SCALING UP FROM BRANCH TO TREE

The *Smax* of single branches obtained in the field need to be scaled up to tree level in order to calculate the total interception of that specific tree. A linear up scaling method is used, were the number of branches of a single tree are multiplied by the average *Smax* per branch of that particular tree.

This up scaling method leads to a bigger divergence of *Smax* between species (Figure 4.15), since the different species differ in average number of branches (Figure 4.14).

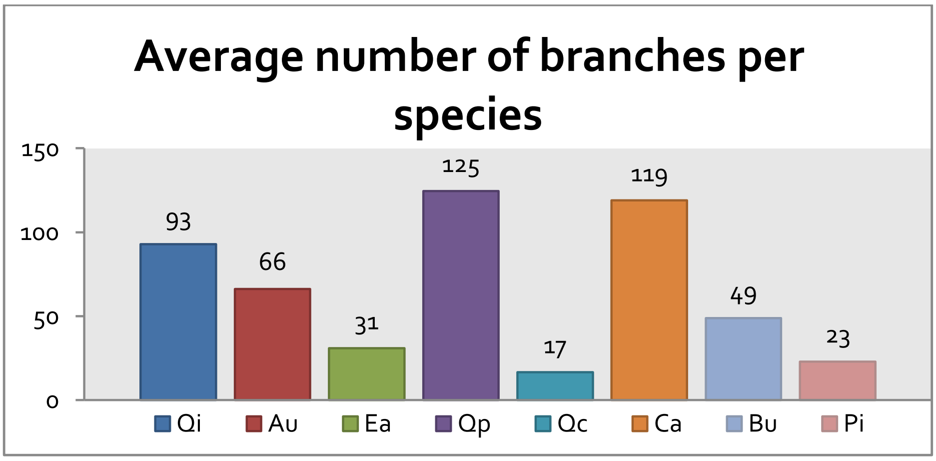


Figure 4.14 Average number of branches per species, measured in the field

Quercus pubescens and *Castanea sativa* have on average the most branches per tree whereas *Pinus pinaster*, *Quercus coccifera* and *Erica arborea* have less number of branches per tree.

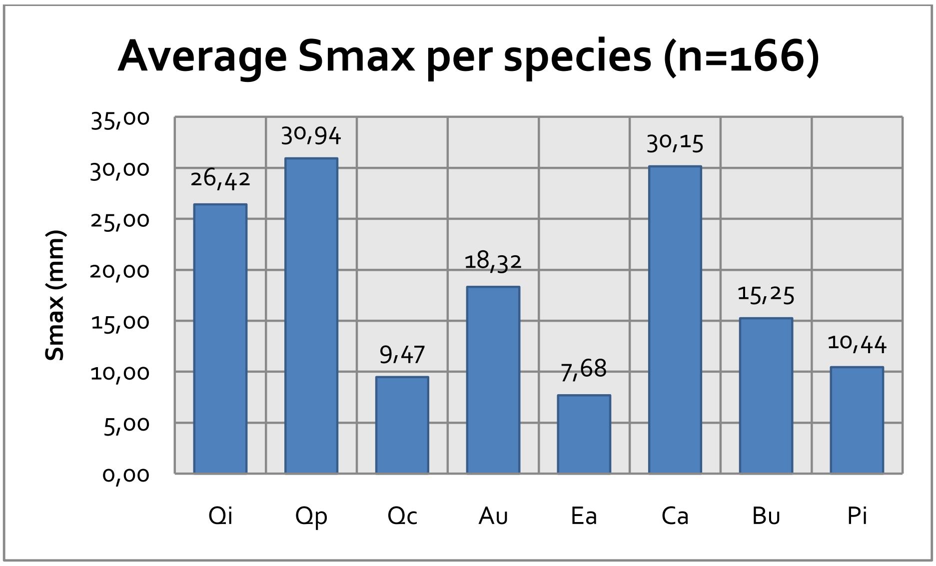


Figure 4.15 The average *Smax* for 8 difference species based on 166 investigated trees

The results show that large trees such as *Quercus ilex*, *Quercus pubescens*, *Arbutus unedo* and *Castanea sativa* have significant higher *Smax* values compared to the small *Quercus coccifera* and *Erica arborea* vegetation. These differences became only apparent after scaling up from branch to tree.

4.3.3 CALCULATED INTERCEPTION PER RAINFALL EVENT

With the Aston formula, interception can be calculated for every tree and every rainfall event (figure 4.16). This figure shows that the relative interception decreases as the total amount of rainfall increases. Smaller rainfall events tend to have larger variation in relative interception values for all species. The minimum interception for every rainfall event lies for all events around 15%. The maximum interception varies strongly per rainfall events, with lowest maximum interception values found for the larger rainfall events.

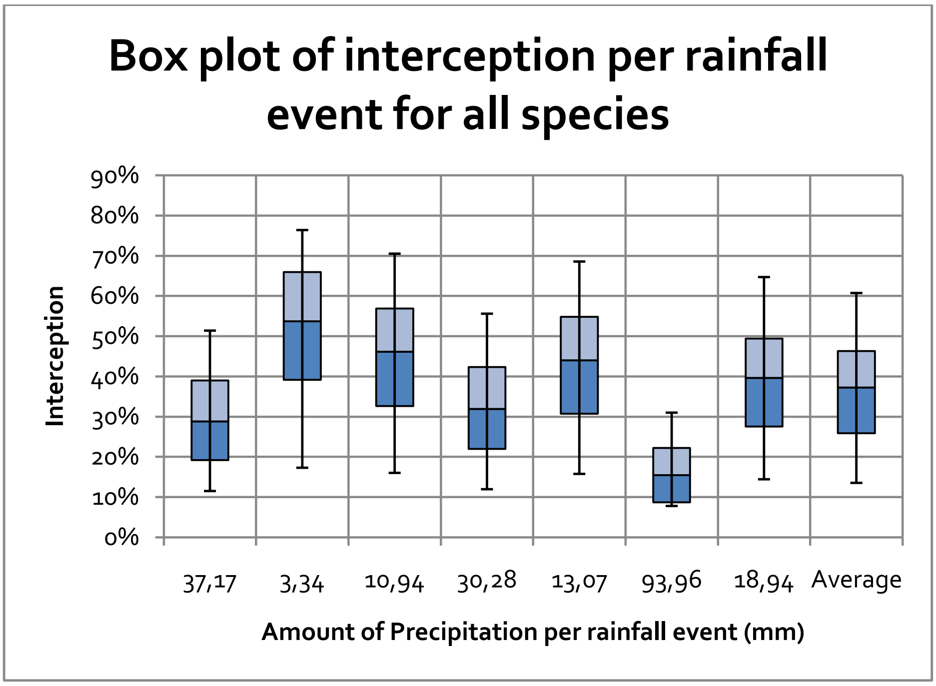


Figure 4.16 Calculated interceptions for every rainfall event and for all plots, displayed in a boxplot

4.3.4 MEASURED INTERCEPTION VERSUS CALCULATED INTERCEPTION

To determine the reliability of the calculated interception, the measured interception is plotted against the calculated interception from the field data (Figure 4.17). The measured and calculated interception percentages are averaged for all six rainfall events.

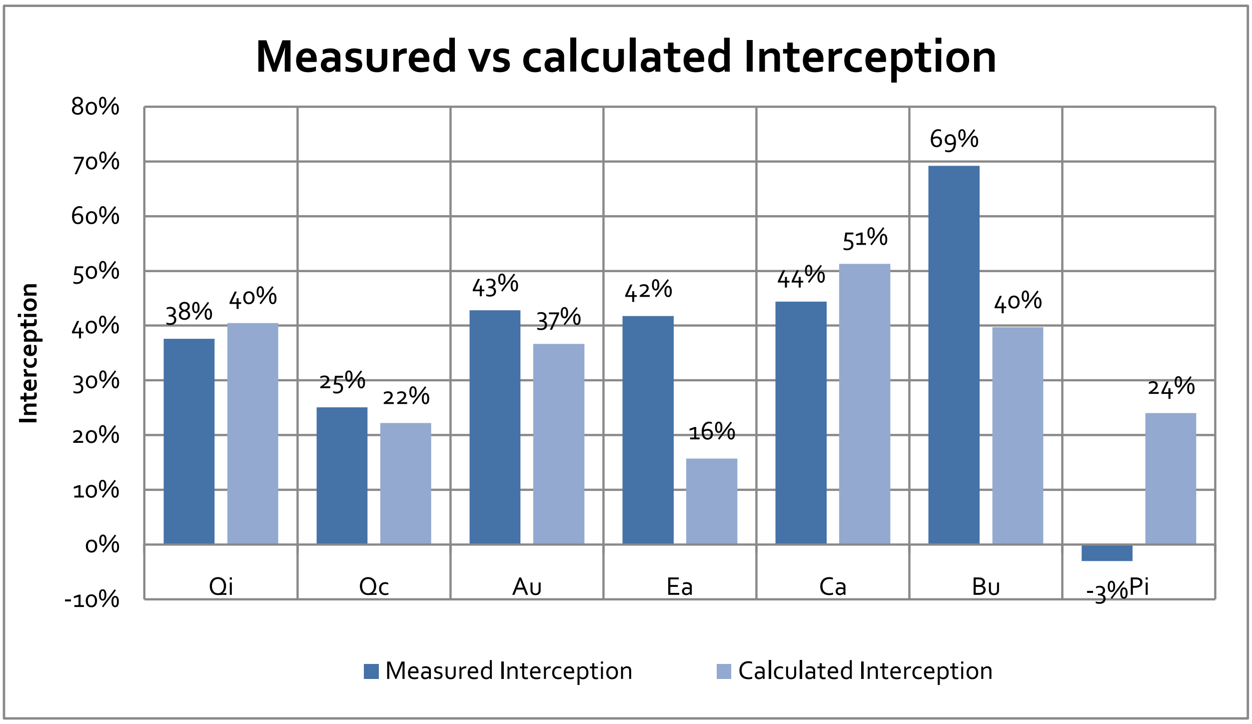


Figure 4.17 The measured interception compared with the calculated interception for 7 species

The results show that in most cases measured interception and calculated interception have nearly the same interception values. Only *Erica arborea*, *Buxus sempervirens* and *Pinus pinaster* show large differences. The difference for *Pinus pinaster* is mainly caused by measuring errors. For *Erica arborea* the difference between measured and calculated interception is 26%, with a significant higher measured interception. Almost the same difference is found for the *Buxus sempervirens*, were the difference is 29% and again a much higher measured interception compared to the calculated interception. For all other species the difference varies between 0 and 7% meaning that the calculated interception compares well with field measurements.

The large difference of the *Buxus sempervirens* interception and *Erica arborea* interception can be explained by overhanging vegetation at the plot location of the interception measurements. This may have caused extra interception, resulting in an overestimation of the interception measurements.

In general, when comparing the calculated interception with the measured interception, absolute differences are negligible (with the exception of *Erica arborea* and *Buxus sempervirens*). Looking at relative interception values per rainfall event, the results are as expected; larger interception values are found with smaller rainfall events and relative low interception is found for bigger rainfall events.

SMAX & LAI RELATIONS

5 *SMAX* & LAI RELATIONS

The maximum canopy storage (*Smax*) is one of the most important factors in the interception formula of Aston. In order to make an interception map based on remote sensing, the *Smax* has to be determined for different vegetation species. Because LAI data can be derived from remote sensing images using the LAI – NDVI relation and LAI data is available from hemispherical photographs, specific LAI – *Smax* relations can be found for different vegetation species.

5.1 *SMAX* FOR DIFFERENT SPECIES

The *Smax* are calculated for 166 trees (Figure 4.15). Higher *Smax* values are found for taller species such as *Castanea sativa* and *Quercus pubescens*, and low *Smax* values coincide with smaller species (Figure 5.1).

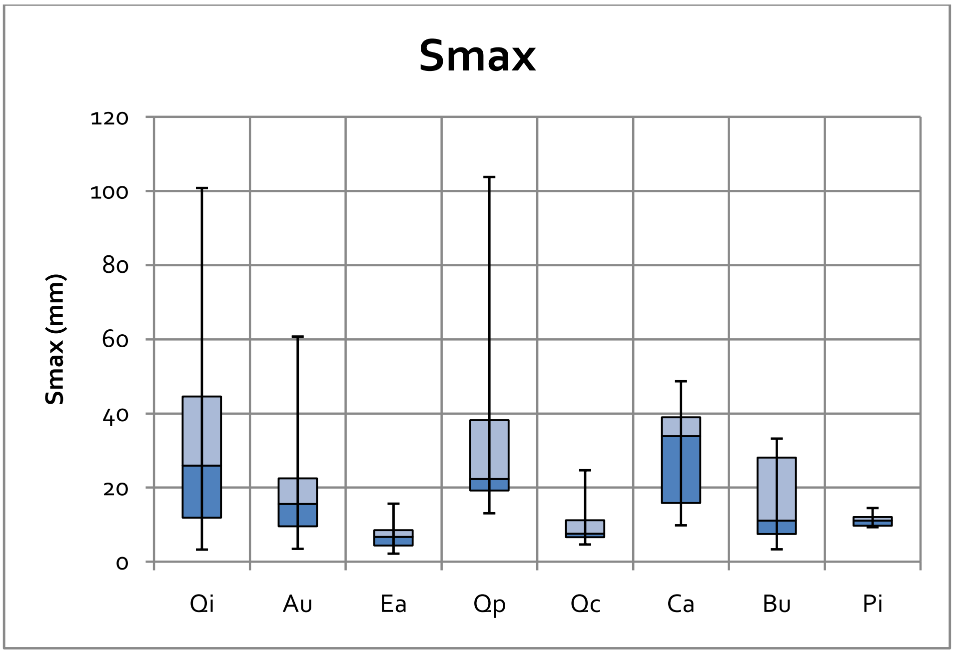


Figure 5.1 Boxplot of *Smax* values for eight different vegetation species

The boxplot shows that the variation for *Smax* values especially for the *Quercus pubescens*, *Quercus ilex* and *Arbutus unedo* is large compared to the other species. The average *Smax* ranges from 8 mm for *Erica arborea* and 36 mm for *Quercus pubescens*. The standard deviations vary between 3 for *Pinus pinaster* and 33 for *Quercus pubescens.* The highest *Smax* value is found for the *Quercus pubescens*, with an *Smax* of 106 mm. Lowest *Smax* is found for *Erica arborea* with 2 mm.

The *Smax* values found by Aston (1979) and Gomez et al. (2001) for coniferous trees (0.5 - 3 mm), olive trees (1.5 - 4 mm) and eucalypt trees (0.1 - 1.0 mm), are low compared to the values found in this study. This indicates that the *Smax* values that are determined in the Peyne area are overestimated due to measurement uncertainties. Determining the LAI of a single branch for example, introduced an uncertainty because branch properties, such as leaf cover and number of leaf layers, are difficult to estimate.

The variation of the *Smax* per species in this study can be explained by the large differences in heights and sizes within these species. *Buxus sempervirens* and *Castanea sativa* show less variation in size and occurrence, and therefore show less variation in *Smax* values. Especially the *Erica arborea*, *Quercus coccifera* and *Pinus pinaster* only show little variation. This might be explained by the fact that *Pinus pinaster* trees in the study area are strongly homogeneous in size and height due to artificial planting. *Quercus coccifera* and *Erica arborea* are also homogeneous in size and height, although variation is larger compared to *Pinus pinaster*.

5.2 LAI FOR DIFFERENT SPECIES

LAI values for individual trees are derived from hemispherical photographs (figure 5.2). LAI calculated for single branches, using branch properties, was necessary to convert the dry/wet difference into *Smax* values. This LAI cannot be scaled up to tree scale because the LAI is a ratio between leaf surface and total surface that cannot be scaled up linear. Therefore the LAI of trees is obtained from hemispherical photographs.

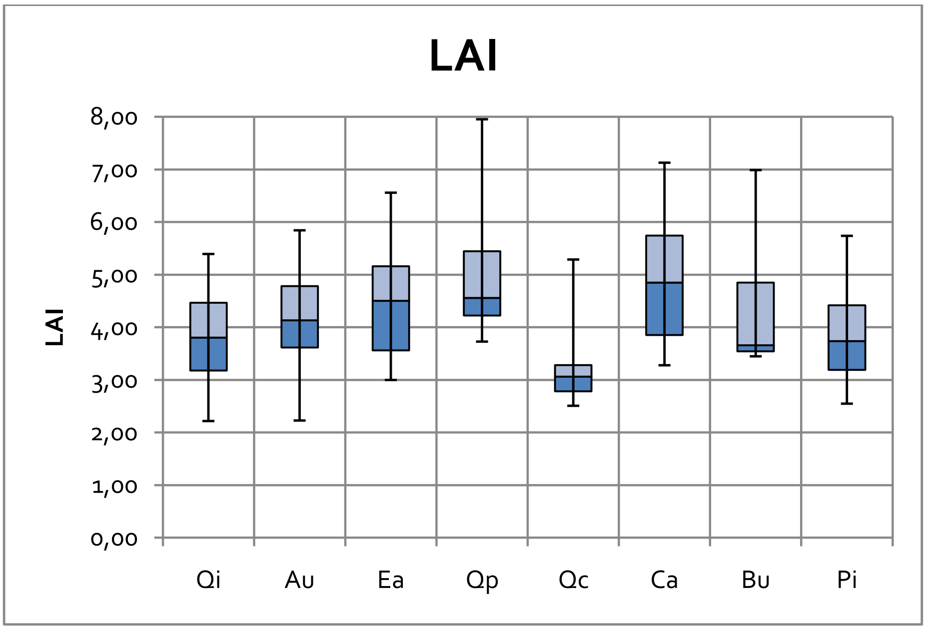


Figure 5.2 The LAI values (from hemispherical photographs) of eight different species displayed in a boxplot

In general larger trees species such as *Quercus pubescens* and *Castanea sativa* have higher LAI values. *Quercus coccifera* and *Pinus pinaster* have lower LAI values compared to other species. The average LAI values varies from 3,55 for *Quercus coccifera* up to 4,87 for *Quercus pubescens*. The standard deviation varies from 0,85 for *Pinus pinaster* up to 1,46 for *Quercus coccifera*. Remarkably are the high LAI values for *Buxus sempervirens* and *Erica arborea*, which can be explained by the interference of overhanging vegetation that affect the registered leaf coverage by the hemispherical photographs.

Since *Erica arborea* and *Buxus sempervirens* are mostly understorey vegetation and occur mostly in the presence of large overhanging vegetation, it is difficult to take a clear hemispherical photo without interference of other vegetation. Some interference can be cleared out using CanEye software, but it is difficult to mask out all other interfering vegetation out. The result is that *Erica arborea* and *Buxus sempervirens* LAI values tend to be overestimated.

Quercus coccifera is also a vegetation species that could suffer from interference by other species; however the plot locations of the *Quercus coccifera* in this study were mostly clear of other vegetation species. And in other cases the interference of overhanging vegetation could be masked out well.

For other Mediterranean species such as olive trees and eucalypt trees, LAI values of 1 - 6 m^2m^{-2} are found (Gomez et al., 2001). The values are slightly lower compared to the values found in this study, due to an overestimation of LAI values in the Peyne area caused by overhanging vegetation.

The variation in LAI is for all values nearly equal. Highest values are found for the *Quercus pubescens* and *Castanea sativa* with an average LAI of 4.5 and maximum LAI's between 7 and 8. Lowest LAI values are found for the *Quercus ilex*, *Arbutus unedo* and *Quercus Coccifera*, with LAI values ranging from 2 to 5.5.

Summarizing, LAI values differ per vegetation species in the study area. Larger tree species tend to have larger LAI values compared to smaller tree species. *Buxus sempervirens* and *Erica arborea* show larger LAI values than expected, caused by interference of overhanging vegetation that could not be cleared out completely by software.

5.3 PLOTTING LAI AND *SMAX*

In order to obtain LAI – *Smax* relationships per species, scatter plots are used. A regression analysis is then performed to describe the linear relationship and investigate the strength of that relationship.

5.3.1 TREE SPECIES DISTRIBUTION

The total amount of investigated trees is 166; however the number of trees that are investigated per species varies strongly (figure 5.3). This variation is caused by the difference in abundance of species in the study area and the suitability to do accurate measurements on some species.

The *Quercus ilex* for example is the most abundant species in the area, has a relative easy accessibility (due to its abundant presence) and accurate measurements can be performed. The *Buxus sempervirens* in contrary is less common in the study area, suffers often from interfering vegetation and is mostly found in remote areas.

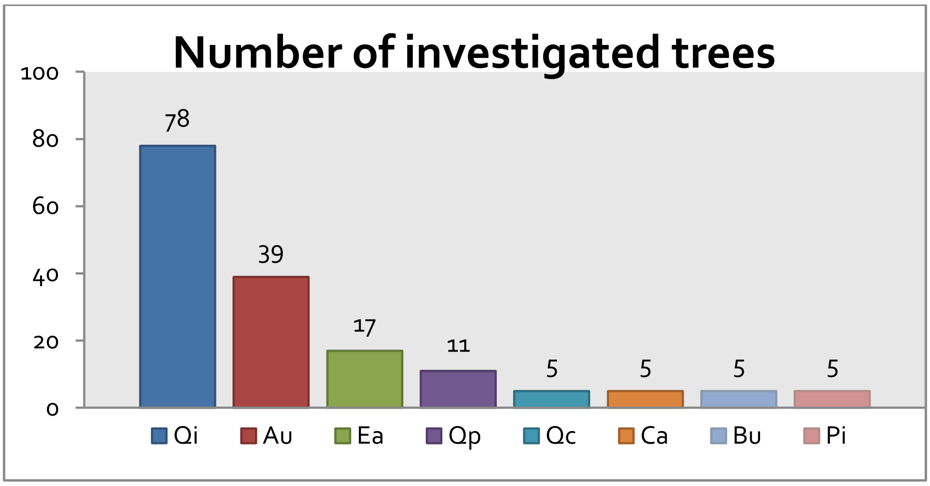


Figure 5.3 The number of investigated trees per species for 166 measurements

Quercus ilex and *Arbutus unedo* are most investigated, *Quercus coccifera*, *Castanea sativa*, *Buxus sempervirens* and *Pinus pinaster* least. The distribution of investigated trees shown in figure 5.3 gives a good estimation of the distribution of vegetation species in the area, since the plot locations were partly randomly chosen. The *Castanea sativa* and the *Buxus sempervirens* are likely to be underestimated due to vegetation health and isolated locations. The health of the *Buxus sempervirens* was mostly bad due to a plant disease. *Castanea sativa* trees were often partly damaged by thunder and wind, making them unsuitable for proper hemispherical photographs and branch cutting.

5.3.2 LAI VERSUS *SMAX* SCATTER PLOTS

In figure 5.4 the *Smax* and LAI are plotted for *Quercus ilex*. The scatter plot shows that there is a relationship between the *Smax* and LAI though this relationship is not strong (R-squared is 0.21). Nevertheless a clear trend is visible in the plot. When expressing the *Smax* and LAI into the linear relationship, given by figure 5.4, the following relationship can be formulated:

$$Smax = 0.7107LAI + 0.1827(n = 78, R^2 = 0.21) \qquad (5.1)$$

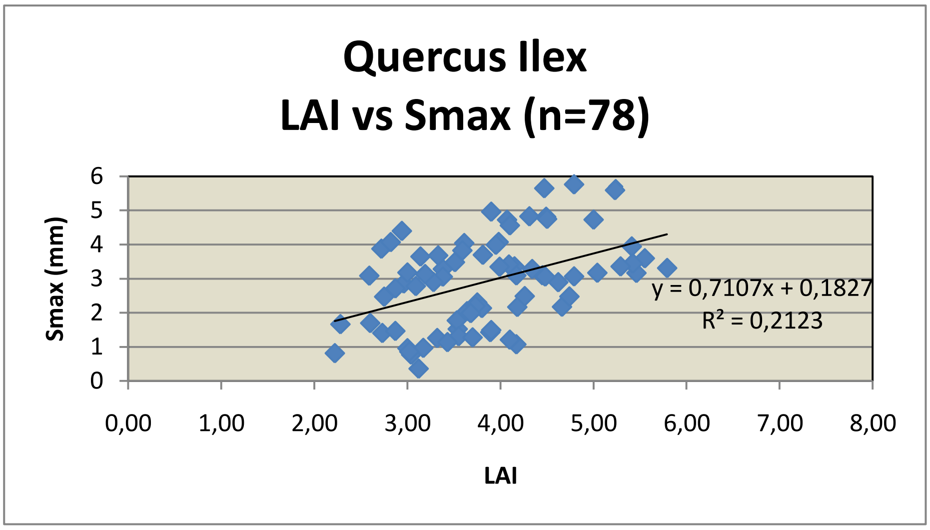


Figure 5.4 Scatterplot of *Smax* and LAI values from 78 *Quercus ilex* trees

When looking to the *Arbutus unedo* plot (figure 5.5), the relationship is stronger compared to the *Quercus ilex*, although still not high enough to speak of a clear relationship. The *Smax* and LAI relation for *Arbutus unedo* can be described by:

$$Smax = 0.5605LAI - 0.3302\ (n = 39, R^2 = 0.40) \qquad (5.2)$$

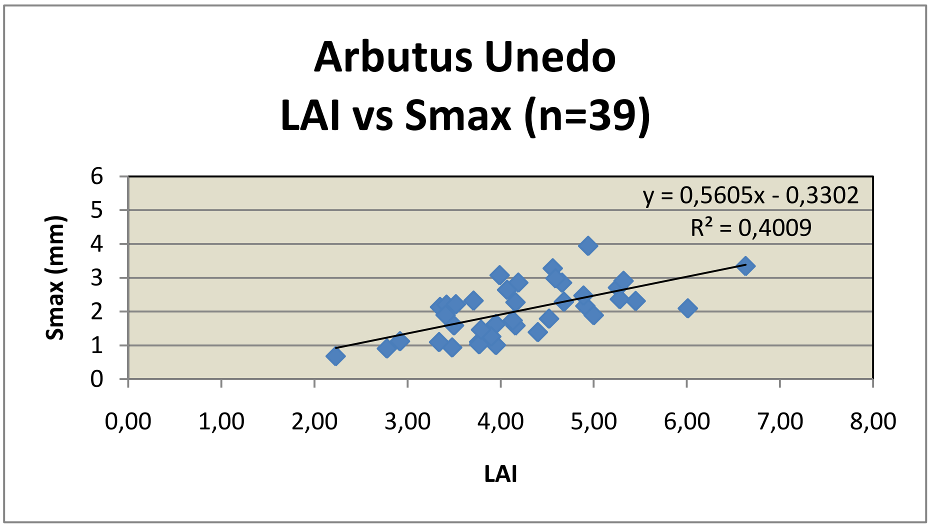


Figure 5.5 Scatterplot of *Smax* and LAI values from 39 *Arbutus unedo* trees

The scatter plot of *Erica arborea* (figure 5.6) shows a clear trend between *Smax* and LAI but still no strong relationship exists. The LAI – *Smax* relationship of *Erica arborea* is given by:

$$Smax = 0.2149LAI - 0.1021\ (n = 17, R^2 = 0.31) \qquad (5.3)$$

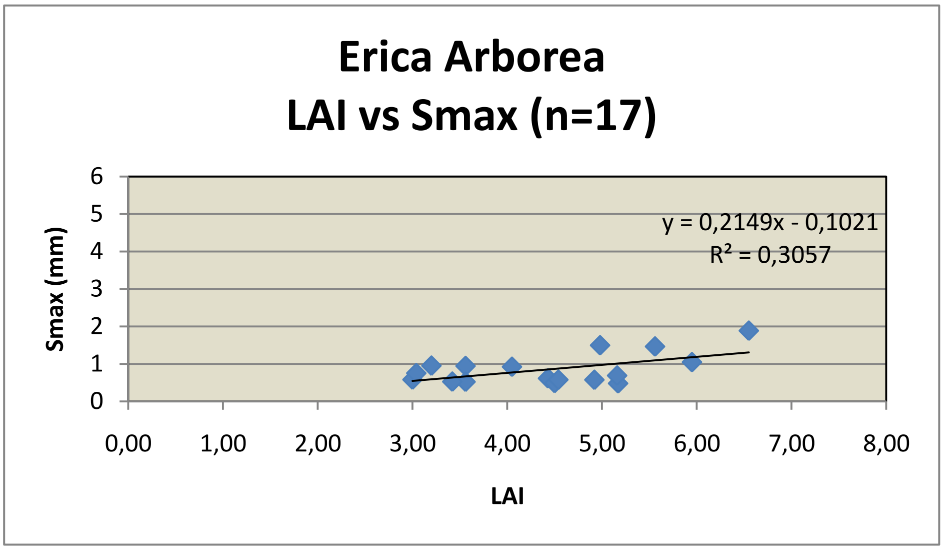


Figure 5.6 Scatterplot of *Smax* and LAI values from 17 *Erica arborea* trees

For the *Quercus pubescens* a stronger relationship is found compared to the previous mentioned species. Figure 5.7 shows that relationship, although the strength of this relationship is still not very convincing. The LAI – *Smax* relationship for the *Quercus pubescens* is given by:

$$Smax = 0.6548LAI + 0.1986\ (n = 11, R^2 = 0.54) \tag{5.4}$$

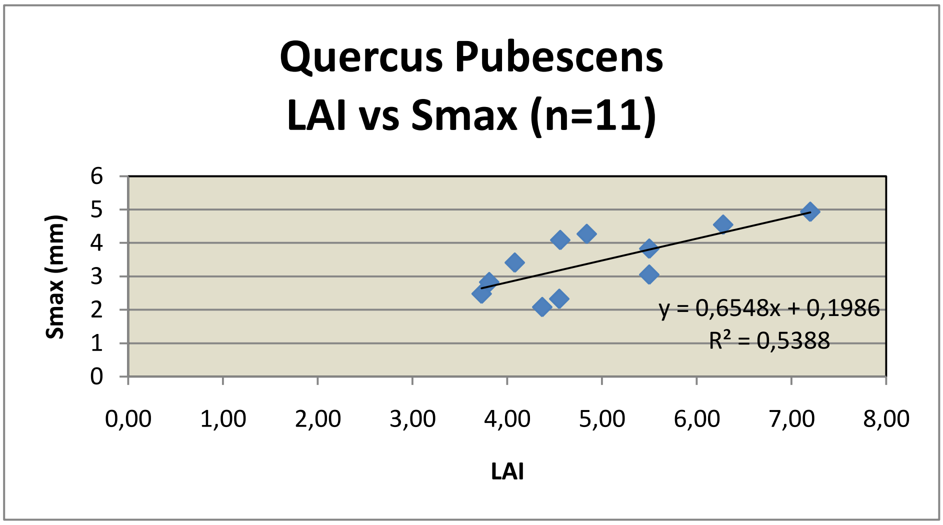


Figure 5.7 Scatterplot of *Smax* and LAI values from five *Quercus pubescens* trees

For the *Quercus coccifera* five trees were investigated. The results (figure 5.8) show a much stronger relationship compared to the previous mentioned species, although the relationship would be less strong without the outlier. The relationship is given by:

$$Smax = 0.3388LAI - 0.1488\ (n = 5, R^2 = 0.83) \tag{5.5}$$

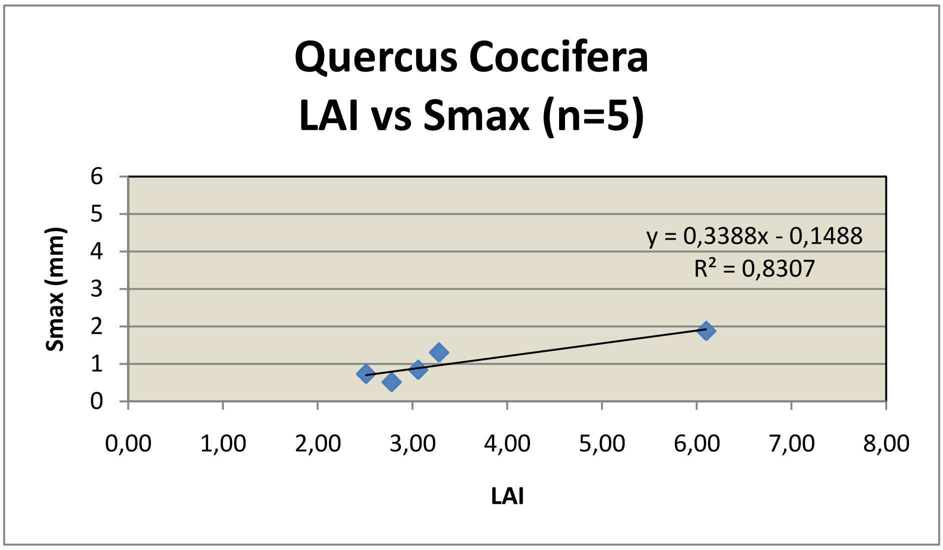


Figure 5.8 Scatterplot of *Smax* and LAI values from five *Quercus coccifera* shrubs

For *Castanea sativa* also five trees are investigated for LAI and *Smax* relationships. Figure 5.9 shows a strong relationship in the scatter plot. The LAI – *Smax* relationship for *Castanea sativa* is given by:

$$Smax = 0.6888LAI - 0.101 \ (n = 5, R^2 = 0.88) \qquad (5.6)$$

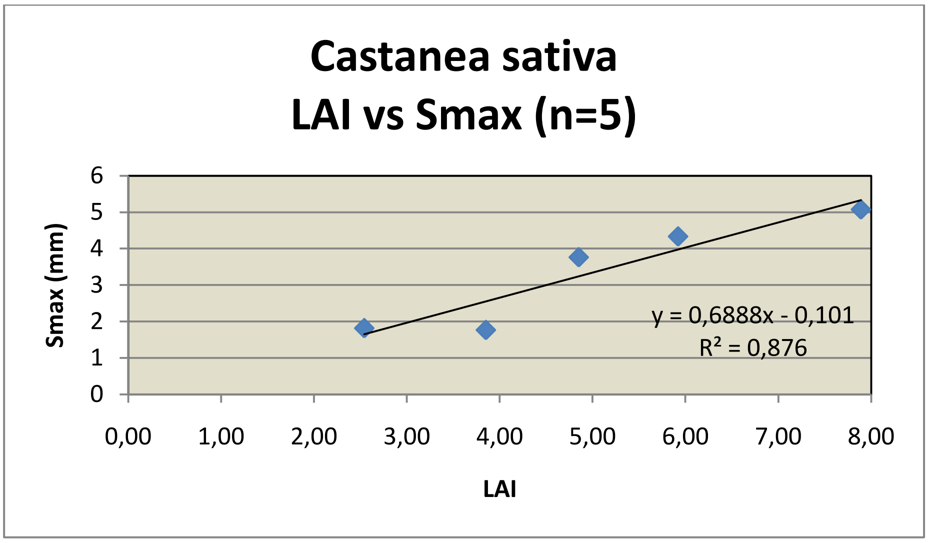


Figure 5.9 Scatterplot of *Smax* and LAI values from five *Castanea sativa* trees

For *Buxus sempervirens* and *Pinus pinaster* also five trees are investigated. Both species have strong LAI – *Smax* relationships. For *Buxus sempervirens* (Figure 5.10) the *Smax* – LAI relationship is given by:

$$Smax = 0.8274LAI - 1.7785 \ (n = 5, R^2 = 0.86) \qquad (5.7)$$

For *Pinus pinaster* (Figure 5.11) this relationship is:

$$Smax = 0.2695LAI + 0.164 \ (n = 5, R^2 = 0.80) \qquad (5.8)$$

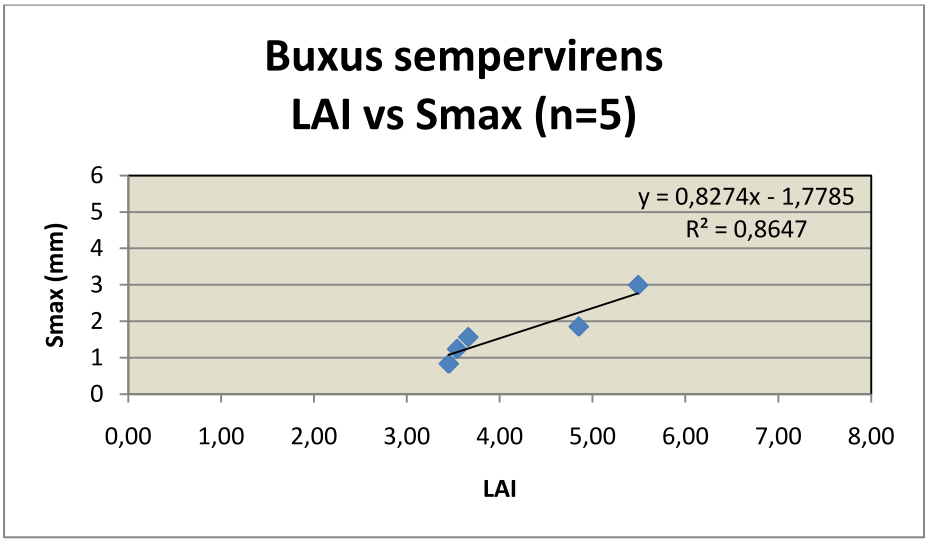


Figure 5.10 Scatterplot of *Smax* and LAI values from five *Buxus sempervirens* shrubs

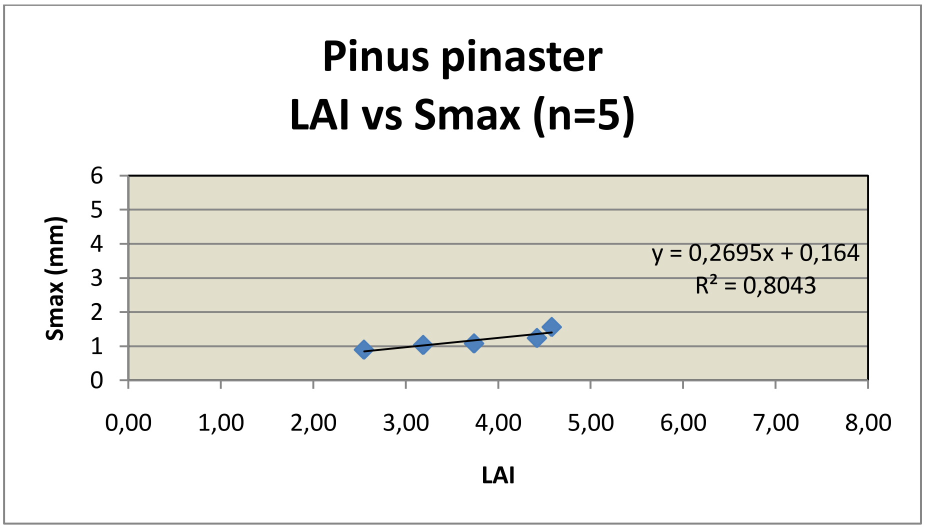


Figure 5.11 Scatterplot of *Smax* and LAI values from five *Pinus pinaster* trees

To summarize, previous study done on the *Smax* – LAI relationship showed already signs of different relationships for different species. This could however not be proven since the different studies were carried out using different methods and under different meteorological circumstances. The results of this study showed that different *Smax* – LAI relationships indeed exist for different vegetation species. However the strength of the relationships decreases with the number of investigated trees.

The *Quercus ilex* (78 trees) has the weakest relationship whereas the species with five investigated trees show the strongest relationships. This can partly be explained that due to an increasing number of measurements, variation is likely to increase. This means that the *Smax* – LAI relationships for species with only five samples require more sample point to obtain a more realistic result. Another reason for the weak *Quercus ilex* relationship could be the divergent occurrence of *Quercus ilex* in the study area, resulting in larger variation of *Smax* and LAI between trees.

INTERCEPTION MAPPING USING REMOTE SENSING

6 INTERCEPTION MAPPING USING REMOTE SENSING

With the HyMap remote sensing image of 2008 and the computer programs ENVI and ArcMap an interception map of the research area is calculated and analysed. To come up with a final interception map, which shows the absolute interception values (mm) depending on the amount of rainfall, a number of steps are taken. This chapter describes these steps and shows the results.

6.1 RESIZE DATA

The HyMap image taken from the Peyne area in 2008 is resized by cutting the area of interest from the total image (Figure 6.1). The new image is much smaller resulting in less calculation time for computer software.

Figure 6.1 Resized original 2008 HyMap image (RGB = 648 nm, 546 nm, 457 nm)

6.2 NDVI & LAI DERIVATION

With ENVI an NDVI map is created. The NDVI map shows values varying from -0.66 to 0.92. Negative values (values approaching -1) correspond to water. Values close to zero (-0.1 to 0.1) generally correspond to barren areas. Low, positive values represent shrub and grassland (approximately 0.2 to 0.4), while high values indicate dense forest (values approaching 1). Appendix C shows the NDVI map.

To calculate the LAI map field data is used. LAI values calculated by the computer program CanEye from the hemispherical photo's taken of each plot location, are used to come up with an LAI formula for the research area. The LAI values are plotted against the NDVI values (calculated from the HyMap image) of the same locations (see Figure 6.1).

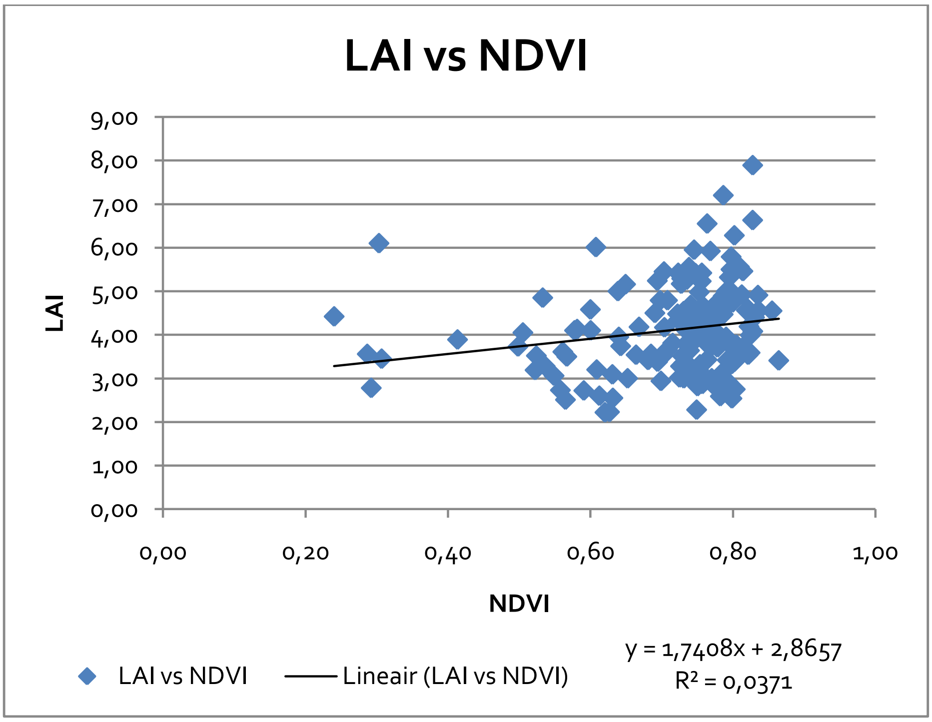


Figure 6.2 LAI field values against NDVI HyMap values

With a linear regression analysis a formula of the kind "y = ax * b" is determined. This is the same type of formula as Tabarant (2000) introduced, but now specified for the research area. The formula for the research area is:

LAI field = 1.7408 * NDVI + 2.8657 $(R^2 = 0.0371)$ (6.1)

By applying formula 6.1 to the NDVI map a LAI map is created (Appendix D). The statistics of this map are shown in table 6.1.

Lowest LAI	Highest LAI	Mean LAI	Standard deviation
1.71	4.47	3.26	0.58

Table 6.1 Resulting values of the calculated LAI map

Since the pixel size of the HyMap image is 5 by 5 meters, and the coordinates of the GPS system used in the field are in meters, the coordinates of the HyMap image for determining the NDVI values match as close as possible the corresponding plot coordinates used in the field by determining the LAI values.

6.3 OBTAINING INTERCEPTION PARAMETERS FROM REMOTE SENSING

The maximum storage capacity (*Smax*) is one of the parameters in the Aston (1979) interception formula. To improve reliability, the average of the calculated *Smax* values is adjusted to a realistic scenario for the study area by weighing the importance of different vegetation species. The importance is based on the occurrence of each species as determined in the field and is mainly based on figure 5.3.

The variation between the numbers of investigated species, resulting from field data, provides a good estimate at first hand. By applying some minor adjustments to the vegetation composition based on field observations, a realistic and weighed average *Smax* can be determined. The minor adjustments are done for the *Castanea sativa*, *Buxus sempervirens* and *Pinus pinaster* species. *Castanea sativa* has a slightly higher abundance, whereas the abundance of *Pinus pinaster* and *Buxus sempervirens* is slightly lower (see table 6.2). From table 6.2 follows that the average *Smax* value for all eight species is 22 mm.

Species	Absolute	Fraction	Revised fraction	Average *Smax*	Revised fraction * Average*Smax*
Total Qi	78	0,47	0,47	26,42	12,42
Total Qp	11	0,07	0,07	30,94	2,17
Total Qc	5	0,03	0,05	9,47	0,47
Total Au	39	0,24	0,24	18,32	4,40
Total Ea	17	0,10	0,10	7,68	0,77
Total Ca	5	0,03	0,05	30,15	1,51
Total Bu	5	0,03	0,01	15,25	0,15
Total Pi	5	0,03	0,01	10,44	0,10
Sum	**165**	**1,00**	**1,00**		**21,99**

Table 6.2 Derivation of weighed *Smax* value for eight vegetation species

The canopy cover fraction is determined by using selected end-members. The selected end-members are green vegetation, water and bare soil and are visible as the colours green, red and blue. The computed bare soil fraction (value 0–1) is one of the resulting abundance maps. Appendix E shows the C_p map.

The C_p map is necessary to determine the interception, which is calculated for all rainfall events fallen during the field campaign. Table 6.3 shows the results of the interception map for each rainfall event. The columns “Lowest I”, “Highest I”, “Mean I” and “Stdev” (standard deviation) show the values obtained directly from the interception map as calculated with the computer program ENVI and with the different parameters described earlier.

In the other columns the percentages of the rainfall which is intercepted is showed. The column "I field data (%)" is added as comparison for the highest interception and shows the interception values as calculated directly from the field data.

P (mm)	Lowest I (mm)	Highest I (mm)	Mean I (mm)	Stdev	I (% of Mean I)	I (% of Highest I)	I field data (%)
3,34	0,00	1,07	0,65	0,15	19,43	31,96	52,61
10,94	0,00	3,33	2,04	0,47	18,65	30,46	44,91
13,07	0,00	3,93	2,42	0,55	18,53	30,05	43,12
18,94	0,00	5,49	3,41	0,77	18,02	28,97	38,83
30,28	0,00	8,19	5,17	1,13	17,08	27,03	32,44
37,17	0,00	9,64	6,15	1,32	16,54	25,94	29,42
93,96	0,00	17,78	12,13	2,36	12,91	18,92	16,03
				Average	**17,31**	**27,62**	**36,77**

Table 6.3 Interception map statistics for seven rainfall events

Table 6.3 shows that the average difference between the results of the interception maps and the calculated field data interception is 9%. The difference is largest for small rainfall events and decreases for larger rainfall events.

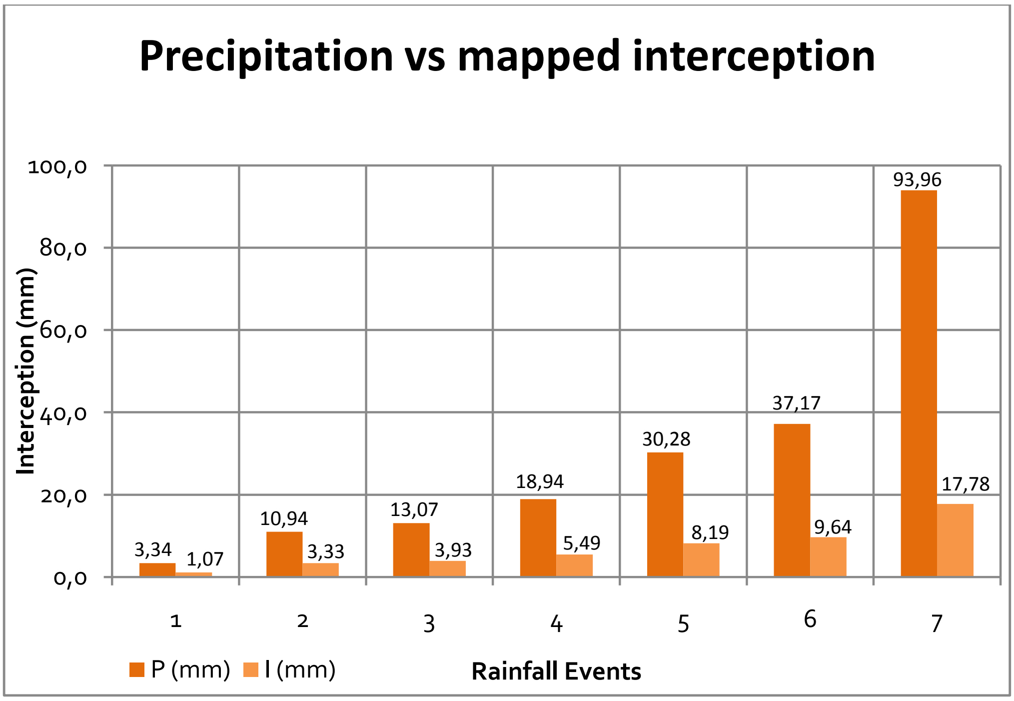


Figure 6.3 Mapped interception and total precipitation compared for seven rainfall events.

Figure 6.3 shows the maximum interception for each rainfall event in the study area. The rainfall events are sorted by smallest to largest. From this figure follows that absolute interception values increase with larger events.

However, the relative interception (%) decreases with larger rainfall events. As an example, an interception map of one of the rainfall events can be found in appendix F. On this map the lowest interception values are shown in blue and the highest values in red. The red colours can be found, as expected, in the dense forests. Since the interception values are absolute values and the interception map shows relative values (the colour scheme is stretched out over the interception values), the maps of the other rainfall events look the same, despite their difference in absolute values.

To investigate the effect of different vegetation scenarios on the interception outcome, average *Smax* values per vegetation species are used for the simulation of a homogenous coverage (i.e. assuming the study area consists only of *Quercus ilex* vegetation for example). The *Smax* values are used from table 6.2. With the data of the different vegetation species, a LAI formula is determined with linear regression analyses for each vegetation species. These formulas are shown in table 6.4.

SPECIES	FORMULA	
Qi	$LAI = 2.5687 * NDVI + 1.9937$	$(R^2 = 0.0332)$
Qp	$LAI = 3.4596 * NDVI + 2.2972$	$(R^2 = 0.0937)$
Qc	$LAI = 1.1817 * NDVI + 2.3788$	$(R^2 = 0.2309)$
Au	$LAI = 1.6012 * NDVI + 3.0149$	$(R^2 = 0.0206)$
Ea	$LAI = 3.3901 * NDVI + 2.1159$	$(R^2 = 0.1672)$
Ca	$LAI = 35.257 * NDVI - 22.993$	$(R^2 = 0.1434)$
Bu	$LAI = 1.232 * NDVI + 3.4175$	$(R^2 = 0.0831)$
Pi	$LAI = 0.5005 * NDVI + 3.2152$	$(R^2 = 0.001)$

Table 6.4 LAI formulas for the eight vegetation species

For the simulation an average rainfall event of 30 mm is used. Table 6.5 shows the results of the interception map for the different vegetation species.

	P (mm)	Lowest I (mm)	Highest I (mm)	Mean I (mm)	Stdev	I (% of Mean I)	I (% of highest I)
Average	30	0,00	8,12	5,13	1,12	17,10	27,08
Qi	30	0,00	8,12	4,21	1,38	14,03	27,05
Qp	30	0,00	10,08	5,00	1,81	16,68	33,58
Qc	30	0,00	5,48	3,70	0,73	12,33	18,28
Au	30	0,00	7,88	5,15	1,06	17,15	26,26
Ea	30	0,00	6,38	3,57	1,02	11,91	21,26
Ca	30	0,00	14,25	1,49	3,00	4,96	47,49
Bu	30	0,00	7,65	5,36	1,01	17,86	25,51
Pi	30	0,00	5,95	4,52	0,81	15,08	19,84
		Average	**8,22**	**4,12**		**13,75**	**27,41**

Table 6.5 Interception values for the eight vegetation species

Figure 6.4 shows the maximum amount of interception for each vegetation species with a rainfall event of 30 mm. In general, shrub species have lower interception values compared to tree species as *Castanea sativa* or *Quercus pubescens*.

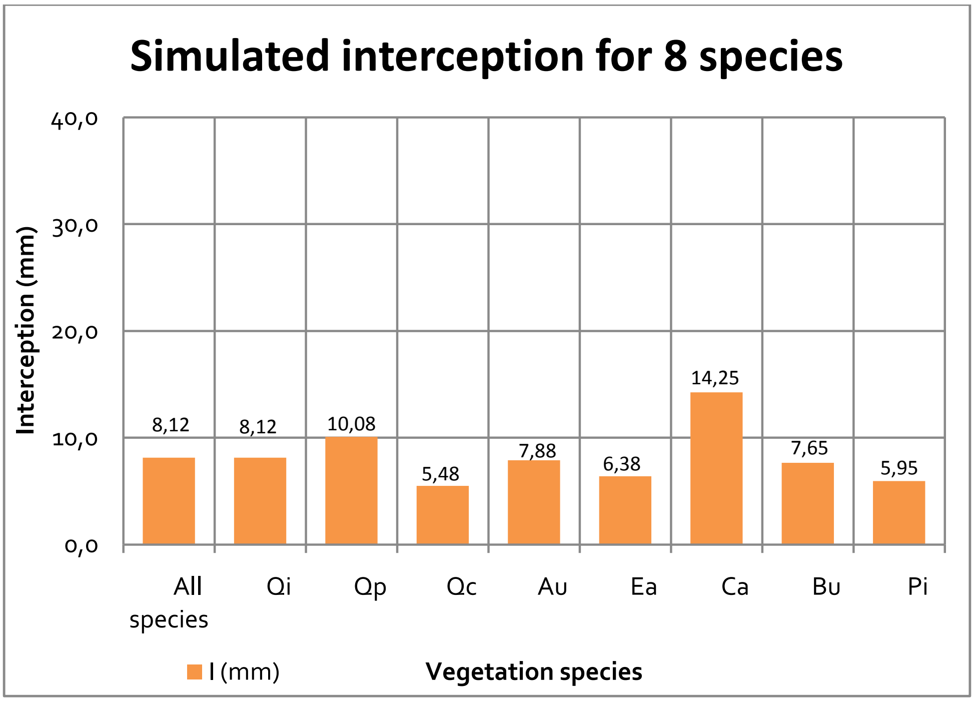


Figure 6.4 Maximum amount of interception for all vegetation species together and for the eight different species separately, with a rainfall event of 30 mm.

If the vegetation in the study area would consist only of *Castanea sativa*, highest interception values would be highest with 47%. If the vegetation would exist of *Quercus coccifera*, highest interception values would be lowest with 18%.

As an example, the interception map for one of the vegetation species can be found in appendix G. Again, since the interception values are absolute values and the interception map shows relative values (the colour scheme is stretched out over the interception values), the maps of the other vegetation species look the same, despite their difference in absolute values.

To summarize, mapped interception gives a good estimation when comparing to field based calculated interception values. Best results were found for average rainfall events, small rainfall events showed largest differences. When looking at different vegetation scenarios, an area covered with only *Castanea sativa* vegetation showed significant larger interception compared to an area only covered with bush like species. When knowing *Smax* values and other vegetation characteristics for different species, different interception losses can be found using remote sensing images to map interception.

DISCUSSION

DISCUSSION

The aim of this study project was to improve existing methods to create a quantitative rainfall interception map, using remote sensing images combined with field data. The methods used to obtain this interception map are based on previous study done by De Jong & Jetten (2007). Their study focused especially on finding the best method to quantitatively map interception using earth observation images. This study project focused on finding different interception values for different species and to use that information to create a large scale interception map. Interception was measured and calculated for seven different vegetation species and for different rainfall events during a two month period. The measured interception values were used to validate the calculated interception values. The results showed that for some species and rainfall events, calculated interception is in accordance with what was measured in the field. Only for the *Buxus sempervirens* and *Erica arborea* species, measured interception was much higher compared to the calculated interception. Large differences also occurred for the 94 mm rainfall events. These differences can be explained by the properties of the interception plots. The plots for *Buxus sempervirens* and *Erica arborea* were strongly affected by other vegetation and may have received extra water from overhanging canopy, thereby measuring extra funnel precipitation. This resulted in much higher interception values than expected. The *Pinus pinaster* plot showed large measurement errors, with negative interception values for three events. The measured interception was therefore not reliable for comparison with calculated interception for *Pinus pinaster*. The other interception plots were more suitable and approached ideal circumstances, meaning less interference from understorey and overhanging vegetation and generally homogenous vegetation around and in the plots. Measurement uncertainties were caused by moved gauges, gauges that suffered strongly from precipitation funneling and the number of rainfall gauges used.

A number of six rainfall gauges per plot, which were carefully distributed under the canopy to obtain most reliable results, was used in this study. This number was chosen because of practical reasons. Due to transport limitations it was not possible to bring enough gauges to the study area. Therefore water bottles of the same branch and with the same dimensions were used as rainfall gauges.

The measurement errors that occurred during the different rainfall events show that six rainfall gauges per plot is not sufficient. Other studies confirm this and advise 30 to 40 rainfall gauges per plot (Robinson & Ward, 2000). More rainfall gauges results in better measurements, because errors can be minimized by averaging.

Normal relative interception values for most vegetation species vary between 25 and 35% (Augusto et al., 2001). The average interception for seven species in this study was 40%, which is higher compared to other species. Especially the *Buxus semptervirens* had a very unrealistic relative interception of almost 70%. The limited number of rainfall gauges per plot location may have caused this overestimation.

Measuring interception is based on subtracting throughfall and stemflow from gross precipitation. Due to practical reasons it was not possible to measure stemflow. Besides this, stemflow on average only accounts for less than 5% from the gross rainfall. Therefore stemflow was left out of interception calculations. Nevertheless, stemflow is still a contributor in interception calculations and should always be taken into account if possible.

Field experiments yielded *Smax* and LAI values and formed the basic input data to calculate interception at tree scale. When calculating *Smax* and LAI for single branches, parameters as the number of leaf layers and the leaf cover were estimated in the field. Estimating parameters always introduces a certain level of uncertainty to the calculations based on those parameters. Uncertainties were especially caused by the determination of the LAI for branches, because leaf cover and the number of leaf layers were difficult to estimate.

Compared with other studies, the measured and calculated *Smax* values for some species are overestimated. In this study, *Smax* values of 80 mm were found, were normal *Smax* values found in literature are generally not higher than 6 mm (Gomez et al., 2001). This is caused by the measurement method used and by estimation of parameters such as leaf layers and leaf cover. For measuring the *Smax* in the field, branches were cut off and weighted. With a watering can they are wetted and weighted again. The branches were made soaking wet, to reach the maximum storage capacity. The high intensity of rainfall and the total amount of rain simulated by use of the watering can, seems to generate unnatural situations which cause the overestimation of the average *Smax*. The moment of weighing the wet braches is another cause. When still dripping the branches were weighted, which indicates that they can’t hold all the water yet. There is no equilibrium and one measures more weight (water) than the amount which can be hold against gravity during equilibrium, which is the *Smax*.

To keep the uncertainty as low as possible, consistent measurement techniques were used and estimating parameters was done by two persons. The biggest challenge was the up scaling of the *Smax* from branch to tree, which also introduces uncertainty.

To minimize data loss a linear up scaling was used, meaning that the *Smax* per branch was multiplied by the total number of branches. The largest uncertainty here was the number of branches, which was counted in the field.

Since *Smax* is an important parameter in the Aston interception equation, more study was required on finding LAI – *Smax* relationships for single vegetation species. These LAI – *Smax* relationships are necessary to obtain a more specified interception map. Previous study done by Aston (1979), Gomez et al. (2001) and Van Dijk & Bruijnzeel (2001), showed already that the *Smax* – LAI relationships differ for different types of vegetation. However, different *Smax* and LAI were obtained with different techniques and experiments were performed under different meteorological circumstances (resulting in different evapotranspiration that affects interception). The results of this study project showed that different relationships for different vegetation species can indeed be found. The experiments were carried out using consistent measuring methods and were performed under generally stable weather conditions. Plot locations selection was hampered by practical issues but were selected as random as possible.

The LAI – *Smax* relationships were determined for eight different vegetation species. The number of trees investigated per species showed large variation however. This large variation is caused by the occurrence of species in the study area. *Quercus ilex* and *Arbutus unedo* are strongly abundant whereas species such as *Pinus pinaster* or *Quercus coccifera* are much less abundant. The variation in species abundance was also caused by the vegetation quality. *Buxus sempervirens* and *Castanea sativa* suffered from plant diseases that affected the number and strength of leaves, making them unreliable for optimal measurements. The coefficients of the LAI – *Smax* relationships found in this study for the *Quercus ilex*, *Arbutus unedo*, *Quercus pubescens*, *Castanea sativa* and *Buxus sempervirens* are high compared to the coefficients found in literature; for conifers, eucalypt trees and olive trees, the coefficient varies between 0.17 and 0.49 (Gomez et al., 2001). The coefficients in this study vary between 0.21 and 0.83, with lowest coefficients for *Erica arborea* and *Pinus pinaster*. The relative high coefficients in this study are a result of an overestimation of *Smax* values in the field. An accurate estimation of the *Smax* in the field is therefore required for optimal LAI – *Smax* relationship fitting.

The influence of the variation of the number of investigated trees is found in the strength of the *Smax* – LAI relations for the different species. The strength of the LAI – *Smax* relationship for a particular species decreases when the number of samples for a species increases.

Another reason for the difference in strength is possibly the overhanging and understorey vegetation, which affects the LAI calculation from the hemispherical photographs. Although most disturbing factors on the photographs can be cleared out using specialized software, masking out unwanted vegetation remains difficult. This effect is mostly visible for *Quercus ilex*, *Arbutus unedo* and *Erica arborea,* were relationships for LAI – *Smax* are weakest and the amount of investigated trees is highest.

The use of remote sensing images to create an interception map with absolute interception losses is most reliable when it is used in combination with field data. Because different areas have specific vegetation properties, local field measurements like *Smax* and LAI remain necessary to provide reliable data input. Although vegetation composition might be similar for different areas, local variations in understorey vegetation can cause differences in the amount of interception for different areas. Field data also remains necessary to minimize mapping uncertainties and generalization of the final interception map.

The formula used for calculating LAI values from the HyMap image, is based on field data of the research area. The LAI map is used to calculate the *k* value in the interception formula which is used for the interception map. The R-squared of the LAI formula is relatively low (0.0371), because there is not a clear relation between the LAI and NDVI values (see Figure 6.2). If the calculated LAI values of the HyMap image were compared for each plot location with the LAI values measured in the field, a difference would occur. When taking into account the total study area however, it is still better to use the formula because it is based on field data.

The LAI formulas are determined with data of the different vegetation species and by linear regression analyses for each vegetation species. These formulas (Table 6.4) show in some cases very high coefficients, with the formula of the *Castanea satival* as example. This is caused by undersampling of these vegetation species. To improve these relationships, more samples are required.

A vegetation classification map could provide an easy solution to link *Smax* to different species on larger scales. The unsupervised classification map that was created for the Peyne area was not suitable for vegetation classification.

The map was created in advance of the field work, to give a first impression of the vegetation distribution in the area. After carrying out the field work however, it appears that the unsupervised classification map does not give a realistic representation of the distribution of the vegetation species in the study area. Further investigation on creating a classified vegetation map from the HyMap image is therefore necessary. This can possibly be done by performing a supervised classification, but the large abundance of mixed forests in the Peyne area and the overhanging and understorey vegetation can cause problems in doing so.

A solution to the absence of a proper classification map was found in averaging the *Smax* values for the eight investigated species. The average is a weight based on the abundance of the different vegetation species in the study area. This abundance is an estimate based on field observations. A better estimate is necessary to improve the average weight. This average weight is good when information about the distribution of different species in the area is known, but remains an estimate because it is applied on a large scale. A classified vegetation species map would however provide the ideal information link between *Smax*, LAI and interception.

Averaging the *Smax* values shows however good results for the final interception loss map, when looking at differences between interception values for dense forests and shrub or barren areas. When comparing the interception values from the interception map and the predicted values, minimum and maximum difference are 0.4 % and 14.4 %. The average difference is 4.6%.

By simulating homogeneous vegetation patterns for the Peyne areas, the influence of the vegetation species on the overall interception is investigated. Results showed that indeed differences occurred for different species, but species with higher *Smax* values did not result in higher absolute interception values for a 30 mm rainfall event. These results are useful to show that when knowing the absolute interception value of a certain vegetation species, height and the vegetation volume remain important.

It is important to note that for the mapping of interception using remote sensing images, only a 2-dimensional HyMap image is used for interception calculations, whereas 3-dimensional vegetation properties are of great importance regarding interception (Pradal et al., 2008). This dimension difference can only be masked out if strong relationships exist between the earth observation images and field data (i.e. the LAI – *Smax* relationship). When these relationships are not strong, 3-dimensional vegetation mapping could become useful for interception mapping.

For interception measurements, the following recommendations can be made to reduce measurement uncertainties and to improve measurement quality:

Rainfall gauges should be placed in a homogenous forest to prevent measurement interference by other species.

The plot location for rainfall gauges must be free of understorey vegetation to prevent interference by shrub vegetation. This is necessary, because otherwise a clear distinguish between the different vegetation species and their related properties cannot be made.

The following recommendations for image analysis and interception mapping can be made:

A good classified vegetation map can be useful for interception mapping. More study on obtaining a reliable vegetation classification map is therefore required. When mixed forests are abundant in a specific area, it could be useful to perform a classification based not only based on single species but also a composition of species composition for a particular forest. For the Peyne area this could be done for a *Quercus ilex, Arbutus unedo* and *Erica arborea* forest for example.

A 3-dimensional canopy model can help improve the interception map quality when field data and remote sensing image lack a strong relationship. Further research on linking earth observation images and 3-dimensional canopy models is therefore useful.

For more realistic LAI – *Smax* relationships, more samples are required for most species investigated in this study. More research on local LAI – *Smax* relationships for different species is required.

CONCLUSIONS

CONCLUSIONS

In this study, field work data and earth observation images are combined to obtain a detailed quantitative interception map. It is important to determine interception as accurately as possible because interception is an important variable in both small and larger scale hydrological cycles and models. Different interception models exist and are applied in many different forms according to purpose and use. For this study project, the analytical Aston interception model is used to calculate interception for different rainfall events and vegetation species. This interception model is combined with field observations and HyMap remote sensing images to construct an interception map of the Peyne area. The parameters required for the Aston interception formula, *Smax* and canopy cover fraction, are derived from field experiments. Remote sensing images were used to derive LAI and fractional coverage to produce spatial interception maps.

Emphasis was put on the differences of storage capacity (*Smax*) between different vegetation species, leading to different interception losses and finding unique *Smax* - LAI relations for different species. These relations provided the missing link between field data and remote sensing images.

For seven investigated vegetation species, interception losses were derived during field experiments by measuring throughfall. With an average relative interception of 40% for all seven species, the interception is overestimated because of a limited number of rainfall gauges and a poor plot quality of the *Buxus sempervirens*. Using data from the same rainfall events, interception losses were also calculated using the Aston interception formula. Both interception values were compared for seven species. For *Quercus ilex*, *Arbutus unedo*, *Pinus pinaster*, *Castanea sativa* and *Quercus coccifera* the average difference was 4.5% between interception, measured in the field, and calculated interception from branches and LAI photograph. *Buxus sempervirens* and *Erica arborea* showed large differences, most probably caused by interference of other vegetation on the measurements. However, some species had only few observations, making them less reliable for statistical analysis. Because the difference in measured interception and the calculated interception from branches is small for most species, the Aston interception formula can provide a good prediction on interception losses for this study area and is therefore applicable to create an interception map.

When the different interception losses between the seven investigated species are considered, a division is made between trees and shrubs. For trees higher interception values are found than for shrubs. Looking at specific tree species, interception values also show quite some variation.

The deciduous and evergreen species have higher relative interception values compared to pine species. For shrubs, variation is also found between species, where *Quercus coccifera* and *Erica arborea* have low interception values compared to the *Buxus sempervirens* species. The interception values of the *Buxus sempervirens* are overestimated however, due to measurement errors.

These results show that for the studied vegetation species, different interception are measured. Therefore, the degree of vegetation species heterogeneity is important when mapping interception on large scales.

Interception values do not only vary per vegetation species, interception values also depend on the rainfall event characteristics causing different interception losses for different events. In general, for all species higher relative interception percentages are found for smaller rainfall events and lower interception values coincide with larger rainfall events. Sources of uncertainty in the field experiments, are the location of the rainfall gauges, preferential throughfall caused by canopy structure and neglecting stemflow in the interception calculation.

The *Smax* – LAI relationship provides the necessary link between field data and remote sensing images. Because LAI can be derived from earth observation images, it supports the interception model with vegetation information on a large scale. A classified vegetation map could be a useful source of information, but could not be constructed for this study. By determining, *Smax* – LAI relationships for different species from field data, *Smax* values and thus interception losses can be calculated from remote sensing images.

The applied measurement methods to determine the *Smax* of single branches are easy to carry out but result in an overestimation of the *Smax* values. When branch parameters, such as leaf layers and leaf cover, can be determined more accurately in the field, this method can result in a more realistic estimation of *Smax* values. For the throughfall measurements, 6 gauges per plot location were used. In order to improve these measurements, more gauges are required for statistically better measurements.

For eight vegetation species LAI – *Smax* relationships were found, though the strength of these relationships varied between species. The *Castanea sativa, Pinus pinaster, Quercus coccifera* and *Quercus pubescens* had a strong relationship between LAI and *Smax* but these species were undersampled. For *Quercus ilex, Arbutus unedo* and *Erica arborea* a weak correlation was found and only trends were noted.

The LAI - *Smax* relationships where then used to convert spatial LAI information from remote sensing images and used it for mapping interception. Mapping interception resulted in reliable interception values when comparing these with the earlier calculated interception values (difference of 9%). Interception losses appeared to be relatively largest for small rainfall events and small for larger rainfall events. Differences between mapped and calculated interception were highest for small rainfall events and proved to be most reliable for moderate rainfall events. When looking at mapped interception when for single species only, interception is highest for large species such as *Castanea sativa* and *Quercus pubescens* and smallest for bush like vegetation species as *Erica arborea* and *Buxus sempervirens*. Uncertainties for image analysis and interception mapping were the relation between NDVI and LAI, and difficulties with classifying different species in remote sensing images.

In conclusion, mapping interception using remote sensing images provides mixed results. The quality of the results depends strongly on the rainfall characteristics. *Smax* values are overestimated in the field, resulting in high interception values for the seven investigated species when comparing them to other Mediterranean species. The overestimation of *Smax* values also resulted in relative high coefficients in the LAI – *Smax* relationships. Vegetation species have an influence on the total amount of interception, where larger vegetation species have higher interception losses compared to shrub like vegetation. *Smax* and LAI relations for different species are found but these relations vary strongly in strength and reliability. Because no strong relations are found for all species and no classified vegetation map is obtained, field data remains required for optimal interception mapping.

When strong *Smax* – LAI relations are found for different species and a classified vegetation species map can be constructed, the use of field data would no longer be necessary. More study is therefore required on deriving a classified vegetation species map from remote sensing images. In combination with 3-dimensional canopy models this classified vegetation map could result in improved large scale quantitative interception mapping.

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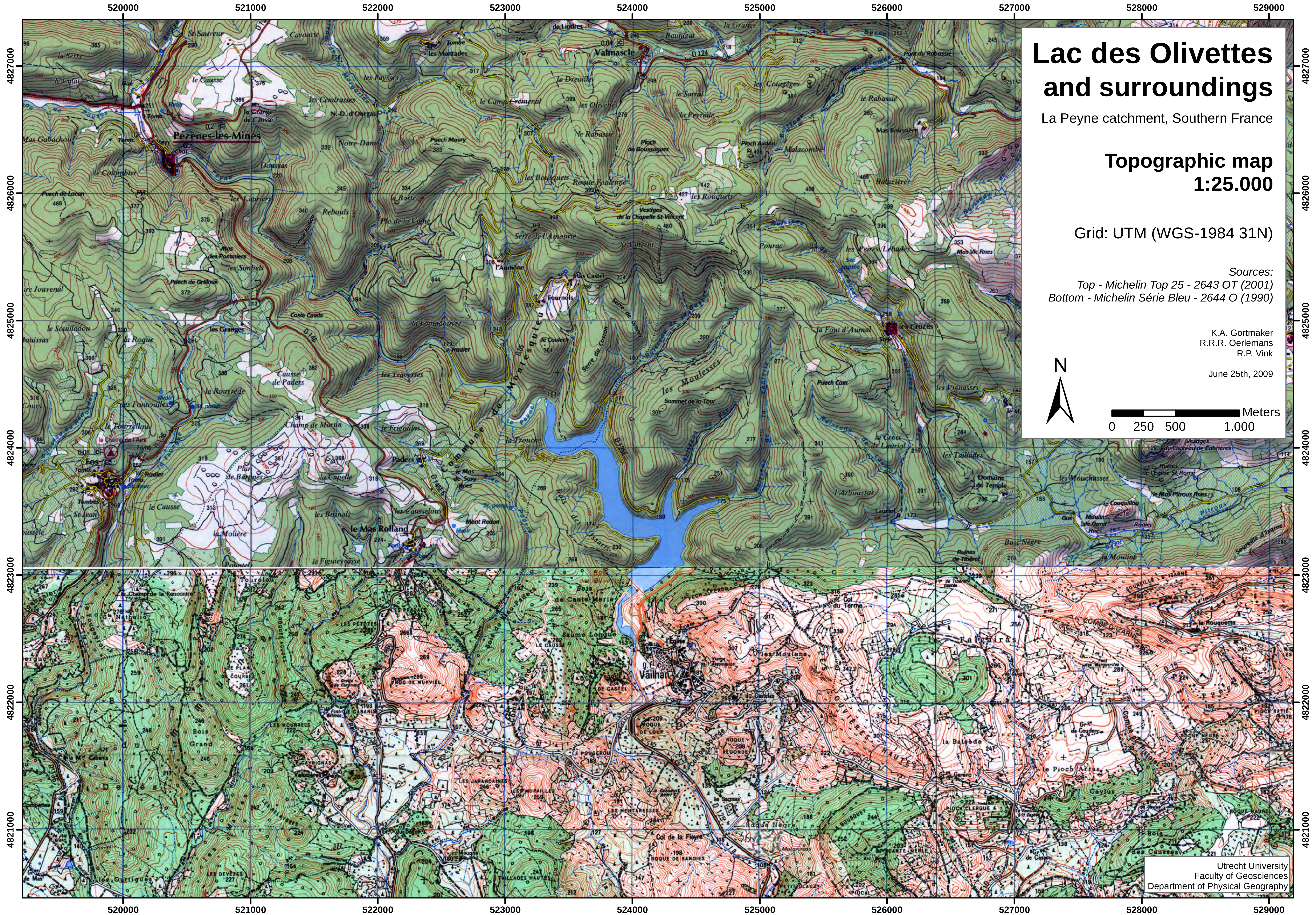


Lac des Olivettes and surroundings

La Peyne catchment, Southern France

Topographic map
1:25.000

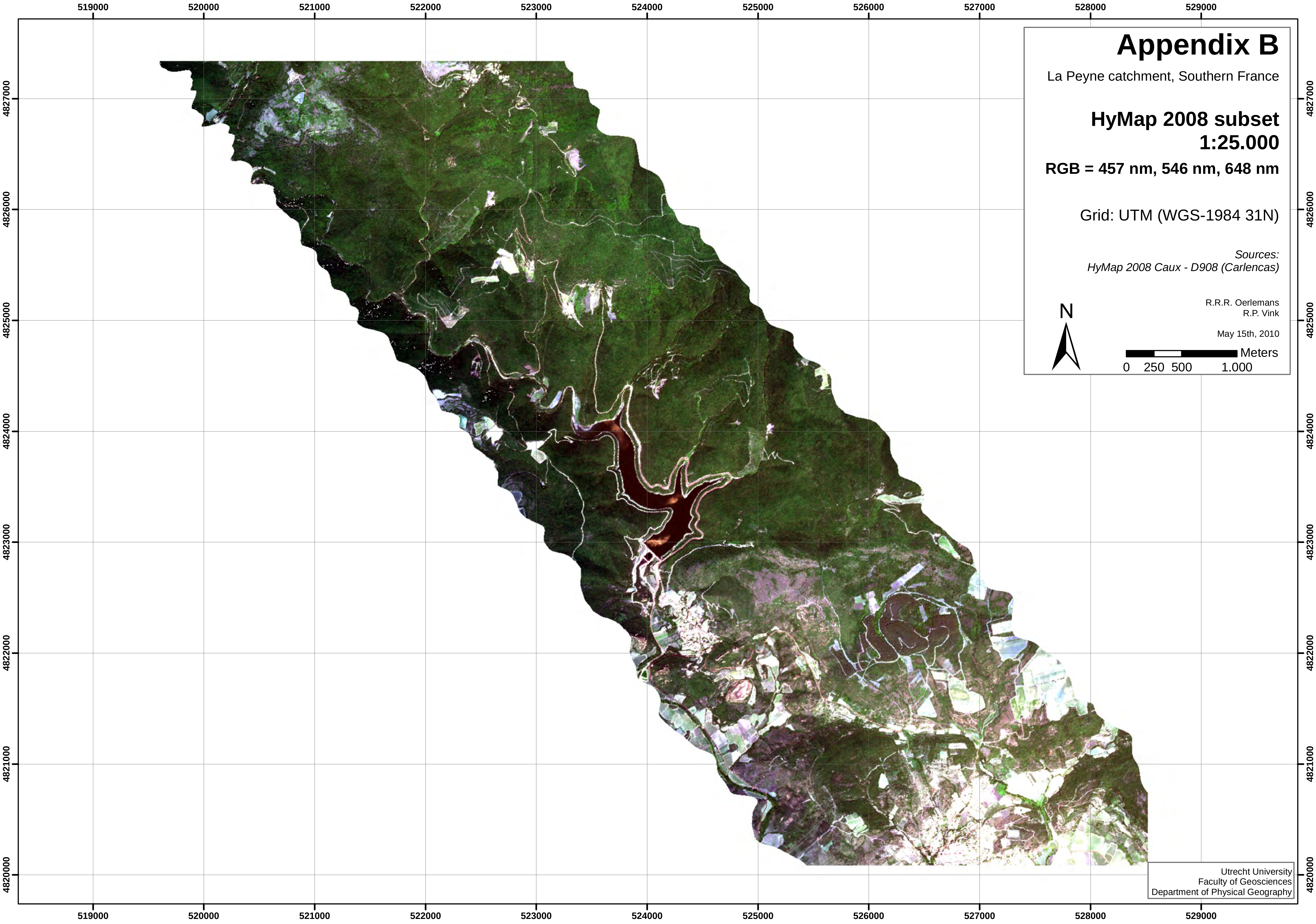
Grid: UTM (WGS-1984 31N)

Sources:
Top - Michelin Top 25 - 2643 OT (2001)
Bottom - Michelin Série Bleu - 2644 O (1990)

K.A. Gortmaker
R.R.R. Oerlemans
R.P. Vink

June 25th, 2009

Utrecht University
Faculty of Geosciences
Department of Physical Geography



Appendix B

La Peyne catchment, Southern France

HyMap 2008 subset
1:25.000

RGB = 457 nm, 546 nm, 648 nm

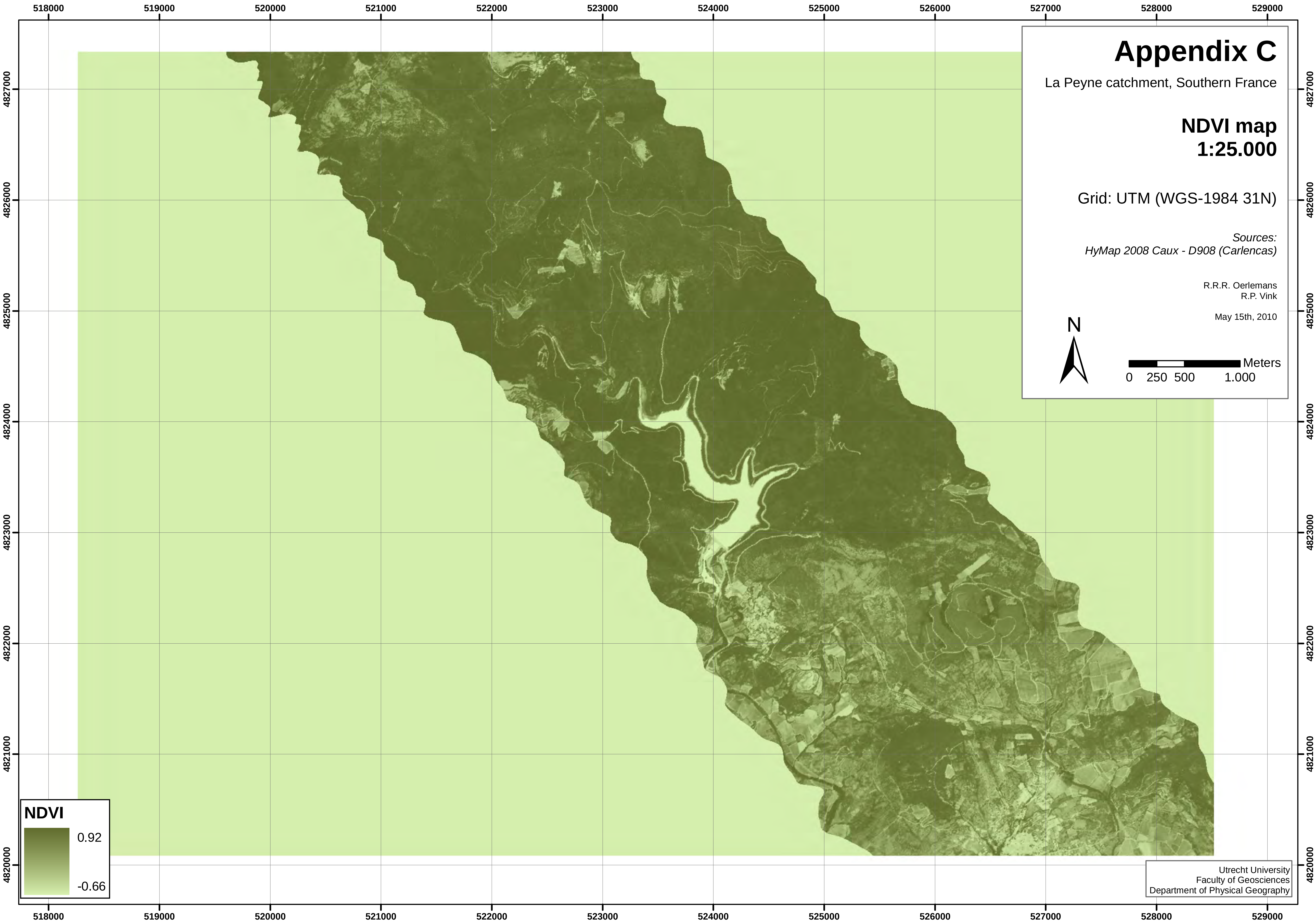
Grid: UTM (WGS-1984 31N)

Sources:
HyMap 2008 Caux - D908 (Carlencas)

R.R.R. Oerlemans
R.P. Vink

May 15th, 2010

Utrecht University
Faculty of Geosciences
Department of Physical Geography



Appendix C

La Peyne catchment, Southern France

NDVI map
1:25.000

Grid: UTM (WGS-1984 31N)

Sources:
HyMap 2008 Caux - D908 (Carlencas)

R.R.R. Oerlemans
R.P. Vink

May 15th, 2010

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Faculty of Geosciences
Department of Physical Geography

Appendix D

La Peyne catchment, Southern France

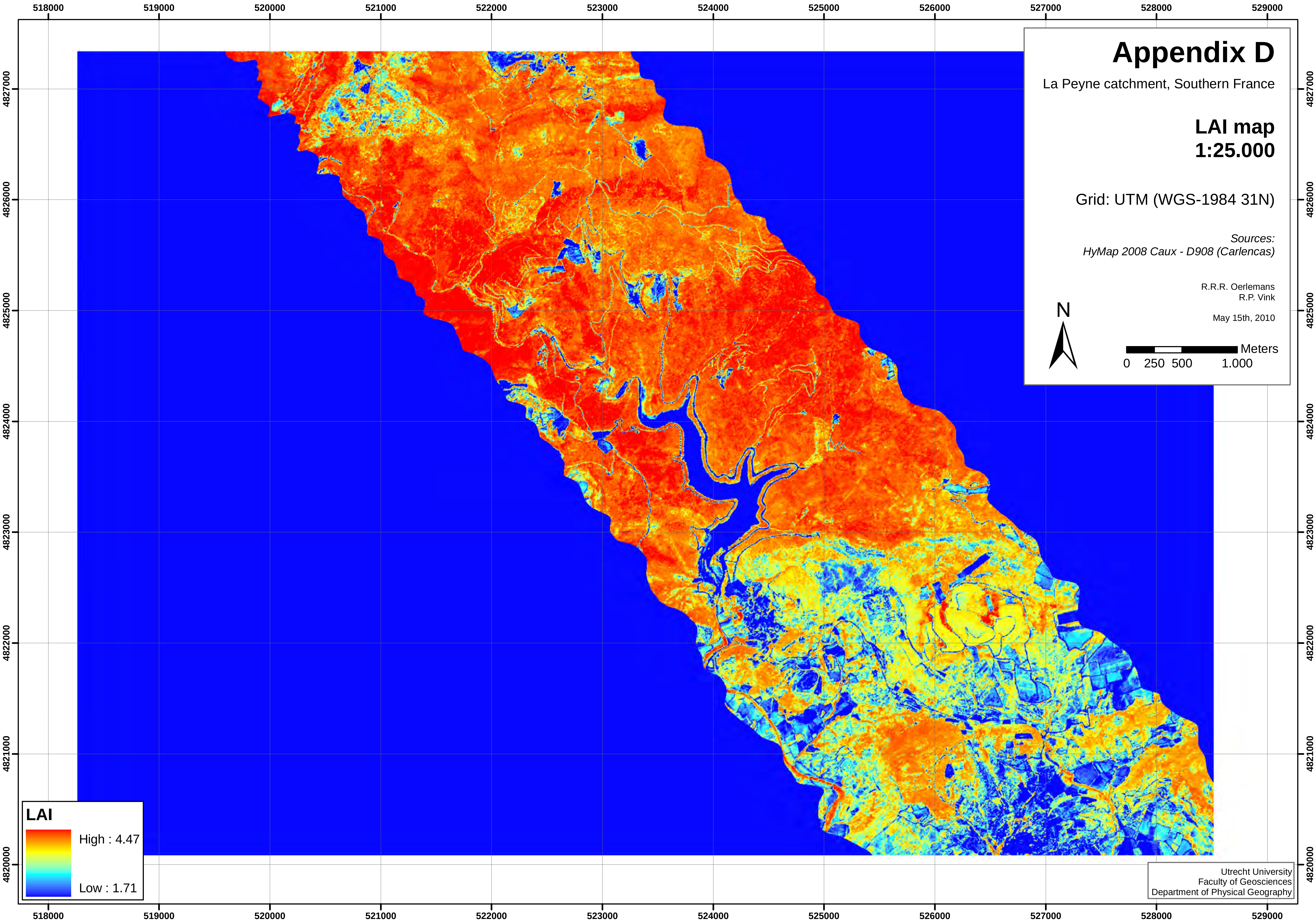
LAI map
1:25.000

Grid: UTM (WGS-1984 31N)

Sources:
HyMap 2008 Caux - D908 (Carlencas)

R.R.R. Oerlemans
R.P. Vink

May 15th, 2010



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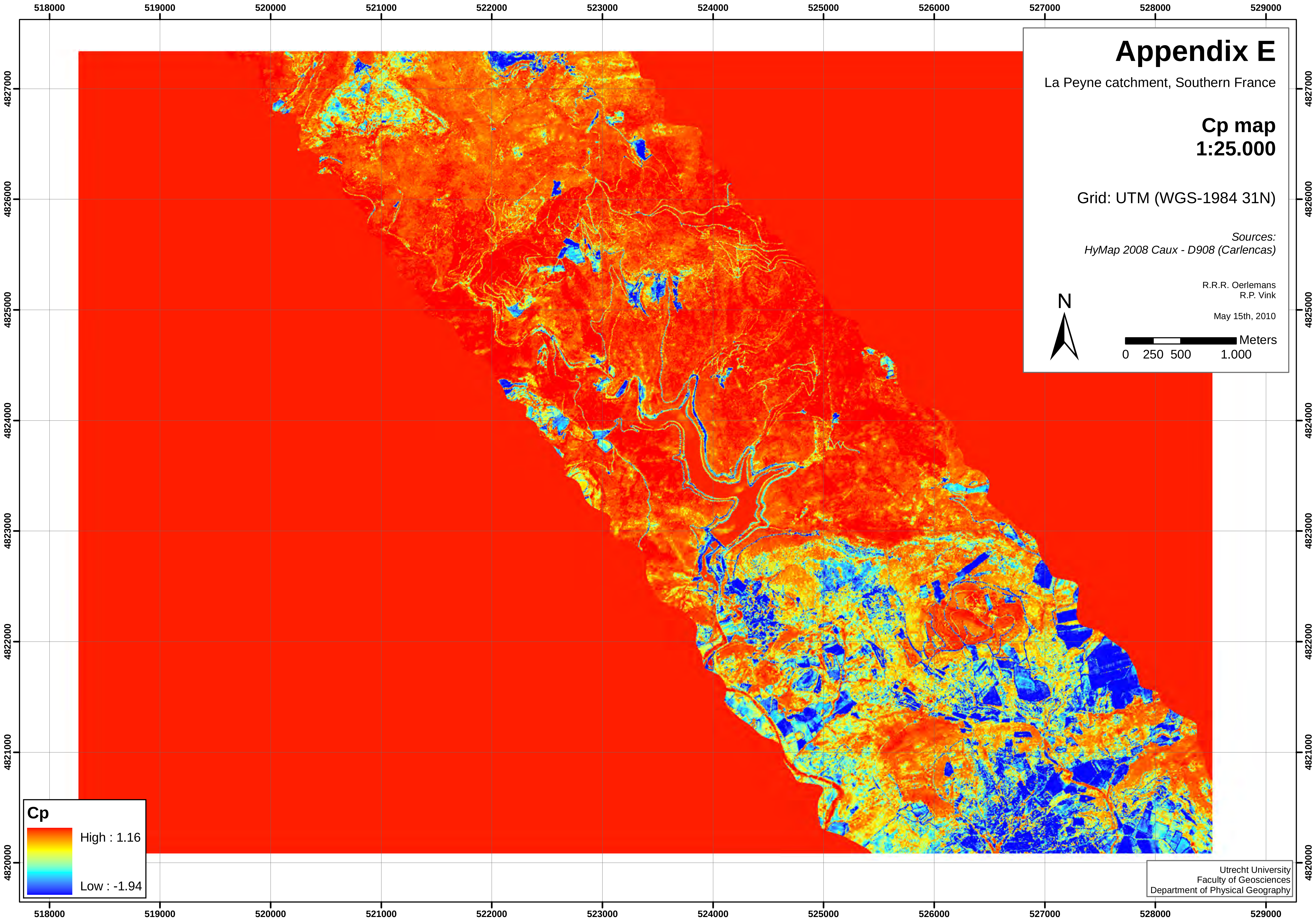
Appendix E


La Peyne catchment, Southern France
Cp map
1:25.000
Grid: UTM (WGS-1984 31N)
Sources:
HyMap 2008 Caux - D908 (Carlencas)
R.R.R. Oerlemans
R.P. Vink
May 15th, 2010
N
Meters
0
250
500
1.000
Cp
High : 1.16
Low : -1.94
Utrecht University
Faculty of Geosciences
Department of Physical Geography
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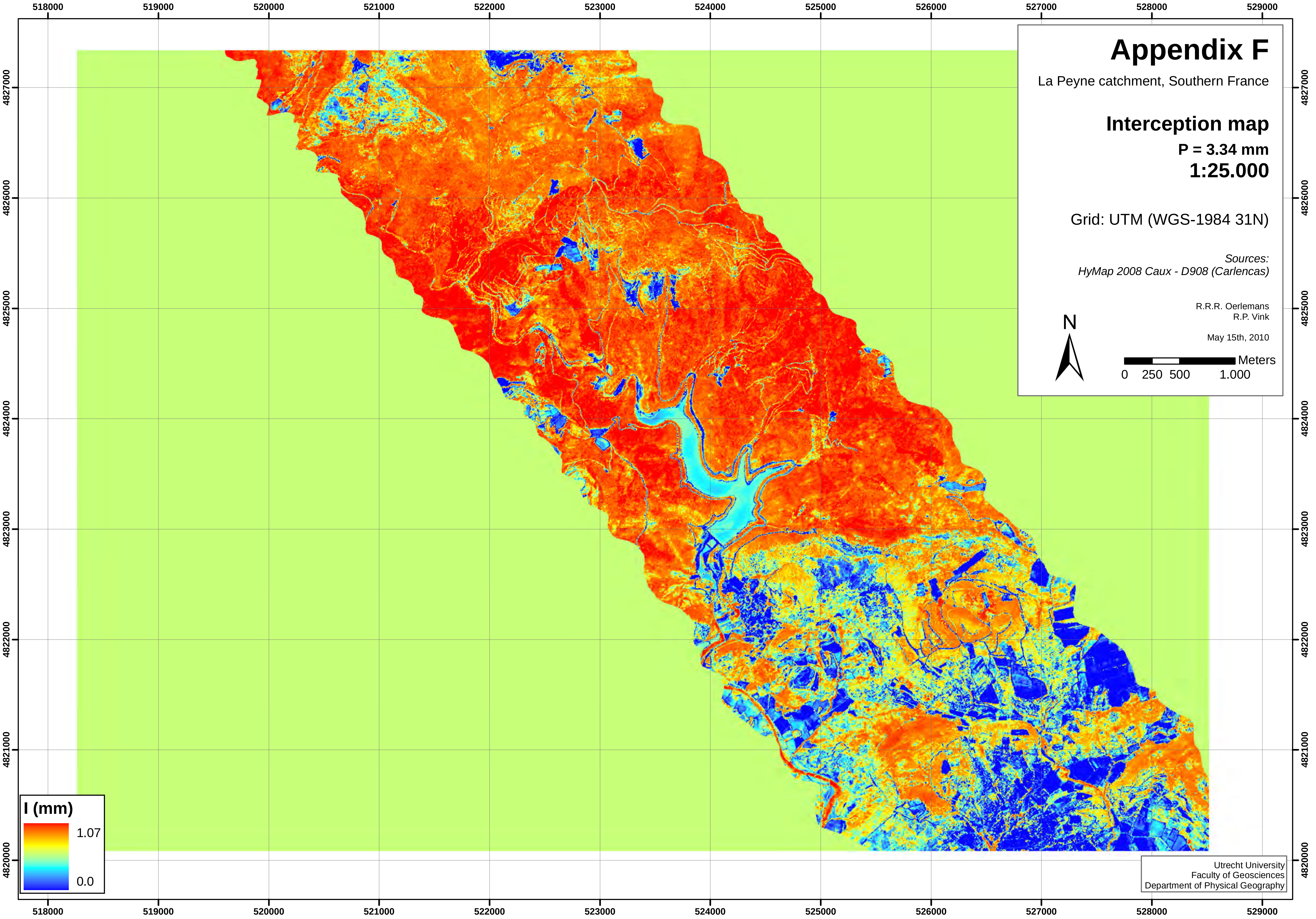
Appendix F

La Peyne catchment, Southern France

Interception map

P = 3.34 mm

1:25.000



Grid: UTM (WGS-1984 31N)

Sources:
HyMap 2008 Caux - D908 (Carlencas)

R.R.R. Oerlemans
R.P. Vink

May 15th, 2010

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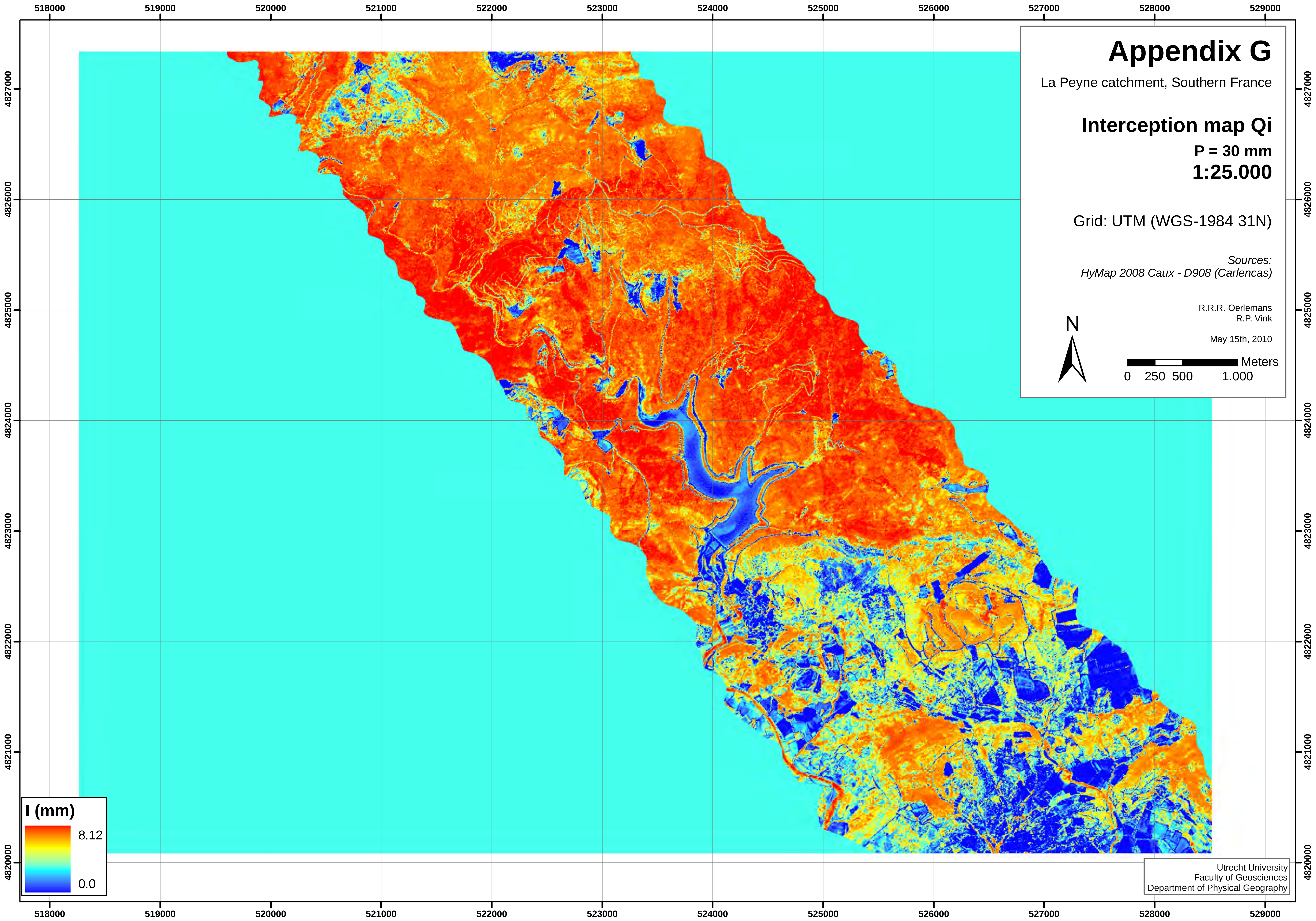

Appendix G

La Peyne catchment, Southern France

Interception map Qi

P = 30 mm

1:25.000

Grid: UTM (WGS-1984 31N)

Sources:
HyMap 2008 Caux - D908 (Carlencas)

R.R.R. Oerlemans
R.P. Vink

May 15th, 2010

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Field Data Branch Scale

Plot	*Date*	*Meteo*	*X*	*Y*	*Fish nr.*	*Veg*	*Br. Nr*	*L (m)*	*L_G (m)*	*W (m)*	*W_G (m)*	*Layers*	*S (m2)*	*Dry(g)*	*W (g)*	*D (g)*	*Pct*	*COV*	*Smax*	*LAI*	*Remarks*
002	04-09-09	LC-WA	0527475	4821262	2540	Qi	120	0,82		0,35			0,14	90	110	20	0,18	0,10	0,00	1,44	Steep slope facing east
					2541	Qi		1,14		0,74			0,42	480	550	70	0,13	0,35	0,17	1,21	heterogeneous forest
						Qi		1,04		0,89			0,46	960	1210	250	0,21	0,65	0,54	0,71	garrigue and maquis combined
003	04-09-09	LC-WA	0526933	4821095	2536	Qi	70	0,98		0,89			0,44	600	690	90	0,13	0,35	0,21	1,25	Homogeneous Qi forest
					2537	Qi		1,25		0,63			0,39	880	1030	150	0,15	0,55	0,38	0,72	slope facing east-south
						Qi		1,15		0,60			0,35	420	490	70	0,14	0,10	0,20	3,45	
						Qi		1,12		0,70			0,39	500	610	110	0,18	0,25	0,28	1,57	
						Qi		1,37		0,86			0,59	740	850	110	0,13	0,25	0,19	2,36	
090	04-09-09	BR-HO	0524463	4823976	2542	Qi	25	0,89		0,69			0,31	170	230	60	0,26	0,25	0,20	1,23	Steep slope facing east
					2543	Qi		1,47		1,31			0,96	970	1190	220	0,18	0,35	0,23	2,75	strong wind
						Qi		1,50		0,78			0,59	1040	1330	290	0,22	0,75	0,50	0,78	
163	07-09-09	BR-WA	0521100	4825865	2544	Bu	24	1,25		0,91			0,57	110	150	40	0,27	0,15	0,07	3,79	Mixed deciduous forest
					2545	Bu		1,22		0,69			0,42	150	190	40	0,21	0,25	0,10	1,68	Buxus Quercus Ilex
						Bu		1,53		0,89			0,68	190	250	60	0,24	0,20	0,09	3,40	Slopem facing north east
						Bu		1,32		0,89			0,59	110	150	40	0,27	0,10	0,07	5,87	LAI influenced by Quercus Ilex
						Bu		1,56		0,76			0,59	190	260	70	0,27	0,20	0,12	2,96	
165	07-09-09	BR-WA	0520675	4826121	2546	Qi	60	0,94		0,38			0,18	100	140	40	0,29	0,10	0,22	1,79	Mixed deciduous forest
					2547	Qi		1,34		0,58			0,39	510	620	110	0,18	0,40	0,28	0,97	Quercus / Buxus Mixed
						Qi		1,17		0,89			0,52	530	620	90	0,15	0,45	0,17	0,86	Steep slope facing north-east
166	07-09-09	BR-HO	0522882	4823859	2548	Qi	28	1,08		0,35			0,19	210	240	30	0,13	0,15	0,16	0,79	Mixed Forest
					2549	Qi		0,86		0,71			0,31	510	680	170	0,25	0,80	0,56	2,62	Quercus ilex / Erica Arborea
						Qi		0,84		0,73			0,31	410	500	90	0,18	0,85	0,29	2,77	Slope facing east
053	07-09-09	BR-HO	0522859	4823804	2550	Qi	42	1,05		0,73			0,38	710	930	220	0,24	0,75	0,57	1,96	Homogeneous Qi forest
					2551	Qi		1,06		0,49			0,26	220	330	110	0,33	0,35	0,42	1,35	
						Qi		0,67		0,41			0,14	210	350	140	0,40	0,45	1,02	3,28	
						Qi		1,50		0,94			0,71	630	750	120	0,16	0,20	0,17	0,28	
015	11-09-09	BR-WA	0526092	4822323	2552	Ca	75	1,04		1,03			0,54	140	210	70	0,33	0,70	0,13	1,31	Castanea forest
					2553	Ca		1,22		0,98			0,60	330	400	70	0,18	0,65	0,12	1,09	Lots of dead wood
						Ca		1,02		0,72			0,37	120	160	40	0,25	0,50	0,11	1,36	Varying tree age
						Ca		1,07		1,31			0,70	420	580	160	0,28	0,95	0,23	1,36	
013	11-09-09	BR-HO	0526194	4822017	2554	Pi	20	0,94		0,76			0,36	420	520	100	0,19	0,25	0,28	0,70	Homogeneous Pine forest

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					2555	Pi		1,16		0,54			0,31	330	360	30	0,08	0,10	0,10	0,32	Some shrubs
						Pi		1,35		0,84			0,57	450	520	70	0,13	0,15	0,12	0,26	
						Pi		1,18		1,11			0,65	900	1100	200	0,18	0,30	0,31	0,46	
011	11-09-09	SC-HO	0526103	4821910	2558	Qc	50	0,74		0,53			0,20	230	310	80	0,26	0,45	0,41	2,29	Small short Shrubs
					2559	Qc		0,78		0,62			0,24	410	500	90	0,18	0,50	0,37	2,07	Mostly Qc
						Qc		0,77		0,49			0,19	180	240	60	0,25	0,45	0,32	2,39	Some Pi
012	11-09-09	SC-HO	0526273	4822156	2560	Pi	30	0,97		0,88			0,43	380	450	70	0,16	0,25	0,16	0,59	Pi forest, some shrubs
					2561	Pi		1,03		0,57			0,29	210	250	40	0,16	0,10	0,14	0,34	
						Pi		1,11		0,58			0,32	230	260	30	0,12	0,10	0,09	0,31	
014	11-09-09	SC-HO	0526631	4822064	2562	Pi	20	1,15		0,77			0,44	380	480	100	0,21	0,25	0,23	0,56	
					2563	Pi		1,22		0,71			0,43	300	340	40	0,12	0,15	0,09	0,35	
						Pi		1,09		0,44			0,24	150	170	20	0,12	0,10	0,08	0,42	
						Pi		1,18		0,54			0,32	230	300	70	0,23	0,10	0,22	0,31	
						Pi		0,95		0,67			0,32	140	170	30	0,18	0,10	0,09	0,31	
010	11-09-09	SC-HO	0526517	4821905	2568	Pi	30	0,89		0,91			0,40	640	710	70	0,10	0,30	0,17	0,74	
					2569	Pi		0,77		0,56			0,22	210	270	60	0,22	0,25	0,28	1,16	
						Pi		0,80		0,78			0,31	510	610	100	0,16	0,25	0,32	0,80	
						Pi	-	0,86		0,72			0,31	290	340	50	0,15	0,15	0,16	0,48	
						Qc		0,58		0,55			0,16	80	130	50	0,38	0,40	0,31	2,51	
						Qc		0,59		0,55			0,16	120	200	80	0,40	0,65	0,49	4,01	
						Qc		0,74		0,70			0,26	230	350	120	0,34	0,85	0,46	3,28	
045	14-09-09	BR-WA	0523346	4822971	2573	Ea	15	1,13	0,71	0,64	0,38	2,5	0,36	330	520	190	0,37	0,60	0,53	4,15	Mixed forest (Q, Ca, EA, AU)
					-	Ea		1,04	0,66	0,75	0,43	1,5	0,39	250	440	190	0,43	0,50	0,49	1,92	Few bushes
					2577	Ea		1,18	0,72	0,53	0,62	4,0	0,31	430	700	270	0,39	0,70	0,86	8,95	Almost flat
151	16-09-09	LC-WA	0524057	4825836	2586	Qi	90	0,78	0,78	0,52	0,52	2,0	0,20	250	300	50	0,17	0,40	0,25	3,94	Mixed forest Qi and Bu
					-	Qi		0,71	0,71	0,45	0,45	1,0	0,16	260	370	110	0,30	0,35	0,69	2,19	Very Dense
					2591	Qi		1,10	1,10	0,38	0,38	1,0	0,21	180	260	80	0,308	0,10	0,38	0,48	Almost flat
						Bu		1,60	1,12	0,26	0,26	1,0	0,21	120	170	50	0,29	0,40	0,24	1,92	
						Bu		1,65	1,10	0,23	0,23	1,0	0,19	140	190	50	0,26	0,35	0,26	1,84	
						Bu		1,70	1,24	0,76	0,76	1,0	0,65	260	340	80	0,24	0,45	0,12	0,70	
143	16-09-09	LC-WA	0523428	4825836	2595	Qi	90	0,96	0,96	0,94	0,94	2,0	0,45	290	370	80	0,22	0,15	0,18	0,66	
					-	Qi		0,98	0,98	0,83	0,83	1,0	0,41	260	350	90	0,26	0,20	0,22	0,49	

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					2599	Qi		1,17	1,17	1,00	1,00	2,0	0,59	450	560	110	0,20	0,15	0,19	0,51	
						Qi		1,08	1,08	0,59	0,59	1,0	0,32	210	280	70	0,25	0,25	0,22	0,78	
150	17-09-09	BR-MI	0524120	4826039	2600	Qi	130	0,74	0,64	0,50	0,50	2,0	0,19	250	380	130	0,34	0,60	0,70	6,49	Slope facing south west
					-	Qi		0,99	0,99	0,69	0,69	3,0	0,34	610	810	200	0,25	0,90	0,59	7,91	Dense forest, mostly Qi and Ulex
					2604	Qi		1,03	1,03	0,85	0,85	1,0	0,44	410	510	100	0,20	0,15	0,23	0,34	
						Qi		1,04	1,04	0,67	0,67	1,0	0,35	460	590	130	0,22	0,20	0,37	0,57	
						Qi		1,10	1,10	0,74	0,74	2,5	0,41	710	920	210	0,23	0,70	0,52	4,30	
152	17-09-09	BR-MI	0523639	4826008	2605	Ca	150	1,27	1,27	0,78	0,78	1,0	0,50	100	130	30	0,23	0,50	0,06	1,01	Slope facing north
					-	Ca		1,55	1,55	1,10	1,10	1,0	0,85	180	200	20	0,10	0,45	0,02	0,53	Open forest, only Ca
					2609	Ca		1,26	1,06	0,60	0,60	1,0	0,38	80	100	20	0,20	0,40	0,05	1,06	Rainfall gauges placed
						Ca		1,00	1,00	0,63	0,63	1,0	0,32	40	70	30	0,43	0,40	0,10	1,27	
138	17-09-09	SC-MI	0523296	4825857	2610	Qi	110	0,82	0,82	0,59	0,59	1,0	0,24	120	170	50	0,29	0,25	0,21	1,03	Slope facing South west
					-	Qi		0,99	0,99	0,48	0,48	1,0	0,24	120	160	40	0,25	0,10	0,17	0,42	Dense Qi forest
					2614	Qi		1,20	1,20	0,53	0,53	1,0	0,32	270	340	70	0,21	0,25	0,22	0,79	
						Qi		0,96	0,96	0,66	0,66	1,0	0,32	110	210	100	0,48	0,30	0,32	0,95	
						Qi		1,03	1,03	0,62	0,62	1,0	0,32	210	330	120	0,36	0,30	0,38	0,94	
137	17-09-09	SC-WA	0522902	4825778	2615	Qi	150	1,17	1,00	0,57	0,57	1,0	0,33	170	220	50	0,23	0,10	0,15	0,30	Slope facing west
					-	Qi		0,90	0,90	0,66	0,66	1,0	0,30	140	180	40	0,22	0,15	0,13	0,51	Dense forest
					2619	Qi		0,91	0,91	0,49	0,49	2,0	0,22	350	490	140	0,29	0,65	0,63	5,83	Qi and Rubus Fruticosis
						Qi		0,83	0,83	0,69	0,69	2,0	0,29	370	550	180	0,33	0,60	0,63	4,19	
						Qi		1,11	1,11	0,68	0,68	1,0	0,38	160	240	80	0,33	0,10	0,21	0,26	
136	17-09-09	SC-WA	0522957	4825686	2620	Qi	250	1,35	0,68	0,64	0,64	1,0	0,43	120	170	50	0,29	0,10	0,12	0,23	Slope facing South east
					-	Qi		0,91	0,91	0,65	0,65	1,0	0,30	220	280	60	0,21	0,25	0,20	0,85	Partly open forest
					2624	Qi		0,90	0,90	0,97	0,97	1,5	0,44	280	350	70	0,20	0,35	0,16	1,20	Mostly Qi
						Qi		0,99	0,99	0,62	0,62	1,5	0,31	390	510	120	0,24	0,35	0,39	1,71	
						Qi		1,14	1,14	0,74	0,74	2,0	0,42	560	750	190	0,25	0,50	0,45	2,37	
055	21-09-09	LC-MI	0524157	4823245	2630	Au	35	0,96	0,59	0,63	0,59	1,5	0,30	480	570	90	0,16	0,35	0,30	1,74	Mixed forest
					-	Au		0,84	0,67	0,60	0,67	1,0	0,25	340	440	100	0,23	0,20	0,40	0,79	Qi / Au / Ea
					2634	Au		0,87	0,63	0,33	0,63	1,5	0,14	440	550	110	0,20	0,20	0,77	2,09	
058	21-09-09	BR-WA	0523684	4823714	2635	Qi	75	0,92	0,73	0,70	0,73	1,5	0,32	520	620	100	0,16	0,20	0,31	0,93	Qi forest
					-	Qi		1,33	0,67	1,05	0,67	1,0	0,70	550	650	100	0,15	0,20	0,14	0,29	Some Au
					2640	Qi		0,92	0,47	0,92	0,47	1,0	0,42	230	270	40	0,15	0,30	0,09	0,71	

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
						Qi		0,99	0,52	0,74	0,52	1,5	0,37	400	500	100	0,20	0,35	0,27	1,43	
						Qi		1,01	0,64	0,59	0,64	2,0	0,30	600	750	150	0,20	0,70	0,50	4,70	
059	21-09-09	MC-WA	0523692	4823859	2651	Qi	35	1,06	0,78	1,06	0,78	2,0	0,56	730	940	210	0,22	0,75	0,37	2,67	Deciduous forest
					-	Qi		1,09	0,48	1,09	0,48	1,0	0,59	470	560	90	0,16	0,25	0,15	0,42	Qi dominant
					2655	Qi		1,39	0,75	1,12	0,75	1,0	0,78	650	840	190	0,23	0,30	0,24	0,39	Some Au
						Qi		1,19	0,45	1,19	0,45	1,0	0,71	350	420	70	0,17	0,15	0,10	0,21	Steep slope facing east
						Qi		0,73	0,39	0,73	0,39	1,0	0,27	200	250	50	0,20	0,25	0,19	0,94	
060	21-09-09	SC-WA	0523211	4823888	2656	Au	30	1,06	0,73	0,91	0,73	1,5	0,48	450	550	100	0,18	0,25	0,21	0,78	Au forest
					-	Au		0,78	0,54	0,52	0,54	1,0	0,20	220	270	50	0,19	0,10	0,25	0,49	90% Au 10% Qi
					2660	Au		1,40	0,48	0,98	0,48	1,0	0,69	410	530	120	0,23	0,30	0,17	0,44	Steep slope NE
108	21-09-09	MC-WA	0523097	4823992	2661	Au	35	0,76	0,52	0,43	0,52	1,5	0,16	310	400	90	0,23	0,40	0,55	3,67	Mixed forest
					-	Au		0,77	0,49	0,36	0,49	1,5	0,14	280	390	110	0,28	0,40	0,79	4,33	Qi / Au / Ea
					2666	Au		0,60	0,42	0,38	0,42	1,5	0,11	210	310	100	0,32	0,35	0,88	4,61	Steep slope facing north
						Au		0,68	0,46	0,35	0,46	2,0	0,12	280	400	120	0,30	0,35	1,01	5,88	
						Au		0,67	0,27	0,17	0,27	1,0	0,06	130	180	50	0,28	0,60	0,88	10,54	
109	21-09-09	MC-WA	0522838	4824022	2667	Au	45	0,86	0,31	0,73	0,31	1,0	0,31	200	260	60	0,23	0,15	0,19	0,48	Mixed forest
					-	Au		0,62	0,60	0,43	0,60	1,0	0,13	260	330	70	0,21	0,25	0,53	1,88	Qi / Au / Ea
					2671	Au		0,82	0,40	0,60	0,40	1,5	0,25	340	460	120	0,26	0,30	0,49	1,83	
						Au		0,94	0,47	0,66	0,47	1,0	0,31	240	340	100	0,29	0,20	0,32	0,64	
						Au		0,63	0,67	0,35	0,67	1,0	0,11	150	210	60	0,29	0,10	0,54	0,91	
094	22-09-09	SC-HO	0524659	4824479	2677	Qp	150	0,70	0,70	0,58	0,58	1,0	0,25	90	120	30	0,25	0,30	0,12	1,22	Slope facing SW
					2678	Qp		0,83	0,83	0,44	0,44	1,0	0,34	130	160	30	0,19	0,15	0,09	0,44	Mixed very dense forest
					2680	Qp		0,92	0,92	0,55	0,55	1,0	0,42	180	220	40	0,18	0,20	0,09	0,47	Qp, Qi, and Au
					2681	Qp		1,02	1,02	0,76	0,76	1,0	0,52	220	280	60	0,21	0,15	0,12	0,29	
					2682	Qp		0,86	0,86	0,83	0,83	1,0	0,37	320	440	120	0,27	0,15	0,32	0,41	
093	22-09-09	SC-HO	0524693	4824235	2684	Qi	100	0,82	0,65	1,08	1,08	1,5	0,27	490	600	110	0,18	0,50	0,41	2,81	Steep slope facing SE
					-	Qi		1,05	1,05	0,85	0,85	1,0	0,55	470	570	100	0,18	0,15	0,18	0,27	Qi and Au
					2688	Qi		0,72	0,72	0,68	0,68	1,0	0,26	250	300	50	0,17	0,20	0,19	0,77	
075	23-09-09	BR-WA	0525988	4823411	2689	Qi	60	1,06	1,06	0,61	0,61	1,5	0,56	420	510	90	0,18	0,40	0,16	1,07	Qi forest
					-	Qi		0,73	0,54	0,36	0,36	1,0	0,20	100	120	20	0,17	0,15	0,10	0,76	some Au and Ea bushes
					2693	Qi		0,91	0,54	0,50	0,50	1,0	0,25	170	210	40	0,19	0,10	0,16	0,41	
083	23-09-09	BR-WA	0526094	4823700	2694	Ea	30	0,76	0,58	0,49	0,49	1,5	0,22	150	200	50	0,25	0,35	0,23	2,38	Branch estimate difficult

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					-	Ea		1,00	0,72	0,49	0,49	1,5	0,36	350	520	170	0,33	0,35	0,47	1,46	Ea/Au/Qi forest
					2698	Ea		1,00	0,44	0,56	0,56	1,0	0,22	150	220	70	0,32	0,20	0,32	0,91	
084	23-09-09	BR-WA	0525907	4823868	2699	Au	120	0,80	0,65	0,80	0,80	2,0	0,26	540	660	120	0,18	0,75	0,46	5,77	Mixed dense forest Qi / Au
					-	Au		0,90	0,40	0,68	0,68	1,5	0,18	550	660	110	0,17	0,70	0,61	5,83	
					2703	Au		0,65	0,25	0,75	0,75	1,0	0,08	210	260	50	0,19	0,15	0,62	1,85	
072	23-09-09	BR-WA	0525757	4824060	2704	Qi	70	0,71	0,71	0,62	0,62	1,0	0,25	120	150	30	0,20	0,30	0,12	1,19	Qi forest some Qp / Au
					-	Qi		1,10	1,10	0,95	0,95	1,0	0,61	440	500	60	0,12	0,30	0,10	0,50	High trees up to 12-15m
					2708	Qi		0,70	0,70	0,50	0,50	1,0	0,25	80	100	20	0,20	0,20	0,08	0,82	No shrubs
073	23-09-09	SC-HO	0526139	4823949	2709	Au	90	0,58	0,49	0,73	0,73	1,0	0,14	170	200	30	0,15	0,15	0,21	1,06	
					-	Au		0,51	0,51	0,72	0,72	1,5	0,13	290	340	50	0,15	0,35	0,38	4,04	
					2713	Au		0,51	0,31	0,55	0,55	1,0	0,08	140	170	30	0,18	0,20	0,38	2,53	
085	23-09-09	SC-HO	0525109	4824479	2714	Ea	60	1,01	6,00	0,62	0,62	1,0	3,03	250	340	90	0,26	0,15	0,03	0,05	EA forest. Some Qi and Au.
					-	Ea		0,83	0,55	0,60	0,60	1,5	0,23	330	460	130	0,28	0,60	0,57	3,94	
					2718	Ea		1,20	0,50	0,59	0,50	1,0	0,30	190	270	80	0,30	0,10	0,27	0,33	
077	23-09-09	SC-HO	0526286	4823283	2719	Qi	120	1,05	0,60	0,92	0,92	2,0	0,32	600	760	160	0,21	0,70	0,51	4,44	Qi, Qc and Ea forest.
					-	Qi		0,82	0,46	0,53	0,53	1,0	0,19	130	170	40	0,24	0,25	0,21	1,33	
					2723	Qi		1,03	0,52	0,68	0,68	1,0	0,27	250	330	80	0,24	0,30	0,30	1,12	
076	23-09-09	SC-WA	0526130	4823287	2724	Au	100	1,03	0,71	0,64	0,64	1,5	0,37	400	500	100	0,20	0,40	0,27	1,64	Mixed forest Qi / Ea / Au / Bu
					-	Au		0,81	0,81	0,67	0,67	2,0	0,33	330	420	90	0,21	0,25	0,27	1,52	Branch nr 1 was wetted to early.
					2728	Au		0,91	0,51	1,02	0,76	1,0	0,23	270	330	60	0,18	0,20	0,26	0,86	
074	23-09-09	BR-WA	0526571	4823084	2729	Qi	80	0,82	0,82	0,68	0,68	1,0	0,34	170	230	60	0,26	0,20	0,18	0,59	Qi and Bu forest. Both with high
					-	Qi		0,81	0,81	0,71	0,71	1,0	0,33	170	230	60	0,26	0,25	0,18	0,76	heigths.
					2733	Qi		1,02	1,02	0,97	0,97	1,0	0,52	300	400	100	0,25	0,15	0,19	0,29	
035	24-09-09	SC-HO	0524302	4822928	2759	Qi	100	1,31	0,94	0,75	0,75	1,0	0,62	530	570	40	0,07	0,15	0,06	0,24	On top of a steep rock cliff
					-	Qi		0,84	0,84	0,41	0,41	1,0	0,35	170	190	20	0,11	0,10	0,06	0,28	Also Au en Bu
					2762	Qi		0,71	0,41	0,49	0,49	1,0	0,15	130	150	20	0,13	0,10	0,14	0,69	
036	24-09-09	SC-HO	0524039	4822750	2763	Qi	250	0,81	0,81	0,54	0,54	1,5	0,33	520	690	170	0,25	0,40	0,52	1,83	Qi between 2 P-places
					-	Qi		0,72	0,72	0,51	0,51	1,0	0,26	220	320	100	0,31	0,40	0,39	1,54	
					2767	Qi		0,76	0,76	0,61	0,61	2,0	0,29	350	480	130	0,27	0,70	0,45	4,85	Rubus
						Qi		0,79	0,79	0,52	0,52	1,5	0,31	290	430	140	0,33	0,75	0,45	3,61	
						Qi		0,71	0,71	0,82	0,82	2,0	0,25	440	580	140	0,24	0,60	0,56	4,76	
064	24-09-09	BR-HO	0524464	4823333	2750	Qi	50	0,78	0,49	0,73	0,73	1,5	0,19	320	450	130	0,29	0,35	0,68	2,75	Low QI, Ea and Au forest. Plot

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					-	Qi		0,76	0,50	0,38	0,38	1,5	0,19	170	200	30	0,15	0,60	0,16	4,74	location difficult to reach
					2754	Qi		0,92	0,79	0,45	0,45	1,5	0,36	400	500	100	0,20	0,65	0,28	2,68	strong wind
065	24-09-09	SC-HO	0524507	4823033	2755	Qi	90	0,82	0,82	0,64	0,64	2,5	0,34	710	970	260	0,27	0,90	0,77	6,69	Qi forest, very dense.
					-	Qi		0,62	0,50	0,55	0,55	1,5	0,16	320	430	110	0,26	0,70	0,71	6,77	Some Bu, Ea and Au.
					2758	Qi		0,69	0,69	0,34	0,34	1,0	0,24	210	270	60	0,22	0,40	0,25	1,68	
069	24-09-09	BR-WA	0524931	4823597	2740	Au	60	0,69	0,42	0,64	0,64	2,0	0,14	260	340	80	0,24	0,40	0,55	5,52	Steep slope facing North.
					-	Au		0,64	0,39	0,58	0,58	2,0	0,12	310	420	110	0,26	0,50	0,88	8,01	Qi, Au and Ea forest.
					2744	Au		0,67	0,44	0,64	0,64	2,0	0,15	290	370	80	0,22	0,60	0,54	8,14	
						Au		0,71	0,39	0,58	0,58	2,0	0,14	240	430	190	0,44	0,60	1,37	8,67	
						Au		0,54	0,54	0,85	0,85	1,5	0,15	280	350	70	0,20	0,35	0,48	3,60	
070	24-09-09	BR-WA	0524799	4823571	2745	Ea	25	0,94	0,94	0,57	0,57	2,0	0,44	280	500	220	0,44	0,30	0,50	1,36	LAI picture overestimated
					-	Ea		0,90	0,52	0,48	0,44	1,0	0,23	190	310	120	0,39	0,30	0,51	1,28	due to overhanging vegetation.
					2749	Ea		1,10	0,91	0,64	0,64	1,5	0,50	220	380	160	0,42	0,25	0,32	0,75	Slope facing North.
						Ea		0,74	0,40	0,62	0,62	1,5	0,15	120	250	130	0,52	0,35	0,88	3,55	Ea, Qi and Au forest.
						Ea		0,91	0,60	0,82	0,82	1,0	0,27	270	450	180	0,40	0,15	0,66	0,55	
071	24-09-09	BR-WA	0525028	4823676	2735	Qi	120	1,73	0,80	0,58	0,58	1,0	0,69	460	500	40	0,08	0,10	0,06	0,14	Slope facing West.
					-	Qi		0,92	0,62	0,59	0,59	1,0	0,29	220	260	40	0,15	0,20	0,14	0,70	Qi, Au and Vogelkers forest.
					2739	Qi		0,60	0,60	0,57	0,57	1,0	0,18	120	140	20	0,14	0,20	0,11	1,11	
001	25-09-09	BR-HO	0527969	4821406	2778	Qi	220	0,71	0,58	0,34	0,34	1,0	0,21	200	270	70	0,26	0,50	0,34	2,43	Qi forest and shrubs with besjes.
					-	Qi		0,68	0,53	0,48	0,48	1,5	0,18	270	390	120	0,31	0,60	0,67	4,99	Slope facing ZZO, but almost
					2782	Qi		0,46	0,37	0,40	0,40	1,5	0,09	140	200	60	0,30	0,65	0,71	11,46	flat (plateau).
027	25-09-09	BR-HO	0524722	4822094	2768	Qi	90	0,97	0,38	0,60	0,60	1,0	0,18	410	500	90	0,18	0,40	0,49	2,17	Qi (trees and shrubs) and
					-	Qi		0,69	0,31	0,43	0,43	1,5	0,11	240	330	90	0,27	0,60	0,84	8,42	Buxus (shrubs) forest.
					2772	Qi		0,68	0,59	0,53	0,53	1,0	0,20	160	230	70	0,30	0,20	0,35	1,00	Slope facing NWW.
028	25-09-09	BR-HO	0524569	4821970	2773	Qi	110	0,89	0,65	0,58	0,58	2,0	0,29	560	760	200	0,26	0,60	0,69	4,15	Qi forest and dense shrubs.
					-	Qi		0,68	0,68	0,44	0,44	1,0	0,23	240	280	40	0,14	0,30	0,17	1,30	Slope facing NW.
					2777	Qi		0,71	0,59	0,78	0,78	2,0	0,21	490	620	130	0,21	0,50	0,62	4,77	
039	28-09-09	SC-HO	0523530	4822555	2783	Qi	60	0,95	0,62	0,62	0,62	1,5	0,29	290	370	80	0,22	0,35	0,27	1,78	Mixed forest
					-	Qi		1,00	1,00	1,00	0,75	1,0	0,50	350	420	70	0,17	0,10	0,14	0,20	Qi / Ea
					2787	Qi		0,95	0,90	0,45	0,45	1,0	0,43	220	280	60	0,21	0,15	0,14	0,35	
038	28-09-09	SC-HO	0523673	4822450	2788	Ea	30	0,90	0,58	0,75	0,75	2,0	0,26	370	560	190	0,34	0,70	0,73	5,36	Mixed forest Ea / Au / Qi
					-	Ea		0,82	0,48	0,42	0,42	1,0	0,20	150	240	90	0,38	0,35	0,46	1,78	Slope facing NE

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					2792	Ea		1,05	0,60	0,70	0,70	1,0	0,32	300	400	100	0,25	0,40	0,32	1,27	
034	28-09-09	SC-HO	0523845	4822277	2793	Qi	45	0,90	0,80	0,65	0,65	1,5	0,36	360	450	90	0,20	0,40	0,25	1,67	Mixed forest Qi / Ea / Au / Bu
					-	Qi		0,95	0,78	0,61	0,61	1,0	0,37	270	350	80	0,23	0,30	0,22	0,81	
					2797	Qi		0,66	0,60	0,34	0,34	2,0	0,20	210	300	90	0,30	0,80	0,45	8,08	
033	28-09-09	SC-HO	0524000	4822173	2798	Bu	50	0,91	0,91	0,44	0,44	1,0	0,41	250	340	90	0,26	0,25	0,22	0,60	
					-	Bu		1,05	1,05	0,65	0,65	1,5	0,55	360	520	160	0,31	0,40	0,29	1,09	
					2802	Bu		0,81	0,81	0,30	0,30	1,0	0,33	180	240	60	0,25	0,35	0,18	1,07	
						Bu		0,90	0,90	0,41	0,41	1,0	0,41	290	410	120	0,29	0,40	0,30	0,99	
						Bu		0,66	0,66	0,30	0,30	1,0	0,22	160	240	80	0,33	0,35	0,37	1,61	
031	28-09-09	SC-HO	0524202	4821959	2808	Qi	60	1,02	0,72	0,64	0,64	1,5	0,37	460	600	140	0,23	0,40	0,38	1,63	Qi forest
					-	Qi		1,00	0,60	0,49	0,49	1,5	0,30	390	500	110	0,22	0,55	0,37	2,75	some shrubs
					2812	Qi		0,74	0,57	0,54	0,54	1,0	0,21	290	390	100	0,26	0,50	0,47	2,37	
148	29-09-09	BR-WA	0524180	4825375	2813	Qi	40	0,61	0,61	0,54	0,54	1,5	0,19	320	420	100	0,24	0,45	0,54	3,63	Slope facing SW
					-	Qi		0,71	0,61	0,55	0,55	1,0	0,22	230	300	70	0,23	0,35	0,32	1,62	Dense forest, high altitude
					2817	Qi		0,69	0,69	0,53	0,53	1,0	0,24	210	260	50	0,19	0,25	0,21	1,05	Mostly Qi forest
140	29-09-09	BR-WA	0523987	4825391	2818	Ca	120	0,68	0,68	0,42	0,42	1,0	0,23	90	110	20	0,18	0,80	0,09	3,46	Slope facing E
					-	Ca		0,81	0,81	0,61	0,61	1,5	0,33	200	240	40	0,17	0,70	0,12	3,20	Mixed forest
					2822	Ca		0,80	0,80	0,39	0,39	1,0	0,32	150	210	60	0,29	0,60	0,19	1,88	Ca / Ea / Au / Qi
						Ca		0,82	0,82	0,54	0,54	1,5	0,34	250	320	70	0,22	0,65	0,21	2,90	
						Ca		0,71	0,71	0,42	0,42	1,0	0,25	120	150	30	0,20	0,65	0,12	2,58	
142	29-09-09	BR-WA	0523633	4825396	2823	Au	160	0,72	0,52	0,71	0,71	1,0	0,19	280	340	60	0,18	0,15	0,32	0,80	Open forest / no shrubs
					-	Au		0,77	0,49	0,46	0,46	1,5	0,19	160	200	40	0,20	0,25	0,21	1,99	Qi / Ea / Au
					2827	Au		0,83	0,51	0,49	0,49	2,0	0,21	280	380	100	0,26	0,70	0,47	6,61	Slope facing SW
141	29-09-09	BR-HO	0523647	4825115	2828	Qi	400	0,71	0,52	0,83	0,83	3,0	0,18	600	870	270	0,31	0,90	1,46	14,63	Open forest
					-	Qi		0,87	0,87	0,56	0,56	1,0	0,38	320	410	90	0,22	0,30	0,24	0,79	High and old trees Qi forest
					2832	Qi		1,01	1,01	0,78	0,78	1,0	0,51	310	380	70	0,18	0,25	0,14	0,49	
102	29-09-09	BR-HO	0523555	4824990	2833	Au	120	0,98	0,98	0,66	0,66	1,0	0,48	220	270	50	0,19	0,30	0,10	0,62	Steep slope W
					-	Au		0,82	0,52	0,68	0,68	1,0	0,21	140	170	30	0,18	0,50	0,14	2,35	Qi / Au / Ca
					2837	Au		0,68	0,68	0,58	0,58	1,0	0,23	210	290	80	0,28	0,30	0,35	1,30	
101	29-09-09	SC-HO	0523511	4824861	2838	Qi	200	1,07	1,00	0,55	0,55	1,0	0,54	350	410	60	0,15	0,20	0,11	0,37	Slope facing E
					-	Qi		1,18	0,83	0,61	0,61	1,0	0,49	320	380	60	0,16	0,20	0,12	0,41	Large gully
					2842	Qi		1,15	1,15	0,64	0,64	1,0	0,66	310	360	50	0,14	0,20	0,08	0,30	

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
100	29-09-09	SC-HO	0523495	4824574	2843	Qi	70	0,96	0,63	0,81	0,81	1,5	0,30	420	510	90	0,18	0,60	0,30	2,98	Slope facing W
					-	Qi		0,44	0,34	0,61	0,61	1,5	0,07	200	270	70	0,26	0,40	0,94	8,02	Qi / Au / Shrubs
					2847	Qi		0,67	0,51	0,77	0,77	1,5	0,17	300	390	90	0,23	0,40	0,53	3,51	
104	29-09-09	SC-HO	0523553	4824731	2848	Ea	25	1,09	1,09	0,65	0,64	1,5	0,59	300	420	120	0,29	0,40	0,20	1,01	Overhanging Au
					-	Ea		0,98	0,98	0,65	0,65	1,5	0,48	230	360	130	0,36	0,40	0,27	1,25	Mixed forest
					2852	Ea		0,99	0,71	0,42	0,42	1,0	0,35	120	190	70	0,37	0,25	0,20	0,71	Slope facing NW
120	30-09-09	SC-MI	0521838	4825324	2853	Au	40	0,92	0,65	0,60	0,60	1,0	0,30	200	270	70	0,26	0,35	0,23	1,17	Mixed forest Qi /Au
					-	Au		0,76	0,60	0,38	0,38	1,0	0,23	130	150	20	0,13	0,25	0,09	1,10	LAI photo overhanging Canopy
					2857	Au		0,95	0,75	0,55	0,55	1,0	0,36	160	180	20	0,11	0,10	0,06	0,28	Forest border
121	30-09-09	SC-MI	0521465	4825282	2858	Qi	30	1,02	0,85	0,79	0,79	1,0	0,43	180	230	50	0,22	0,30	0,12	0,69	Mixed forest Qi dominant
					-	Qi		0,95	0,78	0,83	0,83	1,0	0,37	200	240	40	0,17	0,35	0,11	0,94	
					2862	Qi		0,95	0,85	0,78	0,78	1,0	0,40	110	130	20	0,15	0,35	0,05	0,87	
122	30-09-09	BR-WA	0521311	4825524	2863	Qp	50	0,78	0,78	0,80	0,80	1,0	0,30	250	280	30	0,11	0,30	0,10	0,99	Mixed forest Qp / Bu / Qi
					-	Qp		0,49	0,49	0,55	0,55	1,0	0,12	70	80	10	0,13	0,20	0,08	1,67	Near Peyne river bed
					2867	Qp		1,00	1,00	0,54	0,59	1,0	0,50	140	170	30	0,18	0,40	0,06	0,80	
						Qp		0,55	0,55	0,70	0,70	1,0	0,15	80	100	20	0,20	0,20	0,13	1,32	
						Qp		0,85	0,80	0,65	0,65	1,5	0,34	150	190	40	0,21	0,60	0,12	2,65	
164	30-09-09	BR-WA	0520858	4826555	2868	Qi	110	1,05	1,05	0,70	0,70	2,0	0,55	490	590	100	0,17	0,50	0,18	1,81	Qi forest
					-	Qi		0,90	0,65	0,62	0,62	2,0	0,29	560	730	170	0,23	0,70	0,58	4,79	Bu shrubs
					2872	Qi		0,85	0,55	0,55	0,55	1,0	0,23	150	190	40	0,21	0,15	0,17	0,64	
124	30-09-09	LC-WA	0521125	4825443	2873	Qp	320	1,20	1,05	0,67	0,67	1,5	0,63	550	640	90	0,14	0,50	0,14	1,19	High Qp forest
					-	Qp		0,92	0,82	0,52	0,52	1,0	0,38	330	400	70	0,18	0,45	0,19	1,19	Some Au / Qi
					2877	Qp		1,00	1,00	0,88	0,88	1,0	0,50	450	540	90	0,17	0,35	0,18	0,70	
123	30-09-09	MC-WA	0521413	4824935	2878	Qi	150	0,63	0,38	0,40	0,40	1,0	0,12	170	220	50	0,23	0,40	0,42	3,34	Qi forest
					-	Qi		0,82	0,75	0,75	0,75	2,0	0,31	540	710	170	0,24	0,80	0,55	5,20	Some Ea / Qp / Au / Bu
					2882	Qi		0,80	0,55	0,75	0,75	1,0	0,22	140	180	40	0,22	0,10	0,18	0,45	
117	30-09-09	MC-WA	0522789	4824270	2883	Au	45	1,05	0,60	0,50	0,50	1,5	0,32	490	610	120	0,20	0,60	0,38	2,86	Au / Qi forest
					-	Au		1,05	0,40	0,42	0,42	1,5	0,21	380	440	60	0,14	0,45	0,29	3,21	Slope facing E
					2887	Au		0,70	0,40	0,35	0,35	1,0	0,14	120	130	10	0,08	0,10	0,07	0,71	
118	30-09-09	MC-WA	0522685	4824354	2888	Au	180	1,00	0,80	0,70	0,70	1,5	0,40	420	500	80	0,16	0,35	0,20	1,31	
					-	Au		0,75	0,50	0,60	0,60	1,0	0,19	130	160	30	0,19	0,25	0,16	1,33	
					2892	Au		1,45	0,90	0,40	0,40	1,5	0,65	520	600	80	0,13	0,30	0,12	0,69	

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
115	30-09-09	MC-WA	0522562	4824605	2893	Au	40	0,92	0,70	0,65	0,65	1,5	0,32	540	690	150	0,22	0,60	0,47	2,80	Low Qi / Au / Ea forest
					-	Au		1,05	0,90	0,80	0,80	1,5	0,47	810	950	140	0,15	0,75	0,30	2,38	Probably reforested
					2897	Au		1,15	1,45	0,50	0,50	2,0	0,83	520	650	130	0,20	0,75	0,16	1,80	
095	01-10-09	SC-MI	0524690	4824859	2898	Au	150	0,98	0,74	0,94	0,94	1,0	0,36	340	400	60	0,15	0,25	0,17	0,69	Number of branches unsure
					-	Au		1,03	0,26	0,81	0,81	1,5	0,13	420	530	110	0,21	0,50	0,82	5,60	Slope facing W
					2903	Au		1,34	0,84	0,94	0,94	2,0	0,56	330	770	440	0,57	0,65	0,78	2,31	Au forest
098	01-10-09	SC-MI	0524449	4824680	2904	Qp	160	0,82	0,82	0,72	0,72	1,5	0,34	250	320	70	0,22	0,35	0,21	1,56	Qp forest
					-	Qp		0,92	0,92	0,82	0,82	1,0	0,42	250	310	60	0,19	0,25	0,14	0,59	High trees, many shrubs
					2909	Qp		0,63	0,63	0,54	0,54	1,5	0,20	190	250	60	0,24	0,30	0,30	2,27	Slope facing NW
146	01-10-09	SC-MI	0524412	4825011	2910	Qi	300	0,76	0,76	0,71	0,71	1,0	0,29	180	210	30	0,14	0,20	0,10	0,69	Slope facing SE near gully
					-	Qi		0,81	0,81	0,91	0,91	1,0	0,33	140	190	50	0,26	0,30	0,15	0,91	No shrubs
					2914	Qi		0,72	0,72	0,96	0,96	1,0	0,26	180	230	50	0,22	0,25	0,19	0,96	Qi / Au forest, dense and mixed
096	01-10-09	SC-WA	0524287	4824869	2915	Qp	40	1,24	0,94	1,08	1,08	1,0	0,58	380	450	70	0,16	0,30	0,12	0,51	Qi branches influencing LAI
					-	Qp		1,07	0,71	0,77	0,77	1,0	0,38	200	240	40	0,17	0,30	0,11	0,79	Slope facing NW
					2919	Qp		0,89	0,89	0,48	0,48	1,0	0,40	130	160	30	0,19	0,25	0,08	0,63	Qi / Au / Qp forest
097	01-10-09	BR-WA	0524066	4824653	2920	Au	70	0,91	0,63	0,84	0,84	1,0	0,29	360	440	80	0,18	0,15	0,28	0,52	Slope facing NW
					-	Au		1,00	0,61	0,83	0,83	3,0	0,31	610	750	140	0,19	0,70	0,46	6,89	Au / Qi forest
					2924	Au		0,81	0,59	0,43	0,43	1,5	0,24	210	300	90	0,30	0,40	0,38	2,51	
105	01-10-09	SC-WA	0523810	4824439	2925	Ea	25	0,92	0,92	0,42	0,42	2,0	0,42	190	300	110	0,37	0,50	0,26	2,36	Slope facing SE
					-	Ea		1,07	0,61	0,46	0,46	2,0	0,33	230	380	150	0,39	0,30	0,46	1,84	Many shrubs and low vegetation
					2929	Ea		1,06	0,74	0,58	0,58	1,5	0,39	200	360	160	0,44	0,25	0,41	0,96	Qi / Au / Ea
107	01-10-09	SC-WA	0523526	4824172	2930	Qi	30	0,91	0,91	0,51	0,51	2,0	0,41	360	470	110	0,23	0,30	0,27	1,45	Overhanging Au
					-	Qi		0,79	0,79	0,31	0,31	1,5	0,31	160	220	60	0,27	0,25	0,19	1,20	Open Qi / Au forest some Ea shrubs
					2935	Qi		0,83	0,83	0,61	0,61	2,0	0,34	320	430	110	0,26	0,30	0,32	1,74	Slope facing west
106	01-10-09	SC-WA	0523536	4824336	2936	Qi	40	0,73	0,55	0,45	0,45	1,5	0,20	220	290	70	0,24	0,50	0,35	3,74	Open Qi / Au forest some Ea shrubs
					-	Qi		0,81	0,81	0,34	0,34	1,5	0,33	220	270	50	0,19	0,55	0,15	2,51	Slope facing W
					2940	Qi		0,71	0,48	0,51	0,51	2,0	0,17	230	310	80	0,26	0,65	0,47	7,63	
088	02-10-09	SC-HO	0525475	4824571	2941	Au	20	1,40	1,30	0,60	0,60	1,0	0,91	420	490	70	0,14	0,15	0,08	0,16	Low Au / Qi forest
					-	Au		1,10	0,80	0,55	0,55	1,0	0,44	270	340	70	0,21	0,20	0,16	0,45	Dense and young forest
					2945	Au		0,95	0,70	0,45	0,45	1,5	0,33	250	330	80	0,24	0,30	0,24	1,35	Windy
087	02-10-09	SC-HO	0525353	4824363	2946	Qi	40	0,95	0,68	0,45	0,45	2,0	0,32	380	470	90	0,19	0,40	0,28	2,48	Open Qi / Au forest
					-	Qi		0,85	0,85	0,80	0,80	1,0	0,36	240	300	60	0,20	0,30	0,17	0,83	No shrubs

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					2950	Qi		0,81	0,70	0,70	0,70	1,0	0,28	170	220	50	0,23	0,15	0,18	0,53	
086	02-10-09	SC-WA	0525292	4824134	2951	Au	75	0,60	0,30	0,49	0,49	1,5	0,09	310	390	80	0,21	0,65	0,89	10,83	Qi / Au forest
					-	Au		0,65	0,50	0,55	0,55	2,0	0,16	400	530	130	0,25	0,75	0,80	9,23	Same as 088
					2955	Au		0,90	0,50	0,80	0,80	1,5	0,23	530	670	140	0,21	0,25	0,62	1,67	
089	02-09-09	SC-WA	0525312	4824733	2956	Au	80	1,05	0,85	0,85	0,85	1,0	0,45	190	240	50	0,21	0,10	0,11	0,22	Qi / Au forest open
					-	Au		0,95	0,70	0,65	0,65	2,0	0,33	280	350	70	0,20	0,40	0,21	2,41	High trees and no shrubs
					2960	Au		0,98	0,65	0,35	0,35	1,5	0,32	210	260	50	0,19	0,40	0,16	1,88	
145	02-09-09	BR-WA	0524886	4825280	2961	Qi	100	1,25	1,10	0,55	0,55	1,0	0,69	410	550	140	0,25	0,50	0,20	0,73	Qi / Au forest
					-	Qi		1,05	0,60	0,72	0,72	1,0	0,32	380	460	80	0,17	0,30	0,25	0,95	Dense, low forest
					2965	Qi		1,20	1,10	0,63	0,63	1,0	0,66	330	370	40	0,11	0,20	0,06	0,30	Some Ca / Qp
147	02-10-09	BR-WA	0524573	4825448	2966	Qp	180	0,70	0,70	0,58	0,58	1,5	0,25	180	240	60	0,25	0,50	0,24	3,06	Mixed forest Qp / Qi / Au /Ca
					-	Qp		0,90	0,90	0,95	0,95	2,0	0,41	320	410	90	0,22	0,70	0,22	3,46	
					2970	Qp		0,95	0,95	1,00	1,00	1,0	0,45	420	600	180	0,30	0,40	0,40	0,89	
099	05-10-09	LC-MI	0523838	4824138	2971	Ea	35	0,84	0,46	0,48	0,48	1,5	0,19	170	250	80	0,32	0,30	0,41	2,33	Streep slope facing W
					-	Ea		1,11	0,82	0,31	0,31	2,0	0,46	210	350	140	0,40	0,60	0,31	2,64	Mixed forest trees / shrubs
					2975	Ea		0,95	0,85	0,45	0,45	2,5	0,40	250	490	240	0,49	0,55	0,59	3,41	Ea / Au / Qi
061	05-10-09	LC-MI	0523910	4823977	2976	Au	30	0,94	0,46	0,71	0,71	2,0	0,22	470	590	120	0,20	0,80	0,56	7,40	Slope facing NW
					-	Au		0,68	0,42	0,54	0,54	1,5	0,14	200	260	60	0,23	0,65	0,42	6,83	Shrubs and trees
					2980	Au		0,69	0,39	0,51	0,51	1,5	0,13	190	250	60	0,24	0,60	0,45	6,69	Ea / Au / Qi
066	05-10-09	LC-WA	0523952	4823772	2981	Qi	70	0,82	0,64	0,66	0,66	1,5	0,26	430	540	110	0,20	0,30	0,42	1,71	Slope facing NW
					-	Qi		0,85	0,58	0,43	0,43	1,5	0,25	280	370	90	0,24	0,35	0,37	2,13	Steep stony slope
					2985	Qi		0,99	0,63	0,49	0,49	1,5	0,31	250	360	110	0,306	0,45	0,35	2,16	Qi / Au / Ea
062	05-10-09	LC-WA	0524042	4823515	2986	Ea	25	1,08	0,62	0,47	0,47	2,5	0,33	270	430	160	0,372	0,50	0,48	3,73	Slope facing W
					-	Ea		0,76	0,39	0,48	0,48	1,5	0,15	170	270	100	0,37	0,30	0,67	3,04	Shrubs Ea / Au
					2990	Ea		0,85	0,57	0,41	0,41	1,5	0,24	130	250	120	0,48	0,35	0,50	2,17	Higher; trees
063	05-10-09	LC-WA	0524238	4823691	2991	Au	40	0,75	0,75	0,72	0,72	1,5	0,28	260	360	100	0,278	0,35	0,36	1,87	Slope facing E
					-	Au		1,01	0,65	0,78	0,78	1,5	0,33	500	680	180	0,265	0,75	0,55	3,43	Qi / Au / Ea
					2995	Au		0,79	0,79	0,68	0,68	2,0	0,31	290	400	110	0,275	0,70	0,35	4,49	Shrub / Tree mixed forest
091	05-10-09	MC-HO	0524561	4824134	2996	Qi	25	1,04	0,72	0,71	0,71	1,0	0,37	260	330	70	0,212	0,25	0,19	0,67	Dense forest Qi / Au / Ea
					-	Qi		0,93	0,52	0,64	0,64	1,0	0,24	140	180	40	0,222	0,15	0,17	0,62	Slope facing SW
					3000	Qi		0,98	0,77	0,74	0,74	1,5	0,38	250	320	70	0,219	0,35	0,19	1,39	
092	05-10-09	MC-WA	0524394	4823726	3001	Ea	30	1,05	0,56	0,57	0,57	2,0	0,29	260	480	220	0,458	0,50	0,75	3,40	Overhanging Au

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					-	Ea		0,89	0,49	0,66	0,66	2,0	0,22	200	360	160	0,444	0,65	0,73	5,96	Slope facing W
					3005	Ea		0,82	0,43	0,51	0,51	1,0	0,18	100	350	250	0,714	0,20	1,42	1,13	Qi / Ea / Au forest with shrubs
067	05-10-09	LC-WA	0524577	4823616	3006	Qi	70	1,14	1,14	0,63	0,63	1,5	0,65	280	380	100	0,263	0,30	0,15	0,69	Steep slope facing SE
					-	Qi		1,03	0,89	0,78	0,78	2,0	0,46	440	610	170	0,279	0,40	0,37	1,75	Dense forest Qi / Au / Ea
					3010	Qi		1,01	0,73	0,78	0,78	2,5	0,37	520	710	190	0,268	0,75	0,52	5,09	
160	06-10-09	CL-WA	0522012	4826371	3011	Qi	100	1,30	0,85	0,80	0,80	1,0	0,55	480	550	70	0,127	0,35	0,13	0,63	Mixed forest
					-	Qi		0,88	0,60	0,50	0,50	1,0	0,26	140	150	10	0,067	0,30	0,04	1,14	High Qi / Qp trees
					3015	Qi		1,10	1,00	0,95	0,95	1,5	0,55	490	520	30	0,058	0,30	0,05	0,82	Bu / Ea shrubs
162	06-10-09	CL-WA	0522025	4826555	3016	Qp	80	1,31	1,20	0,82	0,82	1,5	0,79	210	270	60	0,22	0,40	0,08	0,76	Open Qp forest (high trees)
					-	Qp		0,76	0,76	0,95	0,95	1,5	0,29	240	330	90	0,27	0,70	0,31	3,64	Some Bu / Qi shrubs
					3020	Qp		0,88	0,88	1,30	1,30	1,0	0,39	360	450	90	0,20	0,65	0,23	1,68	
161	06-10-09	LC-WA	0522310	4826855	3021	Qi	90	1,10	1,10	0,48	0,48	1,5	0,61	350	410	60	0,15	0,65	0,10	1,61	Mixed open forest Qi / Qp / Ca
					-	Qi		1,12	1,12	0,60	0,60	1,5	0,63	580	690	110	0,16	0,60	0,18	1,43	High trees
					3025	Qi		1,15	1,05	0,45	0,45	2,0	0,60	460	620	160	0,26	0,80	0,27	2,65	Bu / Ea shrubs
158	06-10-09	LC-WA	0522639	4826801	3026	Bu	120	0,85	0,85	1,10	1,10	1,5	0,36	340	440	100	0,23	0,50	0,28	2,08	Near river bed Qi / Ca forest
					-	Bu		1,10	1,10	0,52	0,52	1,0	0,61	220	300	80	0,27	0,70	0,13	1,16	High Bu shrubs up to 6m
					3030	Bu		0,90	0,90	0,83	0,83	1,0	0,41	150	230	80	0,35	0,55	0,20	1,36	
157	06-10-09	MC-WA	0522847	4826900	3031	Qi	120	1,24	0,92	0,58	0,58	1,0	0,57	510	590	80	0,14	0,40	0,14	0,70	Qi forest
					-	Qi		1,10	0,90	0,70	0,70	1,0	0,50	600	740	140	0,19	0,55	0,28	1,11	Many Ea shrubs
					3035	Qi		1,09	1,09	0,57	0,57	1,5	0,59	410	510	100	0,20	0,65	0,17	1,64	Some Ca
153	06-10-09	LC-WA	0523023	4826798	3036	Ca	60	0,72	0,72	0,63	0,63	1,0	0,26	70	100	30	0,30	0,55	0,12	2,12	Qi / Ca / Qp forest
					-	Ca		0,70	0,70	1,10	1,10	1,0	0,25	120	150	30	0,20	0,60	0,12	2,45	High trees
					3040	Ca		1,05	1,05	0,35	0,35	1,0	0,55	70	100	30	0,30	0,70	0,05	1,27	
154	06-10-09	MC-WA	0523211	4826568	3041	Qi	75	0,95	0,95	0,70	0,70	1,0	0,45	400	470	70	0,15	0,35	0,16	0,78	Low Qi forest some Qp
					-	Qi		0,95	0,95	0,72	0,72	1,5	0,45	290	350	60	0,17	0,20	0,13	0,66	Some Bu shrubs
					3045	Qi		0,96	0,96	0,62	0,62	1,0	0,46	250	310	60	0,19	0,40	0,13	0,87	
155	06-10-09	LC-WA	0523174	4826297	3046	Qi	45	1,05	0,85	0,55	0,55	1,0	0,45	480	580	100	0,17	0,30	0,22	0,67	Qi forest some Bu shrubs
					-	Qi		0,95	0,95	0,50	0,50	1,5	0,45	470	600	130	0,22	0,65	0,29	2,16	
					3050	Qi		0,92	0,92	0,35	0,35	1,0	0,42	230	290	60	0,21	0,40	0,14	0,95	
159	06-10-09	MC-WA	0522261	4826024	3052	Qi	100	0,83	0,60	0,60	0,60	1,0	0,25	210	270	60	0,22	0,10	0,24	0,40	Qi forest some Au
					-	Qi		0,85	0,85	0,45	0,45	1,0	0,36	340	430	90	0,21	0,40	0,25	1,11	Open shrub forest
					3056	Qi		0,95	0,85	0,45	0,45	1,5	0,40	370	500	130	0,26	0,70	0,32	2,60	

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
156	06-10-09	MC-WA	0522836	4826270	3057	Qp	120	1,01	0,90	0,68	0,68	1,5	0,45	410	490	80	0,16	0,45	0,18	1,49	Mixed Qi / Qp forest
					-	Qp		0,85	0,72	0,52	0,52	1,0	0,31	210	280	70	0,25	0,35	0,23	1,14	Bu shrubs
					3061	Qp		0,95	0,82	0,75	0,75	1,5	0,39	580	740	160	0,22	0,60	0,41	2,31	Open forest
149	06-10-09	LC-WA	0522934	4826112	3062	Qp	130	1,05	0,95	1,05	1,05	1,0	0,50	620	780	160	0,21	0,60	0,32	1,20	Qi / Qp / Au forest
					-	Qp		1,10	0,95	0,85	0,85	1,0	0,52	300	380	80	0,21	0,50	0,15	0,96	Very dense
					3066	Qp		1,10	1,10	1,05	1,05	1,0	0,61	480	680	200	0,29	0,70	0,33	1,16	Ea shrubs
016	07-10-09	CL-MI	0526471	4822220	3067	Ca	220	0,98	0,98	0,97	0,97	1,0	0,48	110	140	30	0,21	0,40	0,06	0,83	Ca forest
					-	Ca		1,05	1,05	0,70	0,70	1,0	0,55	120	150	30	0,20	0,50	0,05	0,91	Open forest some low vegatation
					3072	Ca		1,02	1,02	0,90	0,90	1,0	0,52	80	120	40	0,33	0,40	0,08	0,77	Slope facing S
019	07-10-09	CL-WA	0525732	4822232	3077	Qc	8	0,49	0,34	0,31	0,31	1,5	0,08	90	130	40	0,31	0,35	0,48	6,30	Shrub forest Qc / Bu
					3078	Qc		0,53	0,53	0,29	0,29	1,0	0,14	70	100	30	0,30	0,15	0,21	1,07	Slope facing E
						Qc		0,59	0,59	0,38	0,38	1,0	0,17	90	130	40	0,31	0,20	0,23	1,15	
018	07-10-09	CL-WA	0525634	4822399	3080	Qc	15	0,48	0,29	0,32	0,32	1,0	0,07	100	130	30	0,23	0,40	0,43	5,75	Open shrub forest Qc Bu Au
					3081	Qc		0,62	0,32	0,42	0,42	1,5	0,10	180	260	80	0,31	0,35	0,81	5,29	Slope facing E
						Qc		0,63	0,49	0,67	0,67	1,5	0,15	370	530	160	0,30	0,50	1,04	4,86	
023	07-10-09	CL-WA	0525679	4822865	3082	Bu	12	0,89	0,89	0,43	0,43	1,5	0,40	210	300	90	0,30	0,20	0,23	0,76	Mixed open forest Pi / Au
					3083	Bu		0,63	0,63	0,44	0,44	1,5	0,20	150	230	80	0,35	0,25	0,40	1,89	Shrubs Bu / Qi / Au
						Bu		0,65	0,65	0,49	0,49	1,5	0,21	140	230	90	0,39	0,25	0,43	1,78	Slope facing N
022	07-10-09	CL-WA	0526198	4822887	3084	Pi	30	0,75	0,75	0,73	0,73	1,5	0,28	480	580	100	0,17	0,15	0,36	0,80	Shrubs and trees Pi Au Qi
					-	Pi		0,71	0,62	0,58	0,58	1,5	0,22	280	350	70	0,20	0,20	0,32	1,36	
					3088	Pi		0,83	0,75	0,44	0,44	2,0	0,31	330	410	80	0,20	0,30	0,26	1,93	
020	07-10-09	CL-WA	0526168	4822705	3089	Qi	120	0,69	0,52	0,59	0,59	1,0	0,18	200	250	50	0,20	0,25	0,28	1,39	Shrubs and trees Qi Au Qc
					-	Qi		0,86	0,63	0,66	0,66	1,5	0,27	270	350	80	0,23	0,30	0,30	1,66	Dense forest with open spaces
					3093	Qi		0,71	0,54	0,71	0,71	1,5	0,19	290	340	50	0,15	0,25	0,26	1,96	
021	07-10-09	CL-WA	0525826	4822605	3094	Qi	150	1,19	1,19	0,46	0,46	1,0	0,71	260	290	30	0,10	0,25	0,04	0,35	Trees and shrubs Qi / Qc / Au
					-	Qi		1,15	1,15	0,54	0,54	1,5	0,66	430	500	70	0,14	0,35	0,11	0,79	Ea shrubs
					3098	Qi		0,82	0,82	0,55	0,55	2,0	0,34	300	380	80	0,21	0,55	0,24	3,27	
111	08-10-09	CL-WA	0522253	4824706	3099	Qi	300	1,22	1,05	0,43	0,43	1,0	0,64	360	440	80	0,18	0,65	0,12	1,01	Qi open shrub forest
					-	Qi		0,95	0,95	0,48	0,48	1,5	0,45	280	350	70	0,20	0,80	0,16	2,66	Au / Bu shrubs
					3103	Qi		0,85	0,75	0,50	0,50	1,5	0,32	380	480	100	0,21	0,75	0,31	3,53	Brooke valley
110	08-10-09	CL-WA	0522462	4824869	3104	Qi	200	0,80	0,80	0,90	0,90	1,5	0,32	430	540	110	0,20	0,60	0,34	2,81	Qi forest near Peyne river bed
					-	Qi		0,88	0,72	0,72	0,72	1,0	0,32	280	340	60	0,18	0,35	0,19	1,10	Some Au / Ea shrubs

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					3108	Qi		1,04	0,75	0,91	0,91	2,0	0,39	560	690	130	0,19	0,80	0,33	4,10	
112	08-10-09	CL-WA	0522587	4824815	3109	Au	40	1,05	0,50	0,70	0,70	2,5	0,26	440	570	130	0,23	0,40	0,50	3,81	Low shrub forest due to logging
					3110	Au		0,89	0,60	0,40	0,40	2,0	0,27	250	310	60	0,19	0,45	0,22	3,37	Qi / Au / Ea / Bu
						Au		0,82	0,63	0,54	0,54	2,5	0,26	310	400	90	0,23	0,65	0,35	6,29	
044	09-10-09	MC-WA	0523561	4822890	3111	Qi	120	0,98	0,98	0,82	0,82	2,0	0,48	430	580	150	0,26	0,70	0,31	2,92	Slope facing E
					-	Qi		0,91	0,91	0,64	0,64	1,0	0,41	240	280	40	0,14	0,35	0,10	0,85	Qi / Au forest no shrubs
					3115	Qi		0,54	0,54	0,84	0,84	1,5	0,15	170	200	30	0,15	0,65	0,21	6,69	Some Ea
050	09-10-09	LC-WA	0523419	4823134	3116	Qi	120	0,71	0,48	0,77	0,77	1,5	0,17	400	520	120	0,23	0,40	0,70	3,52	Slope facing WNW
					-	Qi		0,79	0,56	0,72	0,72	1,0	0,22	360	430	70	0,16	0,25	0,32	1,13	Bu shrubs
					3120	Qi		0,75	0,54	0,71	0,71	1,0	0,20	350	430	80	0,19	0,30	0,40	1,48	Qi / Ea / Au low forest
049	09-10-09	LC-WA	0523419	4823342	3121	Qi	100	0,66	0,37	0,78	0,78	2,0	0,12	410	590	180	0,31	0,65	1,47	10,65	Slope facing NW
					-	Qi		0,72	0,37	0,63	0,63	1,5	0,13	270	410	140	0,34	0,70	1,05	7,88	Qi / Au / Ea forest
					3125	Qi		0,69	0,58	0,72	0,72	1,5	0,20	200	300	100	0,33	0,60	0,50	4,50	
056	09-10-09	LC-WA	0523708	4823196	3126	Ea	30	1,08	0,63	0,72	0,72	2,0	0,34	330	490	160	0,33	0,30	0,47	1,76	Slope facing SSW
					3127	Ea		0,80	0,49	0,42	0,42	1,5	0,20	120	200	80	0,40	0,50	0,41	3,83	Ea / Au / Qi forest
						Ea		0,71	0,36	0,67	0,67	1,5	0,13	120	200	80	0,40	0,25	0,63	2,93	
047	09-10-09	LC-WA	0523385	4823474	3130	Au	35	0,65	0,53	0,68	0,68	2,0	0,17	380	500	120	0,24	0,70	0,70	8,13	Slope facing NE
					-	Au		0,54	0,36	0,91	0,91	1,5	0,10	490	660	170	0,26	0,60	1,75	9,26	Ea / Au / Qi forest
					3134	Au		0,92	0,81	0,46	0,46	1,0	0,37	210	280	70	0,25	0,15	0,19	0,40	
052	09-10-09	MC-WA	0523252	4823620	3135	Au	20	0,75	0,75	0,55	0,55	1,0	0,28	200	250	50	0,20	0,15	0,18	0,53	Slope facing NE
					-	Au		0,81	0,49	0,68	0,68	1,5	0,20	220	290	70	0,24	0,25	0,35	1,89	Overhanging Ea
					3139	Au		0,77	0,47	0,53	0,53	1,5	0,18	260	350	90	0,26	0,50	0,50	4,14	Au / Ea / Qi shrub forest
051	09-10-09	MC-WA	0523087	4823632	3140	Au	28	0,86	0,62	0,66	0,66	1,0	0,27	220	270	50	0,19	0,20	0,19	0,75	Slope facing W
					-	Au		0,79	0,61	0,63	0,63	2,0	0,24	290	410	120	0,29	0,75	0,50	6,23	Ea / Qi / Au forest and shrubs
					3144	Au		0,86	0,49	0,42	0,42	1,5	0,21	250	330	80	0,24	0,55	0,38	3,92	
079	12-10-09	BR-MI	0525387	4823888	3151	Qi	100	0,80	0,70	0,50	0,50	1,0	0,28	230	290	60	0,21	0,35	0,21	1,25	Qi / Au forest
					-	Qi		0,80	0,65	0,43	0,43	1,0	0,26	210	260	50	0,19	0,40	0,19	1,54	Some Ea
					3155	Qi		0,98	0,75	0,42	0,42	1,5	0,37	310	410	100	0,24	0,45	0,27	1,84	Slope SE
080	12-10-09	BR-MI	0525360	4823650	3156	Qi	110	0,70	0,55	0,40	0,40	1,5	0,19	260	340	80	0,24	0,65	0,42	5,06	Qi / Au forest
					-	Qi		0,82	0,56	0,50	0,50	2,0	0,23	250	330	80	0,24	0,60	0,35	5,23	Very gusty
					3160	Qi		0,80	0,80	0,62	0,62	1,5	0,32	170	220	50	0,23	0,50	0,16	2,34	
081	12-10-09	SC-MI	0525307	4823468	3161	Ea	30	0,92	0,50	0,58	0,58	2,0	0,23	170	230	60	0,26	0,40	0,26	3,48	Low Qi / Au / Ea forest

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					3162	Ea		0,85	0,33	0,55	0,55	1,5	0,14	120	160	40	0,25	0,40	0,29	4,28	Very gusty
					3163	Ea		0,81	0,60	0,30	0,30	2,0	0,24	110	190	80	0,42	0,60	0,33	4,94	
082	12-10-09	SC-WA	0525206	4823304	3164	Au	80	0,89	0,55	0,50	0,50	2,0	0,24	280	350	70	0,20	0,40	0,29	3,27	Au / Qi forest
					-	Au		0,75	0,58	0,65	0,65	2,0	0,22	330	430	100	0,23	0,60	0,46	5,52	Very gusty
					3168	Au		0,78	0,55	0,60	0,60	1,0	0,21	240	300	60	0,20	0,35	0,28	1,63	
078	12-10-09	BR-WA	0525035	4823149	3169	Au	45	0,85	0,36	0,65	0,65	2,0	0,15	400	520	120	0,23	0,75	0,78	9,80	Low Qi / Au / Ea forest
					-	Au		0,69	0,35	0,72	0,72	1,5	0,12	320	450	130	0,29	0,65	1,08	8,07	Very gusty
					3173	Au		0,72	0,65	0,62	0,62	1,0	0,23	150	210	60	0,29	0,25	0,26	1,07	Ea and Qi influence LAI
032	12-10-09	SC-WA	0524602	4822820	3174	Qi	120	0,80	0,80	0,60	0,60	1,0	0,32	300	380	80	0,21	0,40	0,25	1,25	Open shrub forest some Qi
					-	Qi		0,70	0,60	0,68	0,68	1,5	0,21	270	320	50	0,16	0,50	0,24	3,57	Qc / Bu shrubs
					3178	Qi		0,75	0,59	0,59	0,59	1,0	0,22	270	350	80	0,23	0,30	0,36	1,36	Extremely gusty
025	12-10-09	BR-WA	0524584	4822613	3179	Bu	75	1,25	1,25	0,40	0,40	3,0	0,78	460	610	150	0,25	0,80	0,19	3,07	Low Bu forest near gully
					3180	Bu		0,73	0,73	0,35	0,35	2,0	0,27	230	330	100	0,30	0,80	0,38	6,00	some Au / Qi shrubs
						Bu		0,83	0,83	0,38	0,38	2,0	0,34	450	600	150	0,25	0,90	0,44	5,23	Very gusty
024	12-10-09	BR-MI	0524919	4822469	3181	Qc	10	0,69	0,55	0,39	0,39	1,0	0,19	310	430	120	0,28	0,80	0,63	4,22	Grass / shrubland
						Qc		0,70	0,70	0,38	0,38	1,0	0,25	350	490	140	0,29	0,70	0,57	2,86	Qc / Bu shrubs
						Qc		0,61	0,61	0,37	0,37	1,5	0,19	310	460	150	0,33	0,85	0,81	6,85	Extremely gusty
036	12-10-09	BR-MI	0524711	4822700	3182	Qc	20	0,85	0,85	0,38	0,38	1,0	0,36	310	440	130	0,30	0,60	0,36	1,66	Open shrubs forest
						Qc		0,85	0,85	0,47	0,47	1,0	0,36	380	510	130	0,25	0,65	0,36	1,80	Qi / Qc / Au / Bu
						Qc		0,89	0,89	0,61	0,61	1,5	0,40	470	640	170	0,27	0,55	0,43	2,08	Very gusty
017	12-10-09	BR-MI	0524845	4822830	3183	Qi	150	0,85	0,70	0,48	0,48	1,0	0,30	160	230	70	0,30	0,15	0,24	0,50	Open forest
					-	Qi		0,71	0,71	0,78	0,78	2,0	0,25	300	390	90	0,23	0,70	0,36	5,55	Some Qi trees, many shrubs
					3187	Qi		0,83	0,75	0,50	0,50	1,5	0,31	270	360	90	0,25	0,35	0,29	1,69	Very gusty
128	13-10-09	BR-CO	0522680	4825992	3188	Qp	130	0,92	0,92	1,06	1,06	1,0	0,42	270	330	60	0,18	0,50	0,14	1,18	Slope facing SW
					-	Qp		0,79	0,79	0,65	0,65	1,0	0,31	120	160	40	0,25	0,45	0,13	1,44	Qp / Qi forest
					3193	Qp		0,80	0,80	0,78	0,78	1,0	0,32	140	210	70	0,33	0,40	0,22	1,25	In gully
133	13-10-09	BR-CO	0522578	4825709	3194	Au	35	0,82	0,51	0,32	0,32	2,0	0,21	180	240	60	0,25	0,60	0,29	5,74	Slope facing NW
					3195	Au		0,59	0,44	0,49	0,49	2,0	0,13	220	310	90	0,29	0,60	0,69	9,24	Shrub forest, mostly Au
					3196	Au		0,71	0,53	0,34	0,34	2,0	0,19	110	160	50	0,31	0,40	0,27	4,25	Some Qi and Ca trees
134	13-10-09	BR-CO	0522419	4825692	3197	Qi	140	0,84	0,73	0,61	0,61	1,0	0,31	160	200	40	0,20	0,35	0,13	1,14	Slope facing SSW
					-	Qi		1,02	0,74	0,64	0,64	1,5	0,38	350	440	90	0,20	0,55	0,24	2,19	Dense Qi / Au forest
					3201	Qi		0,83	0,57	0,73	0,73	1,5	0,24	370	460	90	0,20	0,65	0,38	4,12	Some Ea

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
135	13-10-09	BR-CO	0522249	4825580	3202	Qi	160	0,84	0,39	0,62	0,62	1,0	0,16	160	200	40	0,20	0,30	0,24	1,83	Slope facing N
					-	Qi		0,91	0,32	0,64	0,64	2,0	0,15	280	390	110	0,28	0,60	0,76	8,24	Qi / Au / Ea forest
					3206	Qi		0,89	0,40	0,48	0,48	1,5	0,18	210	260	50	0,19	0,20	0,28	1,69	Some Qp and no shrubs
132	13-10-09	BR-MI	0522249	4825450	3207	Au	70	0,92	0,61	0,41	0,41	1,5	0,28	200	240	40	0,17	0,30	0,14	1,60	Slope facing W
					-	Au		0,82	0,69	0,44	0,44	1,0	0,28	180	220	40	0,18	0,20	0,14	0,71	Overhanging Qi
					3211	Au		0,98	0,59	0,53	0,53	1,0	0,29	210	260	50	0,19	0,25	0,17	0,86	Dense Qi / Au / Ea forest
119	13-10-09	BR-MI	0522066	4825393	3212	Au	60	0,79	0,48	0,52	0,52	1,0	0,19	190	250	60	0,24	0,35	0,32	1,85	Slope facing NNW
					-	Au		0,91	0,91	0,63	0,63	2,0	0,41	400	550	150	0,27	0,60	0,36	2,90	Dense Qi / Au / Ea forest
					3216	Au		0,65	0,38	0,42	0,42	1,0	0,12	100	150	50	0,33	0,40	0,40	3,24	
131	13-10-09	BR-MI	0522087	4825147	3217	Au	65	0,77	0,44	0,38	0,38	1,5	0,17	210	250	40	0,16	0,50	0,24	4,43	Slope facing SSW
					-	Au		0,80	0,41	0,42	0,42	1,0	0,16	130	170	40	0,24	0,40	0,24	2,44	High shrub forest Qi / Au
					3221	Au		0,91	0,35	0,51	0,51	2,0	0,16	350	430	80	0,19	0,70	0,50	8,79	Many fruits on branches
127	13-10-09	BR-MI	0522466	4825213	3222	Qi	40	0,93	0,80	0,38	0,38	2,0	0,37	290	380	90	0,24	0,40	0,24	2,15	Slope facing SSW
					-	Qi		0,92	0,92	0,66	0,66	2,5	0,42	470	630	160	0,25	0,50	0,38	2,95	Shrub forest Au / Qi
					3226	Qi		0,74	0,48	0,56	0,56	1,5	0,18	210	280	70	0,25	0,25	0,39	2,11	
126	13-10-09	BR-MI	0522749	4825006	3227	Ea	25	0,77	0,31	0,69	0,69	2,0	0,12	250	370	120	0,32	0,40	1,01	6,70	Slope facing E
					-	Ea		0,76	0,30	0,45	0,45	2,0	0,11	160	270	110	0,41	0,50	0,96	8,77	Overhaning Au
					3231	Ea		0,82	0,54	0,53	0,53	1,5	0,22	210	360	150	0,42	0,50	0,68	3,39	Au / Qi / Ea low forest
129	13-10-09	BR-MI	0522527	4825468	3232	Au	50	0,70	0,43	0,59	0,59	2,0	0,15	340	450	110	0,24	0,70	0,73	9,30	Slope facing NE
					-	Au		0,71	0,42	0,56	0,56	1,5	0,15	250	320	70	0,22	0,50	0,47	5,03	Au / Qi / Ea low forest
					3236	Au		0,76	0,41	0,32	0,32	2,0	0,16	190	250	60	0,24	0,60	0,39	7,70	
130	13-10-09	BR-MI	0522731	4825299	3237	Qi	100	0,91	0,31	0,44	0,44	2,0	0,14	360	500	140	0,28	0,70	0,99	9,93	Slope facing SE
					-	Qi		0,89	0,89	0,41	0,41	1,5	0,40	280	350	70	0,20	0,30	0,18	1,14	Qi / Au forest, some Ea
					3241	Qi		0,93	0,93	0,82	0,82	1,0	0,43	210	260	50	0,19	0,20	0,12	0,46	
125	13-10-09	BR-MI	0522842	4825387	3242	Qi	35	0,96	0,96	0,61	0,61	1,0	0,46	440	560	120	0,21	0,25	0,26	0,54	Slope facing ESE
					-	Qi		0,64	0,64	0,48	0,48	1,0	0,20	90	120	30	0,25	0,30	0,15	1,46	LAI with Ea
					3246	Qi		0,77	0,77	0,56	0,56	1,5	0,30	200	260	60	0,23	0,40	0,20	2,02	Qi / Au / Ea forest
030	14-10-09	SC-MI	0524501	4821501	3247	Au	80	0,73	0,60	0,95	0,95	1,5	0,22	540	660	120	0,18	0,60	0,55	4,11	Qi / Au forest
					-	Au		0,80	0,70	0,92	0,92	2,5	0,28	850	1040	190	0,18	0,70	0,68	6,25	Some shrubs
					3252	Au		0,73	0,60	0,65	0,65	2,0	0,22	350	410	60	0,15	0,65	0,27	5,94	
029	14-10-09	SC-MI	0524687	4821456	3253	Qi	130	1,15	0,90	0,65	0,65	2,5	0,52	900	1240	340	0,27	0,65	0,66	3,14	Dense Qi / Au forest
					-	Qi		0,66	0,55	0,60	0,60	1,0	0,18	240	310	70	0,23	0,40	0,39	2,20	Many low vegetation

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					3257	Qi		0,58	0,48	0,55	0,55	1,5	0,14	270	370	100	0,27	0,45	0,72	4,85	Slope facing W
009	14-10-09	BR-MI	0525652	4821178	3258	Qi	120	1,15	0,81	0,45	0,45	1,0	0,47	270	310	40	0,13	0,10	0,09	0,21	Qi / Au / Ea forest
					-	Qi		0,65	0,55	0,78	0,78	1,5	0,18	290	380	90	0,24	0,65	0,50	5,45	Slope facing N
					3262	Qi		0,91	0,91	0,56	0,56	2,0	0,41	440	640	200	0,31	0,80	0,48	3,86	
008	14-10-09	BR-MI	0525470	4820964	3263	Au	40	0,81	0,60	0,60	0,60	2,5	0,24	390	460	70	0,15	0,65	0,29	6,69	Open Qi / Au shrub forest
					-	Au		0,79	0,45	0,72	0,72	2,0	0,18	540	660	120	0,18	0,80	0,68	9,00	Low Qc shrubs
					3266	Au		0,68	0,42	0,58	0,58	1,5	0,14	240	290	50	0,17	0,60	0,35	6,30	Slope facing WNW
005	14-10-09	BR-MI	0526020	4820620	3267	Qi	50	1,10	1,10	0,65	0,65	2,0	0,61	640	840	200	0,24	0,70	0,33	2,31	Qi forest
					-	Qi		0,92	0,92	0,70	0,70	1,5	0,42	410	540	130	0,24	0,70	0,31	2,48	High trees, few shrubs
					3271	Qi		0,90	0,60	0,58	0,58	1,5	0,27	460	620	160	0,26	0,80	0,59	4,44	Some Au
007	14-10-09	BR-MI	0525959	4820837	3272	Qp	90	0,96	0,85	0,80	0,80	1,0	0,41	320	370	50	0,14	0,60	0,12	1,47	Mixed forest Qp / Qi / Au
					-	Qp		0,72	0,60	0,60	0,60	2,0	0,22	300	360	60	0,17	0,70	0,28	6,48	Some Ea shrubs
					3276	Qp		0,88	0,75	0,70	0,70	1,0	0,33	290	340	50	0,15	0,45	0,15	1,36	Near rune
006	14-10-09	BR-MI	0526193	4821087	3277	Qi	50	0,85	0,85	0,90	0,90	2,0	0,36	660	890	230	0,26	0,85	0,64	4,71	Qi / Qp / Ea low forest
					-	Qi		0,71	0,71	0,80	0,80	1,0	0,25	400	480	80	0,17	0,70	0,32	2,78	Slope facing SE
					3281	Qi		0,80	0,70	0,52	0,52	1,0	0,28	210	280	70	0,25	0,25	0,25	0,89	
004	14-10-09	BR-MI	0526572	4821216	3282	Qi	75	0,80	0,80	0,80	0,80	1,0	0,32	270	320	50	0,16	0,25	0,16	0,78	Open Qi forest
					-	Qi		0,95	0,95	0,60	0,60	1,5	0,45	230	300	70	0,23	0,50	0,16	1,66	Some Qp and no shrubs
					3286	Qi		0,90	0,90	0,75	0,75	2,0	0,41	340	440	100	0,23	0,70	0,25	3,46	
037	15-10-09	BR-CO	0523900	4822510	3287	Qi	75	0,86	0,86	0,61	0,61	1,0	0,37	260	320	60	0,19	0,25	0,16	0,68	Qi forest
					-	Qi		0,67	0,67	0,81	0,81	1,0	0,22	340	420	80	0,19	0,20	0,36	0,89	Almost flat
					3291	Qi		1,02	1,02	0,53	0,53	1,0	0,52	330	420	90	0,21	0,35	0,17	0,67	
040	15-10-09	BR-CO	0523731	4822635	3292	Qi	80	0,93	0,93	0,81	0,81	2,0	0,43	330	430	100	0,23	0,70	0,23	3,24	Near steep rock slope
					-	Qi		1,12	1,12	0,72	0,72	1,0	0,63	350	440	90	0,20	0,30	0,14	0,48	Qi / Au forest
					3296	Qi		1,02	1,02	0,86	0,86	1,0	0,52	330	430	100	0,23	0,25	0,19	0,48	Slope facing SE
041	15-10-09	BR-CO	0523608	4822768	6244	Au	30	0,80	0,54	0,54	0,54	1,0	0,22	170	240	70	0,29	0,40	0,32	1,85	Au forest some Qi/Ea
					-	Au		0,86	0,86	0,52	0,52	1,5	0,37	210	290	80	0,28	0,25	0,22	1,01	Dense forest, no shrubs
					6249	Au		0,98	0,61	0,64	0,64	1,0	0,30	220	280	60	0,21	0,30	0,20	1,00	FISH-EYE CAMERA BROKEN
042	15-10-09	BR-CO	0523846	4822801	6253	Ea	15	0,88	0,39	0,49	0,49	1,5	0,17	140	200	60	0,30	0,30	0,35	2,62	Qi / Ea / Au forest with shrubs
					-	Ea		0,84	0,57	0,59	0,59	1,0	0,24	210	350	140	0,40	0,20	0,58	0,84	Slope facing E
					6255	Ea		0,95	0,65	0,44	0,44	1,0	0,31	170	270	100	0,37	0,15	0,32	0,49	
043	15-10-09	BR-MI	0523853	4822986	6259	Ea	15	0,92	0,64	0,48	0,48	2,5	0,29	180	290	110	0,38	0,35	0,37	2,97	Dense Qi / Ea / Au forest

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
					-	Ea		0,76	0,43	0,40	0,40	1,5	0,16	90	140	50	0,36	0,25	0,31	2,29	Slope facing SSW
					6263	Ea		0,72	0,72	0,51	0,51	1,5	0,26	110	160	50	0,31	0,15	0,19	0,87	Many shrubs and low vegetation
054	15-10-09	SC-MI	0524033	4823104	6267	Au	60	0,74	0,35	0,60	0,60	1,0	0,13	160	210	50	0,24	0,35	0,39	2,70	Qi / Au / Ea forest
					-	Au		0,83	0,56	0,67	0,67	2,0	0,23	300	390	90	0,23	0,70	0,39	6,02	Overhanging Qi
					6271	Au		0,72	0,54	0,64	0,64	1,5	0,19	170	220	50	0,23	0,30	0,26	2,31	Slope facing SW
057	15-10-09	BR-MI	0523923	4823275	6275	Ea	30	0,71	0,43	0,68	0,68	2,0	0,15	270	460	190	0,41	0,40	1,24	5,24	Qi / Au / Ea forest
					-	Ea		0,63	0,34	0,38	0,38	1,5	0,11	130	230	100	0,43	0,30	0,93	4,20	Some Ca, along road
					6279	Ea		0,79	0,42	0,63	0,63	1,5	0,17	240	430	190	0,44	0,35	1,15	3,16	Slope facing NNE
048	15-10-09	BR-MI	0523717	4823446	6281	Au	35	0,90	0,60	0,61	0,61	2,0	0,27	500	650	150	0,23	0,80	0,56	5,93	Qi / Au / Ea forest
					-	Au		0,98	0,57	0,64	0,64	1,5	0,28	430	550	120	0,22	0,55	0,43	2,95	Very dense forest
					6285	Au		0,65	0,42	0,69	0,69	1,5	0,14	430	560	130	0,23	0,50	0,95	5,49	Slope facing E
046	15-10-09	BR-MI	0522908	4823376	6289	Qi	25	1,02	0,74	0,68	0,68	2,0	0,38	350	510	160	0,31	0,40	0,42	2,12	Qi / Au / Ea forest
					-	Qi		0,88	0,64	0,51	0,51	1,5	0,28	240	310	70	0,23	0,30	0,25	1,60	Slope facing E
					6291	Qi		0,76	0,61	0,49	0,49	1,0	0,23	220	280	60	0,21	0,30	0,26	1,29	
113	15-10-09	BR-MI	0522716	4824541	6295	Au	70	0,88	0,56	0,53	0,53	1,0	0,25	240	300	60	0,20	0,30	0,24	1,22	Qi / Au / Ea forest
					-	Au		0,61	0,61	0,51	0,51	2,0	0,19	290	400	110	0,28	0,65	0,59	6,99	Relatively open
					6299	Au		0,71	0,47	0,62	0,62	2,0	0,17	350	530	180	0,34	0,70	1,08	8,39	Slope facing S
114	15-10-09	BR-MI	0522982	4824539	6304	Qi	35	0,83	0,83	0,74	0,74	2,0	0,34	340	440	100	0,23	0,50	0,29	2,90	Qi / Ea / Au forest
					-	Qi		0,79	0,53	0,51	0,51	1,5	0,21	120	160	40	0,25	0,45	0,19	3,22	Slope facing S
					6306	Qi		1,05	0,73	0,57	0,57	2,0	0,38	550	740	190	0,26	0,70	0,50	3,65	
116	15-10-09	BR-MI	0522983	4824710	6310	Qi	60	1,02	0,62	0,68	0,68	2,0	0,32	440	590	150	0,25	0,70	0,47	4,43	Dense shrubs forest Qi / Au
					-	Qi		0,74	0,74	0,51	0,51	1,5	0,27	230	310	80	0,26	0,60	0,29	3,29	Slope facing E
					6314	Qi		0,82	0,65	0,43	0,43	1,5	0,27	190	280	90	0,32	0,65	0,34	3,66	
139	15-10-09	BR-MI	0523086	4825145	6318	Qi	90	1,12	0,89	0,72	0,72	1,0	0,50	470	580	110	0,19	0,35	0,22	0,70	Qi / Au / Ea forest
					-	Qi		1,05	1,05	0,57	0,57	1,0	0,55	560	670	110	0,16	0,45	0,20	0,82	Steep slope facing east
					6322	Qi		0,96	0,84	0,48	0,48	1,0	0,40	290	380	90	0,24	0,25	0,22	0,62	
144	15-10-09	BR-MI	0523189	4825477	6326	Ea	35	1,12	0,74	0,54	0,54	1,5	0,41	270	420	150	0,36	0,25	0,36	0,90	Ea / Au shrub like forest
					-	Ea		0,94	0,69	0,42	0,42	1,5	0,32	290	470	180	0,38	0,30	0,56	1,39	Slope facing W
					6327	Ea		0,89	0,27	0,57	0,57	2,0	0,12	290	410	120	0,29	0,55	1,00	9,16	
103	15-10-09	BR-CO	0523059	4824867	6337	Au	75	1,06	0,51	0,89	0,89	1,0	0,27	350	430	80	0,19	0,30	0,30	1,11	Slope facing W, steep
					-	Au		0,92	0,74	0,82	0,82	1,0	0,34	330	410	80	0,20	0,25	0,24	0,73	Near Gully
					6341	Au		1,11	0,98	0,64	0,64	1,0	0,54	320	390	70	0,18	0,25	0,13	0,46	High Qi / Au forest

Appendix H

Plot	Date	Meteo	X	Y	Fish nr.	Veg	Br. Nr	L (m)	L_G (m)	W (m)	W_G (m)	Layers	S (m2)	Dry(g)	W (g)	D (g)	Pct	COV	Smax	LAI	Remarks
						Average		**0,90**	**0,72**	**0,63**	**0,61**	**1,4**	**0,33**	**300**	**391**	**91**	**0,24**	**0,41**	**0,34**	**2,50**	

Pi = Pinus
Au = Arbutus Unedo
Ea = Erica Arborea
Qi = Quercus Ilex
Qp = Quercus Pubescence
Qc = Quercus Coccifera
Bu = Buxus Sempervirens
Ca = Castanea

Plot = Plot number
Meteo = Weather conditions
X = X coordinate
Y = Y coordinate
Fish nr. = Numbers of hemispherical photograps
Veg = Vegetation species
Br. Nr. = Number of branches
L = Branch lenght
L_G = Green branch lenght
W = Branch width
W_G = Green branch width
Layers = number of vegetation layers
Dry = dry branch weight
W = wet branch weight
D = difference wet / dry
Pct = percentage difference wet / dry
COV = leaf coverage of a branch
Smax = maximum canopy storage capacity of a branch
LAI = LAI of a branch

BR = Bright
SC = Small clouds
MC = Middle clouds
LC = Large clouds
CL = Cloudy

EH = Extremely hot (>36˚C)
VH = Very hot (31˚ - 35˚C)
HO = Hot (26˚ - 30˚C)
WA = Warm (21˚ - 25˚C)
MI = Mild (16˚ - 20˚C)
CO = Cool (11˚ - 15˚C)
CD = Cold (<10˚C)

Appendix I

Field Data Tree Scale

								P (mm) =		37,17		3,34		10,94		30,28		13,07		93,96		18,94		
nr	*Plot*	*Sp*	*Asmax*	*B. Nr.*	*Smax*	*SmaxN*	*Cover*	*LAI*	*k*	*I 18-09*	*%*	*I 22-09*	*%*	*I 08-10*	*%*	*I 09-10*	*%*	*I 22-10*	*%*	*I 22-10*	*%*	*I 23-10*	*%*	*Average*
1	055	Au	0,49	50	24,35	2,71	0,45	5,26	0,45	5,44	14,65%	0,66	19,64%	2,01	18,33%	4,70	15,51%	2,35	17,99%	9,03	9,61%	3,24	17,09%	**16,12%**
2	060	Au	0,49	60	29,47	3,27	0,83	4,56	0,83	15,87	42,71%	2,20	65,75%	6,49	59,29%	14,04	46,35%	7,53	57,63%	22,73	24,19%	10,11	53,39%	**49,90%**
3	108	Au	0,41	35	14,23	1,58	0,65	4,16	0,65	7,56	20,33%	1,31	39,19%	3,64	33,25%	6,93	22,89%	4,16	31,82%	9,13	9,71%	5,36	28,28%	**26,50%**
4	109	Au	0,18	80	14,62	1,62	0,69	3,95	0,69	8,34	22,44%	1,47	44,05%	4,07	37,19%	7,67	25,34%	4,64	35,53%	9,97	10,61%	5,96	31,48%	**29,52%**
5	084	Au	0,17	120	20,43	2,27	0,83	4,16	0,83	13,21	35,54%	2,15	64,42%	6,08	55,62%	12,00	39,63%	6,99	53,45%	16,58	17,65%	9,10	48,05%	**44,91%**
6	073	Au	0,29	90	26,13	2,90	0,81	5,32	0,81	14,48	38,95%	2,08	62,33%	6,09	55,64%	12,89	42,56%	7,05	53,95%	20,01	21,30%	9,40	49,62%	**46,34%**
7	076	Au	0,38	50	19,17	2,13	0,76	3,35	0,76	11,23	30,22%	1,81	54,10%	5,13	46,86%	10,18	33,63%	5,89	45,08%	14,22	15,13%	7,69	40,62%	**37,95%**
8	069	Au	0,34	60	20,57	2,29	0,71	4,68	0,71	10,56	28,40%	1,59	47,61%	4,59	41,99%	9,47	31,28%	5,30	40,57%	14,04	14,94%	7,01	37,01%	**34,54%**
9	142	Au	0,26	100	25,65	2,85	0,81	4,66	0,81	14,35	38,61%	2,08	62,27%	6,07	55,48%	12,79	42,24%	7,03	53,75%	19,71	20,97%	9,35	49,38%	**46,10%**
10	102	Au	0,16	120	19,78	2,20	0,86	3,42	0,86	13,63	36,67%	2,30	68,84%	6,44	58,86%	12,45	41,12%	7,37	56,42%	16,72	17,80%	9,54	50,39%	**47,16%**
11	120	Au	0,18	170	30,07	3,34	0,96	6,63	0,96	20,06	53,96%	2,92	87,42%	8,51	77,79%	17,89	59,07%	9,85	75,35%	27,43	29,19%	13,10	69,16%	**64,56%**
12	117	Au	0,16	60	9,88	1,10	0,64	3,77	0,64	5,75	15,48%	1,23	36,83%	3,21	29,34%	5,43	17,94%	3,61	27,63%	6,31	6,71%	4,47	23,59%	**22,50%**
13	118	Au	0,21	120	25,66	2,85	0,62	4,19	0,62	9,43	25,37%	1,23	36,93%	3,70	33,78%	8,26	27,26%	4,31	32,96%	14,27	15,18%	5,84	30,85%	**28,90%**
14	115	Au	0,21	40	8,38	0,93	0,77	3,48	0,77	6,24	16,80%	1,71	51,06%	4,09	37,40%	6,06	20,00%	4,51	34,52%	6,45	6,87%	5,32	28,10%	**27,82%**
15	095	Au	0,32	60	19,45	2,16	0,85	4,91	0,85	13,27	35,71%	2,25	67,22%	6,28	57,43%	12,13	40,06%	7,19	55,04%	16,26	17,30%	9,31	49,14%	**45,98%**
16	097	Au	0,51	70	35,45	3,94	0,96	4,94	0,96	21,59	58,10%	2,94	88,12%	8,73	79,76%	19,04	62,89%	10,14	77,62%	31,36	33,38%	13,66	72,10%	**67,42%**
17	088	Au	0,74	30	22,22	2,47	0,81	4,89	0,81	13,35	35,93%	2,06	61,77%	5,92	54,10%	12,03	39,73%	6,82	52,19%	17,41	18,53%	8,97	47,38%	**44,23%**
18	086	Au	0,89	30	26,79	2,98	0,64	4,59	0,64	10,09	27,15%	1,31	39,37%	3,94	36,05%	8,83	29,16%	4,60	35,18%	15,33	16,32%	6,24	32,95%	**30,88%**
19	089	Au	0,92	30	27,64	3,07	0,64	3,99	0,64	10,21	27,46%	1,32	39,42%	3,96	36,18%	8,91	29,44%	4,62	35,34%	15,68	16,69%	6,28	33,16%	**31,10%**
20	061	Au	0,69	30	20,78	2,31	0,84	5,45	0,84	13,57	36,50%	2,20	66,00%	6,24	57,02%	12,32	40,69%	7,16	54,81%	17,06	18,16%	9,34	49,30%	**46,07%**
21	063	Au	0,53	40	21,26	2,36	0,89	5,28	0,89	14,93	40,16%	2,47	73,92%	6,95	63,55%	13,59	44,89%	7,97	61,00%	18,55	19,74%	10,36	54,69%	**51,14%**
22	112	Au	0,40	40	16,05	1,78	0,78	4,52	0,78	10,46	28,15%	1,88	56,16%	5,16	47,19%	9,65	31,86%	5,89	45,04%	12,39	13,19%	7,53	39,77%	**37,34%**
23	047	Au	0,45	35	15,58	1,73	0,63	4,13	0,63	7,63	20,53%	1,24	37,13%	3,51	32,07%	6,93	22,89%	4,03	30,83%	9,59	10,21%	5,25	27,73%	**25,91%**
24	052	Au	0,45	20	9,03	1,00	0,82	3,95	0,82	7,15	19,24%	1,94	58,00%	4,66	42,62%	6,93	22,89%	5,14	39,36%	7,40	7,88%	6,08	32,09%	**31,73%**
25	051	Au	0,33	28	9,23	1,03	0,68	3,77	0,68	5,87	15,80%	1,37	40,99%	3,47	31,75%	5,60	18,50%	3,88	29,69%	6,27	6,67%	4,72	24,93%	**24,05%**
26	078	Au	0,25	45	11,31	1,26	0,70	3,90	0,70	7,12	19,16%	1,48	44,27%	3,89	35,60%	6,70	22,13%	4,39	33,59%	7,89	8,40%	5,46	28,85%	**27,43%**
27	082	Au	0,10	80	8,11	0,90	0,79	2,78	0,79	6,23	16,77%	1,78	53,27%	4,20	38,39%	6,07	20,05%	4,61	35,29%	6,40	6,82%	5,39	28,48%	**28,44%**
28	133	Au	0,10	190	18,81	2,09	0,97	6,01	0,97	15,56	41,86%	2,89	86,43%	7,87	71,91%	14,42	47,61%	8,95	68,45%	18,10	19,26%	11,37	60,06%	**56,51%**
29	132	Au	0,18	70	12,47	1,39	0,66	4,40	0,66	7,08	19,04%	1,33	39,93%	3,62	33,07%	6,57	21,71%	4,11	31,44%	8,17	8,70%	5,21	27,51%	**25,91%**
30	119	Au	0,28	60	17,05	1,89	0,79	3,41	0,79	11,06	29,77%	1,93	57,82%	5,36	48,96%	10,16	33,55%	6,12	46,81%	13,30	14,15%	7,87	41,55%	**38,94%**

Appendix I

31	131	Au	0,31	65	19,90	2,21	0,87	3,52	0,87	13,91	37,41%	2,35	70,42%	6,58	60,16%	12,71	41,97%	7,54	57,66%	17,03	18,13%	9,75	51,48%	**48,18%**
32	129	Au	0,26	50	13,12	1,46	0,69	3,79	0,69	7,77	20,90%	1,46	43,66%	3,96	36,20%	7,21	23,81%	4,50	34,43%	8,99	9,56%	5,71	30,14%	**28,39%**
33	030	Au	0,18	80	14,25	1,58	0,76	3,50	0,76	9,34	25,13%	1,77	52,91%	4,79	43,76%	8,68	28,66%	5,44	41,60%	10,76	11,45%	6,89	36,36%	**34,27%**
34	008	Au	0,15	40	6,06	0,67	0,79	2,23	0,79	4,75	12,78%	1,69	50,60%	3,64	33,25%	4,70	15,51%	3,92	29,97%	4,79	5,10%	4,38	23,14%	**24,33%**
35	041	Au	0,14	120	16,98	1,89	0,61	5,00	0,61	7,63	20,53%	1,17	35,06%	3,37	30,77%	6,87	22,68%	3,88	29,69%	10,00	10,65%	5,11	26,99%	**25,20%**
36	054	Au	0,16	60	9,82	1,09	0,86	3,34	0,86	8,12	21,85%	2,14	64,13%	5,21	47,59%	7,85	25,93%	5,76	44,05%	8,45	8,99%	6,84	36,11%	**35,52%**
37	048	Au	0,29	35	10,06	1,12	0,86	2,92	0,86	8,29	22,30%	2,15	64,33%	5,25	48,03%	8,00	26,42%	5,82	44,53%	8,64	9,20%	6,94	36,62%	**35,92%**
38	113	Au	0,34	70	23,74	2,64	0,80	4,07	0,80	13,56	36,49%	2,02	60,53%	5,86	53,53%	12,15	40,11%	6,77	51,76%	18,19	19,36%	8,96	47,31%	**44,15%**
39	103	Au	0,42	50	20,87	2,32	0,49	3,71	0,49	5,95	16,02%	0,77	23,09%	2,32	21,17%	5,20	17,18%	2,70	20,68%	9,10	9,68%	3,67	19,38%	**18,17%**
40	163	Bu	0,46	24	11,13	1,24	0,82	3,54	0,82	8,53	22,96%	1,99	59,60%	5,05	46,16%	8,14	26,90%	5,64	43,16%	9,11	9,70%	6,86	36,24%	**34,96%**
41	033	Bu	0,56	25	14,07	1,56	0,92	3,66	0,92	11,80	31,76%	2,54	76,03%	6,61	60,46%	11,16	36,84%	7,44	56,90%	12,91	13,74%	9,19	48,53%	**46,32%**
42	158	Bu	0,45	60	26,91	2,99	0,80	5,49	0,80	14,40	38,74%	2,03	60,93%	5,98	54,63%	12,78	42,20%	6,93	53,03%	20,21	21,51%	9,27	48,94%	**45,71%**
43	023	Bu	0,28	60	16,67	1,85	0,78	4,85	0,78	10,72	28,84%	1,88	56,32%	5,21	47,62%	9,85	32,53%	5,95	45,51%	12,84	13,67%	7,64	40,35%	**37,84%**
44	025	Bu	0,10	75	7,50	0,83	0,91	3,45	0,91	6,75	18,15%	2,27	68,08%	5,01	45,83%	6,65	21,96%	5,43	41,51%	6,82	7,26%	6,14	32,40%	**33,60%**
45	015	Ca	0,13	125	16,33	1,81	0,73	2,54	0,73	9,66	25,98%	1,65	49,50%	4,61	42,15%	8,84	29,20%	5,27	40,36%	11,74	12,50%	6,81	35,95%	**33,66%**
46	152	Ca	0,23	150	33,86	3,76	0,89	4,85	0,89	18,79	50,56%	2,53	75,83%	7,53	68,84%	16,54	54,62%	8,76	67,04%	27,59	29,36%	11,82	62,40%	**58,38%**
47	140	Ca	0,33	120	39,00	4,33	0,85	5,92	0,85	18,41	49,52%	2,33	69,68%	7,03	64,28%	16,02	52,89%	8,22	62,87%	28,88	30,73%	11,21	59,20%	**55,60%**
48	153	Ca	0,26	60	15,87	1,76	0,90	3,85	0,90	12,55	33,76%	2,46	73,79%	6,60	60,36%	11,72	38,70%	7,48	57,21%	14,22	15,13%	9,40	49,66%	**46,94%**
49	016	Ca	0,33	140	45,68	5,08	0,85	7,89	0,85	19,38	52,15%	2,34	70,05%	7,15	65,37%	16,72	55,23%	8,38	64,13%	32,07	34,13%	11,53	60,89%	**57,42%**
50	045	Ea	0,29	15	4,33	0,48	0,49	5,17	0,80	2,12	5,70%	0,98	29,25%	1,84	16,82%	2,11	6,98%	1,93	14,78%	2,12	2,26%	2,06	10,86%	**12,38%**
51	083	Ea	0,45	30	13,44	1,49	0,53	4,98	0,53	5,48	14,74%	0,88	26,32%	2,50	22,82%	4,97	16,40%	2,87	21,95%	6,95	7,40%	3,75	19,79%	**18,49%**
52	085	Ea	0,33	40	13,16	1,46	0,53	5,56	0,53	5,41	14,56%	0,88	26,28%	2,49	22,72%	4,91	16,23%	2,85	21,84%	6,81	7,25%	3,72	19,65%	**18,36%**
53	070	Ea	0,34	25	8,49	0,94	0,66	3,56	0,66	5,29	14,24%	1,28	38,36%	3,21	29,34%	5,07	16,75%	3,57	27,35%	5,60	5,96%	4,32	22,80%	**22,11%**
54	038	Ea	0,26	20	5,23	0,58	0,58	3,00	0,58	2,98	8,03%	0,94	28,11%	2,13	19,48%	2,93	9,67%	2,32	17,76%	3,03	3,23%	2,66	14,05%	**14,33%**
55	104	Ea	0,28	60	16,93	1,88	0,62	6,55	0,62	7,81	21,00%	1,21	36,18%	3,47	31,67%	7,03	23,23%	3,99	30,55%	10,16	10,81%	5,25	27,72%	**25,88%**
56	105	Ea	0,27	35	9,41	1,05	0,61	5,95	0,61	5,22	14,05%	1,12	33,46%	2,92	26,65%	4,93	16,29%	3,28	25,09%	5,73	6,09%	4,06	21,43%	**20,44%**
57	099	Ea	0,24	35	8,30	0,92	0,38	4,05	0,38	2,58	6,94%	0,45	13,39%	1,24	11,36%	2,37	7,81%	1,42	10,87%	3,11	3,31%	1,83	9,66%	**9,05%**
58	062	Ea	0,21	30	6,20	0,69	0,69	5,16	0,69	4,21	11,32%	1,33	39,76%	3,01	27,53%	4,13	13,64%	3,28	25,09%	4,28	4,55%	3,76	19,84%	**20,25%**
59	092	Ea	0,18	30	5,54	0,62	0,84	4,43	0,84	4,63	12,47%	1,85	55,35%	3,77	34,42%	4,60	15,20%	4,01	30,68%	4,65	4,95%	4,39	23,17%	**25,18%**
60	056	Ea	0,15	30	4,40	0,49	0,43	4,50	0,43	1,84	4,96%	0,53	15,78%	1,24	11,36%	1,79	5,93%	1,36	10,44%	1,89	2,01%	1,60	8,42%	**8,41%**
61	081	Ea	0,10	45	4,71	0,52	0,69	3,56	0,69	3,23	8,70%	1,26	37,65%	2,59	23,72%	3,21	10,60%	2,77	21,20%	3,25	3,46%	3,05	16,08%	**17,34%**
62	126	Ea	0,09	60	5,18	0,58	0,71	4,92	0,71	3,66	9,84%	1,35	40,45%	2,86	26,12%	3,62	11,96%	3,07	23,45%	3,68	3,92%	3,40	17,97%	**19,10%**
63	042	Ea	0,24	20	4,75	0,53	0,21	3,42	0,21	0,80	2,16%	0,14	4,10%	0,38	3,50%	0,74	2,43%	0,44	3,35%	0,98	1,04%	0,57	2,99%	**2,80%**

64	043	Ea	0,35	15	5,21	0,58	0,41	4,54	0,41	2,02	5,44%	0,49	14,78%	1,23	11,27%	1,94	6,40%	1,37	10,50%	2,13	2,27%	1,65	8,73%	**8,48%**
65	057	Ea	0,45	15	6,77	0,75	0,17	3,04	0,17	0,70	1,88%	0,09	2,77%	0,28	2,53%	0,61	2,02%	0,32	2,46%	1,04	1,11%	0,44	2,30%	**2,15%**
66	144	Ea	0,43	20	8,56	0,95	0,67	3,20	0,67	5,42	14,59%	1,32	39,50%	3,30	30,16%	5,20	17,18%	3,67	28,11%	5,73	6,10%	4,43	23,41%	**22,72%**
67	013	Pi	0,48	20	9,69	1,08	0,37	3,74	0,37	2,72	7,31%	0,43	12,85%	1,22	11,19%	2,46	8,12%	1,41	10,78%	3,49	3,71%	1,85	9,75%	**9,10%**
68	012	Pi	0,56	25	14,04	1,56	0,50	4,58	0,50	5,15	13,86%	0,79	23,57%	2,27	20,70%	4,63	15,30%	2,61	19,99%	6,77	7,21%	3,44	18,18%	**16,97%**
69	014	Pi	0,46	20	9,29	1,03	0,80	3,19	0,80	7,13	19,18%	1,86	55,62%	4,54	41,45%	6,88	22,74%	5,02	38,41%	7,43	7,91%	5,98	31,56%	**30,98%**
70	010	Pi	0,37	30	11,13	1,24	0,81	4,42	0,81	8,41	22,64%	1,95	58,25%	4,95	45,24%	8,02	26,49%	5,53	42,34%	9,01	9,59%	6,74	35,61%	**34,31%**
71	022	Pi	0,40	20	8,04	0,89	0,80	2,55	0,80	6,27	16,88%	1,82	54,45%	4,27	39,00%	6,12	20,20%	4,68	35,81%	6,43	6,85%	5,46	28,81%	**28,86%**
72	011	Qc	0,59	20	11,72	1,30	0,85	3,28	0,85	9,29	24,99%	2,14	64,17%	5,46	49,88%	8,85	29,24%	6,10	46,68%	9,95	10,59%	7,44	39,28%	**37,83%**
73	019	Qc	0,58	8	4,63	0,51	0,51	2,78	0,51	2,32	6,24%	0,73	21,76%	1,65	15,11%	2,28	7,52%	1,80	13,78%	2,36	2,51%	2,07	10,91%	**11,12%**
74	018	Qc	0,50	15	7,57	0,84	0,57	3,06	0,57	4,05	10,90%	0,96	28,73%	2,42	22,13%	3,87	12,79%	2,70	20,67%	4,31	4,59%	3,28	17,31%	**16,73%**
75	036	Qc	0,56	30	16,86	1,87	0,53	6,10	0,53	6,16	16,57%	0,89	26,67%	2,60	23,77%	5,49	18,12%	3,01	23,03%	8,47	9,01%	4,01	21,17%	**19,76%**
76	024	Qc	0,66	10	6,59	0,73	0,79	2,51	0,79	5,14	13,84%	1,72	51,43%	3,80	34,76%	5,07	16,73%	4,12	31,51%	5,20	5,54%	4,67	24,64%	**25,49%**
77	002	Qi	0,93	55	51,27	5,70	0,84	5,24	0,84	19,64	52,85%	2,29	68,66%	7,07	64,60%	16,84	55,63%	8,30	63,52%	33,83	36,00%	11,49	60,66%	**57,42%**
78	003	Qi	0,80	65	51,90	5,77	0,72	4,79	0,72	15,05	40,50%	1,69	50,66%	5,26	48,10%	12,82	42,33%	6,20	47,41%	27,22	28,97%	8,63	45,59%	**43,36%**
79	090	Qi	0,78	25	19,59	2,18	0,67	4,66	0,67	9,44	25,41%	1,42	42,42%	4,10	37,45%	8,47	27,96%	4,73	36,20%	12,60	13,41%	6,26	33,04%	**30,84%**
80	165	Qi	0,50	60	29,82	3,31	0,63	5,79	0,63	10,22	27,49%	1,28	38,32%	3,88	35,44%	8,88	29,32%	4,53	34,68%	16,21	17,25%	6,20	32,71%	**30,74%**
81	166	Qi	0,44	70	31,04	3,45	0,84	5,42	0,84	16,54	44,50%	2,25	67,47%	6,68	61,08%	14,58	48,16%	7,77	59,43%	24,03	25,57%	10,46	55,21%	**51,63%**
82	053	Qi	0,57	50	28,51	3,17	0,79	5,46	0,79	14,48	38,96%	1,99	59,61%	5,89	53,84%	12,79	42,24%	6,84	52,36%	20,86	22,20%	9,20	48,56%	**45,40%**
83	151	Qi	0,62	70	43,34	4,82	0,55	4,49	0,55	8,96	24,12%	0,99	29,62%	3,09	28,24%	7,61	25,12%	3,64	27,87%	16,60	17,67%	5,09	26,89%	**25,65%**
84	143	Qi	0,53	80	42,55	4,73	0,63	4,07	0,63	11,35	30,52%	1,29	38,72%	4,01	36,64%	9,69	31,99%	4,72	36,09%	20,14	21,43%	6,56	34,61%	**32,86%**
85	150	Qi	0,29	90	25,72	2,86	0,74	2,96	0,74	12,50	33,63%	1,74	52,21%	5,14	46,98%	11,07	36,55%	5,97	45,64%	17,76	18,90%	8,00	42,22%	**39,45%**
86	138	Qi	0,10	110	11,34	1,26	0,59	3,32	0,59	5,72	15,39%	1,07	31,95%	2,90	26,54%	5,31	17,52%	3,30	25,25%	6,64	7,06%	4,19	22,14%	**20,84%**
87	137	Qi	0,20	150	29,57	3,29	0,79	3,38	0,79	14,71	39,56%	1,99	59,71%	5,92	54,12%	12,96	42,79%	6,88	52,68%	21,46	22,84%	9,28	48,98%	**45,81%**
88	136	Qi	0,37	120	44,68	4,96	0,84	3,90	0,84	18,87	50,77%	2,28	68,39%	6,98	63,78%	16,29	53,80%	8,18	62,56%	31,12	33,12%	11,24	59,36%	**55,97%**
89	058	Qi	0,57	75	42,77	4,75	0,81	4,50	0,81	17,51	47,10%	2,12	63,58%	6,48	59,26%	15,12	49,93%	7,60	58,12%	28,80	30,65%	10,44	55,13%	**51,97%**
90	059	Qi	0,62	45	27,89	3,10	0,80	4,45	0,80	14,63	39,36%	2,04	61,03%	6,01	54,93%	12,95	42,77%	6,98	53,37%	20,81	22,14%	9,35	49,38%	**46,14%**
91	093	Qi	0,68	75	50,87	5,65	0,69	4,47	0,69	13,90	37,39%	1,55	46,55%	4,84	44,25%	11,82	39,04%	5,70	43,63%	25,29	26,91%	7,95	41,99%	**39,97%**
92	075	Qi	0,56	90	50,36	5,60	0,64	5,23	0,64	12,13	32,65%	1,34	40,10%	4,18	38,24%	10,30	34,00%	4,93	37,74%	22,47	23,91%	6,89	36,40%	**34,72%**
93	072	Qi	0,63	50	31,37	3,49	0,74	3,51	0,74	13,55	36,46%	1,76	52,66%	5,28	48,26%	11,85	39,13%	6,16	47,12%	20,68	22,01%	8,36	44,16%	**41,40%**
94	077	Qi	0,40	90	36,40	4,04	0,80	3,61	0,80	16,26	43,73%	2,06	61,71%	6,22	56,89%	14,15	46,74%	7,27	55,63%	25,43	27,06%	9,92	52,35%	**49,16%**
95	074	Qi	0,50	80	39,60	4,40	0,79	2,94	0,79	16,38	44,07%	2,02	60,38%	6,13	56,07%	14,19	46,85%	7,18	54,94%	26,49	28,19%	9,84	51,97%	**48,92%**
96	035	Qi	0,36	100	35,51	3,95	0,82	5,41	0,82	16,78	45,13%	2,16	64,71%	6,50	59,42%	14,65	48,37%	7,59	58,04%	25,79	27,45%	10,32	54,46%	**51,09%**

Appendix I

97	036	Qi	0,34	80	27,53	3,06	0,94	3,38	0,94	18,60	50,05%	2,79	83,51%	8,07	73,73%	16,68	55,07%	9,32	71,28%	24,83	26,43%	12,32	65,07%	**60,73%**
98	064	Qi	0,18	70	12,88	1,43	0,83	3,89	0,83	9,72	26,14%	2,07	61,98%	5,41	49,43%	9,17	30,29%	6,09	46,56%	10,67	11,35%	7,54	39,79%	**37,93%**
99	065	Qi	0,34	90	30,25	3,36	0,80	4,15	0,80	15,14	40,74%	2,05	61,25%	6,08	55,57%	13,33	44,04%	7,07	54,11%	22,18	23,61%	9,54	50,34%	**47,10%**
100	071	Qi	0,44	75	33,14	3,68	0,60	3,33	0,60	9,74	26,20%	1,17	34,93%	3,57	32,66%	8,39	27,71%	4,19	32,06%	16,26	17,30%	5,77	30,48%	**28,76%**
101	001	Qi	0,50	50	25,05	2,78	0,85	3,09	0,85	15,26	41,05%	2,28	68,31%	6,60	60,35%	13,67	45,15%	7,63	58,35%	20,41	21,72%	10,09	53,30%	**49,75%**
102	027	Qi	0,34	90	30,74	3,42	0,73	4,09	0,73	13,16	35,40%	1,71	51,23%	5,13	46,93%	11,51	38,00%	5,99	45,81%	20,03	21,32%	8,13	42,92%	**40,23%**
103	028	Qi	0,26	100	26,11	2,90	0,66	3,28	0,66	10,50	28,24%	1,40	41,77%	4,16	38,06%	9,22	30,44%	4,85	37,10%	15,63	16,64%	6,56	34,62%	**32,41%**
104	039	Qi	0,31	60	18,41	2,05	0,75	3,64	0,75	10,77	28,98%	1,76	52,59%	4,97	45,39%	9,79	32,32%	5,70	43,61%	13,51	14,37%	7,42	39,20%	**36,64%**
105	034	Qi	0,30	70	20,72	2,30	0,79	3,75	0,79	12,40	33,36%	1,96	58,60%	5,58	51,03%	11,21	37,01%	6,42	49,15%	15,91	16,93%	8,42	44,44%	**41,50%**
106	031	Qi	0,32	60	19,24	2,14	0,64	3,80	0,64	8,74	23,51%	1,29	38,77%	3,76	34,34%	7,82	25,82%	4,34	33,22%	11,77	12,53%	5,76	30,39%	**28,37%**
107	148	Qi	0,23	55	12,66	1,41	0,64	2,73	0,64	6,86	18,47%	1,26	37,69%	3,44	31,46%	6,35	20,97%	3,92	29,97%	8,03	8,55%	4,99	26,36%	**24,78%**
108	141	Qi	0,26	110	28,21	3,13	0,92	3,19	0,92	18,23	49,05%	2,68	80,19%	7,79	71,19%	16,29	53,79%	9,01	68,91%	24,74	26,33%	11,96	63,15%	**58,94%**
109	101	Qi	0,28	130	36,68	4,08	0,73	3,98	0,73	14,00	37,66%	1,72	51,56%	5,24	47,89%	12,12	40,03%	6,13	46,92%	22,65	24,11%	8,41	44,40%	**41,79%**
110	100	Qi	0,35	80	27,86	3,10	0,72	4,17	0,72	12,38	33,32%	1,66	49,67%	4,94	45,16%	10,89	35,96%	5,75	43,99%	18,29	19,47%	7,76	40,99%	**38,36%**
111	121	Qi	0,37	60	22,30	2,48	0,85	4,74	0,85	14,36	38,63%	2,27	67,84%	6,46	59,08%	12,98	42,86%	7,44	56,91%	18,43	19,62%	9,75	51,46%	**48,06%**
112	164	Qi	0,41	60	24,44	2,72	0,74	2,87	0,74	12,22	32,87%	1,74	52,08%	5,10	46,61%	10,86	35,85%	5,91	45,22%	17,04	18,13%	7,89	41,68%	**38,92%**
113	123	Qi	0,46	75	34,46	3,83	0,82	3,59	0,82	16,59	44,63%	2,16	64,64%	6,48	59,20%	14,51	47,92%	7,55	57,79%	25,24	26,86%	10,25	54,13%	**50,74%**
114	146	Qi	0,44	50	22,25	2,47	0,76	2,75	0,76	12,16	32,71%	1,82	54,59%	5,27	48,19%	10,90	35,99%	6,09	46,59%	16,23	17,27%	8,05	42,53%	**39,70%**
115	107	Qi	0,36	80	28,55	3,17	0,54	5,04	0,54	7,78	20,94%	0,94	28,26%	2,88	26,34%	6,72	22,20%	3,38	25,84%	12,81	13,63%	4,64	24,51%	**23,10%**
116	106	Qi	0,21	65	13,43	1,49	0,64	3,90	0,64	7,13	19,19%	1,26	37,87%	3,49	31,92%	6,56	21,68%	3,98	30,49%	8,50	9,04%	5,11	26,98%	**25,31%**
117	087	Qi	0,14	140	19,53	2,17	0,73	4,18	0,73	10,70	28,80%	1,67	50,10%	4,79	43,74%	9,66	31,90%	5,51	42,16%	13,83	14,72%	7,23	38,19%	**35,66%**
118	145	Qi	0,13	100	13,20	1,47	0,50	2,87	0,50	4,98	13,41%	0,78	23,48%	2,24	20,47%	4,50	14,87%	2,58	19,72%	6,41	6,82%	3,38	17,84%	**16,66%**
119	066	Qi	0,17	160	27,61	3,07	0,78	4,79	0,78	14,00	37,66%	1,94	58,06%	5,73	52,34%	12,38	40,89%	6,65	50,87%	20,02	21,31%	8,92	47,12%	**44,03%**
120	091	Qi	0,17	80	13,73	1,53	0,91	3,54	0,91	11,43	30,75%	2,48	74,28%	6,44	58,89%	10,81	35,71%	7,24	55,39%	12,47	13,27%	8,93	47,16%	**45,06%**
121	067	Qi	0,22	150	32,39	3,60	0,86	5,55	0,86	17,47	47,01%	2,36	70,78%	7,02	64,19%	15,39	50,82%	8,17	62,49%	25,56	27,20%	11,01	58,12%	**54,37%**
122	160	Qi	0,22	120	26,06	2,90	0,69	4,62	0,69	11,26	30,30%	1,52	45,57%	4,52	41,34%	9,92	32,75%	5,26	40,25%	16,49	17,55%	7,09	37,44%	**35,03%**
123	161	Qi	0,34	90	30,15	3,35	0,70	3,99	0,70	12,20	32,82%	1,57	47,15%	4,73	43,27%	10,66	35,19%	5,52	42,26%	18,72	19,93%	7,51	39,65%	**37,18%**
124	157	Qi	0,72	40	28,63	3,18	0,79	3,00	0,79	14,51	39,03%	1,99	59,62%	5,89	53,87%	12,81	42,30%	6,85	52,39%	20,92	22,27%	9,21	48,61%	**45,44%**
125	154	Qi	0,72	60	43,46	4,83	0,77	4,31	0,77	16,14	43,43%	1,92	57,57%	5,90	53,90%	13,89	45,89%	6,92	52,93%	27,13	28,87%	9,54	50,37%	**47,56%**
126	155	Qi	0,61	45	27,57	3,06	0,61	4,48	0,61	9,43	25,36%	1,20	35,87%	3,62	33,05%	8,21	27,12%	4,22	32,31%	14,71	15,66%	5,76	30,40%	**28,54%**
127	159	Qi	0,16	100	15,97	1,77	0,78	3,53	0,78	10,43	28,06%	1,87	56,14%	5,16	47,13%	9,62	31,77%	5,88	44,97%	12,33	13,12%	7,52	39,69%	**37,27%**
128	020	Qi	0,13	120	15,28	1,70	0,85	2,60	0,85	11,35	30,53%	2,20	65,94%	5,92	54,12%	10,58	34,94%	6,71	51,35%	12,92	13,75%	8,46	44,67%	**42,18%**
129	021	Qi	0,20	150	29,54	3,28	0,71	4,34	0,71	12,39	33,33%	1,62	48,44%	4,85	44,33%	10,84	35,81%	5,65	43,26%	18,78	19,99%	7,67	40,50%	**37,95%**

130	111	Qi	0,20	180	35,93	3,99	0,93	3,95	0,93	20,65	55,55%	2,77	82,86%	8,24	75,32%	18,16	59,96%	9,59	73,38%	30,48	32,44%	12,95	68,37%	**63,98%**
131	110	Qi	0,19	220	42,58	4,73	0,56	5,00	0,56	9,22	24,81%	1,02	30,68%	3,20	29,21%	7,83	25,87%	3,77	28,81%	16,92	18,00%	5,26	27,76%	**26,45%**
132	044	Qi	0,10	300	31,03	3,45	0,85	5,42	0,85	16,85	45,32%	2,31	69,04%	6,83	62,43%	14,87	49,10%	7,94	60,73%	24,36	25,93%	10,68	56,37%	**52,70%**
133	050	Qi	0,17	120	19,83	2,20	0,91	3,73	0,91	14,77	39,73%	2,56	76,78%	7,12	65,11%	13,55	44,74%	8,14	62,28%	17,80	18,95%	10,48	55,33%	**51,84%**
134	049	Qi	0,44	80	34,91	3,88	0,81	2,72	0,81	16,34	43,96%	2,11	63,13%	6,34	57,94%	14,27	47,13%	7,40	56,60%	25,08	26,69%	10,06	53,09%	**49,79%**
135	017	Qi	0,59	70	41,07	4,56	0,96	4,10	0,96	22,89	61,58%	2,96	88,65%	8,90	81,32%	20,00	66,05%	10,38	79,41%	35,04	37,30%	14,10	74,47%	**69,83%**
136	032	Qi	0,55	60	33,29	3,70	0,91	3,81	0,91	19,33	52,00%	2,64	79,14%	7,83	71,58%	17,05	56,32%	9,10	69,63%	27,97	29,77%	12,24	64,64%	**60,44%**
137	080	Qi	0,33	110	36,65	4,07	0,77	2,82	0,77	15,30	41,15%	1,91	57,26%	5,79	52,97%	13,28	43,87%	6,78	51,85%	24,30	25,86%	9,26	48,91%	**45,98%**
138	079	Qi	0,22	100	22,40	2,49	0,72	4,26	0,72	11,24	30,25%	1,64	49,15%	4,78	43,71%	10,03	33,14%	5,53	42,33%	15,34	16,33%	7,35	38,83%	**36,25%**
139	134	Qi	0,23	140	32,85	3,65	0,88	3,14	0,88	18,23	49,04%	2,47	74,08%	7,34	67,13%	16,06	53,05%	8,54	65,34%	26,58	28,29%	11,50	60,74%	**56,81%**
140	135	Qi	0,17	160	27,79	3,09	0,86	2,59	0,86	16,33	43,94%	2,35	70,27%	6,86	62,74%	14,54	48,00%	7,95	60,83%	22,59	24,04%	10,60	55,96%	**52,26%**
141	127	Qi	0,13	240	30,24	3,36	0,92	5,29	0,92	18,84	50,69%	2,69	80,48%	7,88	71,99%	16,75	55,31%	9,13	69,84%	26,22	27,91%	12,18	64,33%	**60,08%**
142	130	Qi	0,09	100	8,64	0,96	0,68	3,00	0,68	5,56	14,96%	1,36	40,66%	3,39	31,00%	5,33	17,61%	3,77	28,88%	5,87	6,25%	4,55	24,03%	**23,34%**
143	125	Qi	0,09	35	3,26	0,36	0,72	3,12	0,72	2,35	6,31%	1,22	36,67%	2,14	19,54%	2,34	7,74%	2,22	16,96%	2,35	2,50%	2,31	12,20%	**14,56%**
144	029	Qi	0,09	130	11,82	1,31	0,90	3,55	0,90	10,01	26,94%	2,39	71,52%	6,01	54,97%	9,58	31,64%	6,71	51,31%	10,63	11,32%	8,12	42,89%	**41,51%**
145	009	Qi	0,09	120	10,24	1,14	0,78	3,43	0,78	7,52	20,23%	1,79	53,72%	4,52	41,29%	7,19	23,76%	5,04	38,54%	7,98	8,50%	6,10	32,21%	**31,18%**
146	005	Qi	0,08	90	6,94	0,77	0,61	3,04	0,61	4,07	10,96%	1,08	32,25%	2,62	23,91%	3,94	13,01%	2,89	22,13%	4,23	4,51%	3,43	18,13%	**17,84%**
147	006	Qi	0,08	120	9,68	1,08	0,93	4,17	0,93	8,75	23,53%	2,47	73,98%	5,85	53,52%	8,51	28,10%	6,44	49,25%	9,00	9,58%	7,54	39,82%	**39,68%**
148	004	Qi	0,09	95	8,73	0,97	0,89	3,17	0,89	7,59	20,42%	2,24	67,13%	5,22	47,73%	7,41	24,48%	5,72	43,75%	7,76	8,26%	6,64	35,06%	**35,26%**
149	037	Qi	0,10	75	7,75	0,86	0,72	3,02	0,72	5,40	14,53%	1,49	44,57%	3,56	32,54%	5,24	17,32%	3,92	30,01%	5,58	5,94%	4,62	24,38%	**24,18%**
150	040	Qi	0,14	80	11,50	1,28	0,71	3,70	0,71	7,34	19,75%	1,52	45,55%	4,01	36,65%	6,91	22,81%	4,52	34,60%	8,14	8,66%	5,63	29,72%	**28,25%**
151	046	Qi	0,29	25	7,34	0,82	0,72	2,22	0,72	5,14	13,84%	1,48	44,20%	3,48	31,78%	5,01	16,55%	3,82	29,21%	5,28	5,62%	4,46	23,54%	**23,53%**
152	114	Qi	0,31	35	10,89	1,21	0,95	4,10	0,95	9,94	26,75%	2,62	78,29%	6,36	58,16%	9,61	31,74%	7,04	53,85%	10,35	11,01%	8,36	44,16%	**43,42%**
153	116	Qi	0,30	60	17,90	1,99	0,82	3,68	0,82	12,01	32,30%	2,08	62,35%	5,79	52,89%	11,01	36,37%	6,61	50,59%	14,48	15,41%	8,51	44,96%	**42,12%**
154	139	Qi	0,17	90	14,99	1,67	0,58	2,28	0,58	6,63	17,84%	1,05	31,56%	3,00	27,43%	6,00	19,81%	3,45	26,40%	8,46	9,01%	4,52	23,84%	**22,27%**
155	094	Qp	0,17	150	25,42	2,82	0,92	3,81	0,92	17,30	46,53%	2,66	79,72%	7,65	69,89%	15,57	51,42%	8,81	67,44%	22,61	24,06%	11,60	61,26%	**57,19%**
156	122	Qp	0,26	170	44,39	4,93	0,93	7,20	0,93	22,33	60,09%	2,79	83,53%	8,46	77,29%	19,39	64,04%	9,89	75,66%	35,52	37,80%	13,52	71,39%	**67,11%**
157	124	Qp	0,38	80	30,68	3,41	0,89	4,08	0,89	18,02	48,47%	2,52	75,49%	7,43	67,87%	15,96	52,71%	8,62	65,93%	25,52	27,16%	11,54	60,94%	**56,94%**
158	098	Qp	0,38	100	38,41	4,27	0,94	4,84	0,94	21,57	58,02%	2,83	84,85%	8,48	77,52%	18,90	62,41%	9,88	75,62%	32,49	34,57%	13,39	70,71%	**66,24%**
159	096	Qp	0,37	110	40,91	4,55	0,88	6,28	0,88	19,82	53,31%	2,50	74,72%	7,55	69,00%	17,23	56,91%	8,82	67,51%	31,23	33,24%	12,05	63,60%	**59,76%**
160	147	Qp	0,28	130	36,77	4,09	0,72	4,56	0,72	13,69	36,83%	1,68	50,18%	5,10	46,66%	11,84	39,11%	5,98	45,74%	22,27	23,70%	8,20	43,31%	**40,79%**
161	162	Qp	0,25	140	34,44	3,83	0,71	5,50	0,71	13,09	35,21%	1,63	48,71%	4,94	45,13%	11,35	37,50%	5,78	44,19%	20,93	22,28%	7,90	41,73%	**39,25%**
162	156	Qp	0,19	120	22,29	2,48	0,81	3,73	0,81	13,38	35,99%	2,06	61,78%	5,92	54,14%	12,05	39,78%	6,83	52,23%	17,46	18,58%	8,98	47,43%	**44,27%**

Appendix I

163	149	Qp	0,14	130	18,70	2,08	0,85	4,37	0,85	12,96	34,86%	2,24	67,03%	6,23	56,92%	11,88	39,23%	7,12	54,47%	15,67	16,68%	9,17	48,44%	**45,38%**
164	128	Qp	0,16	130	20,91	2,32	0,57	4,55	0,57	7,59	20,43%	1,04	31,06%	3,07	28,09%	6,70	22,12%	3,57	27,33%	11,00	11,71%	4,81	25,38%	**23,73%**
165	007	Qp	0,25	110	27,44	3,05	0,62	5,50	0,62	9,67	26,01%	1,24	37,03%	3,73	34,06%	8,43	27,84%	4,35	33,28%	14,98	15,94%	5,92	31,27%	**29,35%**
	AVERAGE		**0,34**	**77**	**21,65**	**2,41**	**0,74**	**4,11**	**0,74**	**10,93**	**29,42%**	**1,76**	**52,61%**	**4,91**	**44,91%**	**9,82**	**32,44%**	**5,64**	**43,12%**	**15,06**	**16,03%**	**7,35**	**38,83%**	**36,76%**

Nr = Chronological plot number
Plot = Plot number
Sp = Species
Asmax = Average Smax for the investigated branches
B. Nr. = Number of branches per tree
Smax = Total Smax
SmaxN = Smax per square meter
Cover = Canopy cover
LAI = LAI of a tree
k = canopy cover vs sky
I (18-09) = calculated interception per event
P = precipitation